EV Connect Roadmap

wellington electricity™ | we

CO-FUNDED BY EECA

Contents

1 Introduction

As electric vehicle (EV) uptake increases, electricity networks will need to deliver the associated increase in demand for electricity. The increase will be significant – our studies show that a small EV will increase household electricity use by 35%.

1. Introduction

As electric vehicle (EV) uptake increases, electricity networks will need to deliver the associated increase in demand for electricity. The increase will be significant – our studies show that a small EV will increase household electricity use by 35%. The extra demand could also be needed soon. The Government's 2022 Emissions Reductions Plan includes incentives for consumers to make their next car purchase electric. These incentives mean the uptake of EV's could be faster than what was previously anticipated.

Traditionally, networks would deliver an increase in demand by building a larger network – bigger cables, larger transformers and higher capacity sub-transmission equipment to deliver more energy. Building a larger network is expensive. The large size of the EV driven demand increase means that traditional methods may no longer be affordable. The significant increase in network investment would come at a time when other distribution networks, electricity generators, the transmission grid and other industries like water and transportation will also be replacing, developing and growing their infrastructure in response to the climate change targets. We are concerned that relying on traditional methods will mean services will be too expensive and we won't be able to build the network fast enough to keep up with increasing demand.

The EV Connect project investigated how more energy could be delivered through the existing network. Specifically, EV Connect has developed the steps needed for the electricity network to work with consumers who have smart devices that can be used to shift demand to less congested periods on the network. This will allow us to minimise the amount of traditional, slow to build and expensive network reinforcement required - helping to keep prices low while maintaining a secure electricity supply.

1.1. About EV Connect

EV Connect is a co-funded Energy Efficiency & Conservation Authority (EECA) Low Emission Vehicles Contestable Fund project which has engaged the industry, through workshops and supporting consultations, to develop how EV's can be used to allow more energy to be delivered through existing network infrastructure. The EV Connect project included a technology trial to test the software tools needed to manage EV Chargers and the development of a Roadmap of the actions needed to accommodate EVs. The actions include the development of flexibility services which are needed to manage the additional demand.

Meet the EV Connect team.

wellington electricity™ | we

CO-FUNDED BY EECA

GreenSync

GOODMEASURE

genesis

JET CHARGE

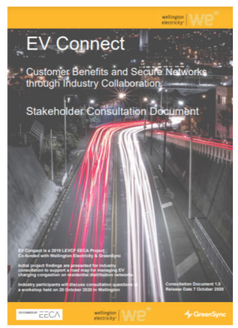
CHARGEFOX

1.2. How was the Roadmap developed?

The EV Connect Roadmap was made from stakeholder input. Fifty stakeholders provided input via workshops and consultations – stakeholders ranged from policy makers at MBIE, other distribution networks, Transpower the national grid owner and operator, regulators including the Commerce Commission and the Electricity Authority, electricity retailers, consumer advocates and EV user groups. A list of organisations who participated in the refinement of the final Roadmap is provided in Appendix A.

We started the process with a consultation document outlining the issues we face accommodating EVs, drawing on experiences from our sister companies in the United Kingdom and Australia. The consultation document explored the use of a Dynamic Connection Agreement (DCA), as used overseas, to set the active management permissions from which EV chargers can be connected and used. We asked stakeholders how we could deliver the expected demand increase while keeping prices affordable and maintaining a secure supply. Feedback suggested developing EV charging flexibility services. We used this feedback to review the viability of DCAs and a roadmap of the steps to accommodate EVs and to develop the services to support their use. Stakeholders then provided further feedback to refine the roadmap. The process also spanned the Climate Change Commissions decarbonation programme – feedback on the draft Roadmap included updated actions reflecting on transport electrification with an accelerated EV uptake. The process and key consultation documents are provided in Figure 1.

Figure 1: Building the EV Connect Roadmap

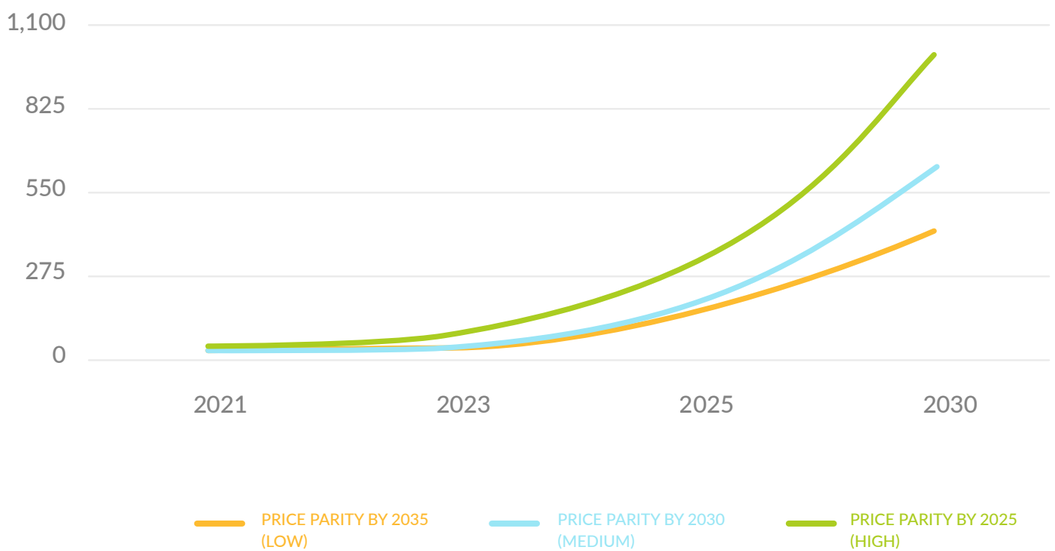
Issues overview	Stakeholder workshop	Draft Roadmap	Final Roadmap
			
Understand the issues	**Develop steps to connect EV's**	**Draft Roadmap actions**	**Final Roadmap actions**

The EV Connect Roadmap, Draft Roadmap, consultation documents and workshop presentations can be found at: https://www.welectricity.co.nz/about-us/major-projects/ev-connect/

1.3. Accelerated emissions reductions

The world's energy systems are changing at a rapid pace as consumer owned devices and distributed energy resources (DER) play an increasingly significant role in energy markets and general life. In particular, EVs are being purchased by New Zealanders in growing numbers. The number of EVs in New Zealand are increasing and are forecast to grow significantly. The scenarios shown in Figure 2 vary based on how fast the price of EVs reach price parity with internal combustion engine vehicles. The speed at which this occurs will be influenced by factors like production/technology costs, petrol costs, government subsidies and incentives[1].

Figure 2: Forecast EV uptake (New Zealand, national estimate)



Actual EV growth is more likely to take the high price path illustrated in Figure 2. The New Zealand Climate Change Commission (CCC) carbon reduction actions prioritise the electrification of light transport and includes incentives for purchasing EVs and a mandate to develop the supporting infrastructure.

Delivering on the emissions outcomes in the context of accelerated EV uptake, while also ensuring an affordable and reliable system is maintained, will require the actions outlined in this roadmap to be fast-tracked.

WELL's analysis of the new CCC targets indicates that:

1. Accommodating EVs will have the largest impact on electricity demand. The change from gas to electric hot water heating will have a compounding impact on peak demand.
2. If demand is not shifted away from peak periods, networks will have to be rapidly upgraded to accommodate an estimated 130% increase (by 2050) in peak demand energy consumption.
3. If demand from EV charging and the shift from gas to electric hot water heating can be shifted to less congested times, this would support an ordered planning approach, reduce the additional network capacity needed, and lower the size of price increases to customers

[1] Energy Efficiency and Conservation Authority by KPMG, https://www.eeca.govt.nz/assets/EECA-Resources/Research-papers-guides/EV-Charging-NZ.pdf

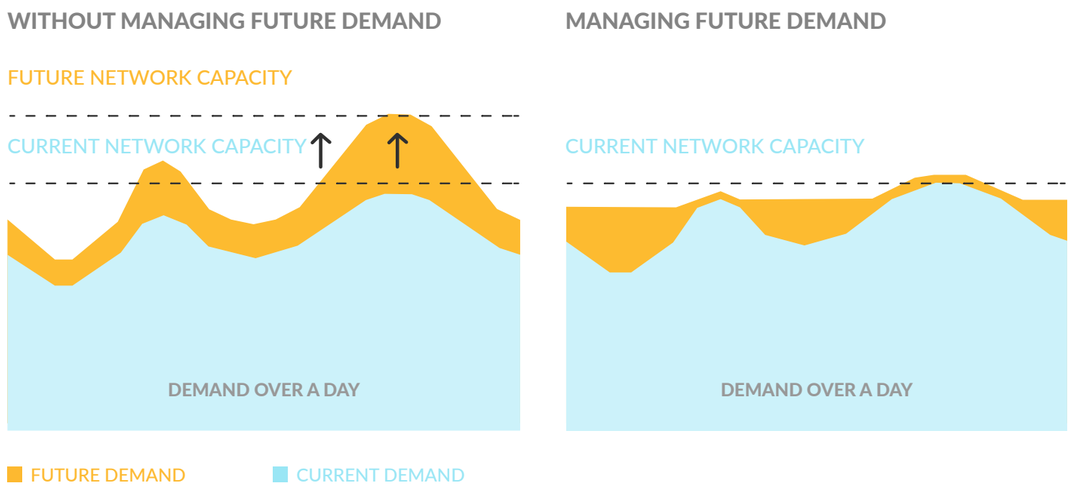
4. There may be trade-offs between price and quality as the network's headroom (peak capacity) used for managing network security is squeezed.
5. Relying on traditional 'wire' solutions to meet the demand increase may mean network investment programmes may not be able to keep up with customer demand and network operations may not be able to maintain a reliable electricity supply.
6. Relying on traditional 'wire' solutions is likely to result in cost and price increases that are unaffordable for some consumers.

1.4. Optimising the electricity network

We estimate the electrification of the transport fleet and the transition away from gas will increase peak demand energy consumption on the Wellington network by around 130% by 2050.

Figure 3 shows that if the new demand is not well managed then higher investment will be required to increase demand capacity. Conversely, if the new demand can be managed and existing capacity headroom utilised during the less congested day and night periods, then further network investment could be deferred, helping to lower long term price increases for customers. Shifting energy use away from peak demand periods could reduce the increased peak demand from 130% to 108% (by 2050) and avoid having to build $300m in additional network capacity.

Figure 3: Optimising the electricity network



While the uptake of consumer owned DER is creating the challenge of rapidly increasing electricity demand, they could also help provide a solution by shifting that demand to less congested periods. Smart DER can be remotely managed to be charged or operated during off-peak periods.

EV's with smart chargers provide the greatest opportunity – an EV charger which can be dynamically managed to charge when the network is less congested. Not only can the charged battery be used to run the vehicle, in time, it could also be used to provide electricity to a household during peak demand periods, reducing network congestion even further.

Concept Consulting have been studying what types of DER provide the best opportunity to shift peak demand and optimise the electricity network[2]. The study found that management of EV chargers and hot water provides the best opportunity for shifting peak residential demand. The use of hot water management has been employed for a number of decades through night storage and ripple control. The management of EV chargers provides the best opportunity to influence demand from new DER.

The purpose of EV Connect is to optimise the use of the existing electricity network to deliver the increase in demand from a rapid uptake of EVs - while maintaining a secure electricity supply and affordable prices.

How EV Connect proposes to do this is to partner with consumers with smart EV chargers through a DCA[3] to provide flexibility services – services which use consumer DER to move electricity demand away from congested periods on the network.

Distribution networks have been using price signals to encourage customers to shift peak demand energy use. However, we have found that price signals alone haven't been effective - at time of writing this Roadmap only 200 of the 5,200 EV's owners in Wellington had adopted time of use prices providing cheaper off-peak prices.

1.5. What next?

To enable consumers to recognise the full value of shifting EV charging demand, cooperation and co-ordination will be required across the electricity value chain. The EV Connect Roadmap has identified the actions needed to develop a managing EV charging flexibility service to optimise the electricity network. We have now reached the point where the industry needs to work together to implement the actions. Many of the actions are outside of the scope of distribution services and many of the changes needed are at a legislative or regulatory level.

The first Roadmap action is the formation of a leadership group to provide governance and oversight of the implementation phase. Feedback supported a co-led programme made up of a responsible government agency and industry representatives. We will hand the Roadmap over to this leadership group.

We look forward to collaborating with stakeholders to drive this forward over the latter half of 2022 and beyond.

[2] Concept Consulting: How New Zealand can accelerate the uptake of low emission vehicles Report 2: Consumer electricity supply arrangements 5 October 2021 (www.concept.co.nz)

[3] In the general context of a flexibility service, a DCA provides the permissions and operating terms that guide a flexibility service. Since the start of our EV Connect project, the term DCA has evolved to mean a flexibility service that can dynamically flex to changes in peak demand.

2 Roadmap Objectives

The Roadmap has clear objectives to deliver (1) customer value while continuing to provide (2) a safe, resilient and affordable electricity distribution services.

2.1. Customer value

Shifting EV demand provides customers with a range of benefits generated from different parts of the electricity system. In most cases the benefits can be aggregated or 'stacked', rather than traded-off. Figure 4 summarises the value that shifting peak demand generates across the electricity system[4].

Figure 4: Flexibility service (shifting demand) value stack

Stakeholders	Value stack	
Consumers & DER owners	• Generation investment deferral • Allowing DER to be connected • Energy arbitrage • Peak demand bill reductions • Backup power • PV self-consumption	Total value provided to consumers
Network owners	• Network congestion relief • Transmission investment deferral • Distribution investment deferral	
Systems Operator	• Frequency keeping • Instantaneous reserves • Voltage support • Black start	

[4] The Summary is based on information from Transpower's submissions to the draft Roadmap.

Consumers will recognise the full value of participating in flexibility services through a transparent, commercial process, where shifting their demand can be dynamically allocated to where this provides the most value. Prices will need to reflect the different values that each purchaser receives from different flexibility services – a value that will change depending on the time and location of the service being offered. It will also be important to ensure there are no barriers to competition – that anybody can participate (as long as participants do not have monopolistic advantages) and flexibility services are open for anybody to use.

2.2. Safe, secure and resilient network performance

The core purpose and responsibility of network owners is to provide consumers with a safe, secure and resilient electricity supply at an affordable price. Network operators work with the Commerce Commission and consumers to agree the level of quality that will be supplied at a price consumer are willing to pay. The level of quality includes network reliability (the frequency and length of outages) and power quality.

Network operators have three important network security considerations when accommodating EVs onto the electricity network:

1. What demand will EV charging require and is this visible for managed services to support the network
2. How and to what extent flexibility services can be used to reduce this demand during peak periods
3. The additional capacity needed to meet the residual (after flexibility services have been applied) increase in peak demand

For distribution networks to have confidence to use flexibility services as an alternative to building more network capacity, they must have the ability to call on flexibility services to curtail energy use when networks have reached their limits. If flexibility services are not available and demand increases, then new capacity will need to be build using traditional wire solutions.

Currently, the Wellington network can struggle for capacity on very cold winter nights when the network is at its highest peak load. During these periods we use hot water control to curtail peak demand so assets remain in service and power stays on. This ability to turn down non-essential power consumption, avoiding or delaying expensive infrastructure upgrades, helps limit future price increases.

Flexibility services could provide a substitute for the aging hot water control technology and provide further savings by increasing the ability to offset network peak demand periods.

The Roadmap's early view is that distribution networks may need priority access to flexibility services in the infrequent extreme peak demand periods. Without priority access, network operators are unlikely to have the confidence to rely on flexibility service as a demand management response to extreme demand events. Without priority access, the high regulatory consequence (annual penalties and up to $5m in fines) for not meeting network quality targets would incentivise networks to favour traditional wire investments.

3 Structure of the Roadmap

3.1. Roadmap phases – reflecting the evolution of flexibility services

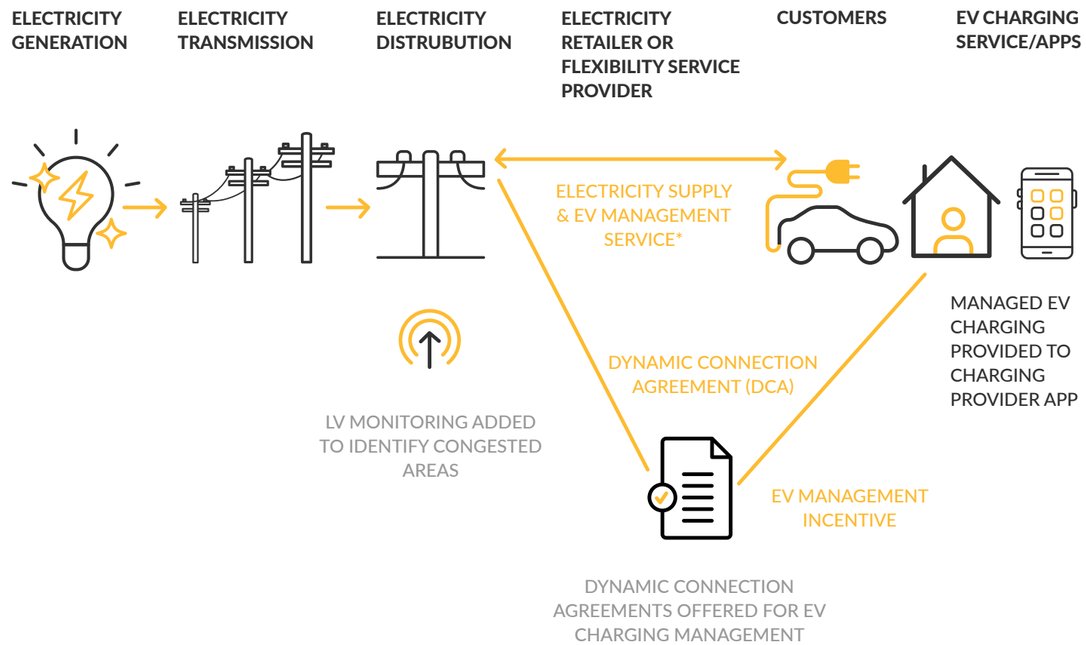
Flexibility services are currently offered in a simple form of ripple control to manage electric hot water storage. Flexibility services will evolve with time to include DER like EV chargers, providing more precise control at the much larger scale needed to allow the electricity supply chain to deliver the additional electrification demand from emission reduction initiatives.

3.1.1. Phase 1 – Demand management services to a single buyer

The evolution of flexibility services using EV chargers will start with flexibility providers (or retailers) offering a demand management response to single buyers of flexibility services. These services will start with simple service offering using one way power flows. The demand management response being offered will be an aggregation of multiple chargers. Figure 5 illustrates Phase 1 services.

Key actions in the first phase include developing standards and policies for smart charger implementation – this includes encouraging or mandating smart chargers that can participate in flexibility services and that can be connected to a centralised platform for direct management and market viability.

Figure 5: Phase 1 - demand management services to a single buyer



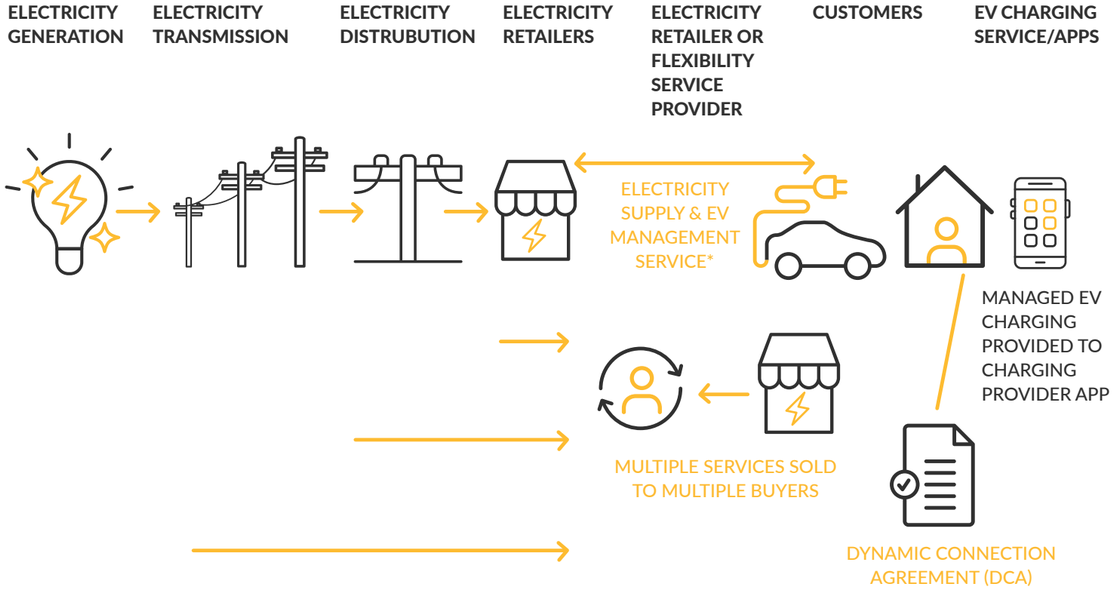
The steps to offer these initial services are certain, least regrets actions that can be delivered with a high degree of confidence that the changes made now, won't be creating barriers for future services.

[4] The Summary is based on information from Transpower's submissions to the draft Roadmap.

3.1.2. Phase 2 – Multiple services offered to multiple buyers

Flexibility services should then evolve to offer a range of different services that deliver the full customer value stack illustrated in figure 4. New services will include services that use two-way power flows allowing consumers to trade their excess energy to other users. This may require a trading platform that provides open access to all buyers and sellers. Figure 6 illustrates Phase 2 services.

Figure 6: Phase 2 - multiple services offered to multiple buyers



The final form of these more complex future services is unknown. Funding and time are needed for sellers and buyers to test and trial what these new services will look like. We believe that care is needed to avoid developing prescriptive commercial and regulatory frameworks too early. Regulatory flexibility is needed to allow stakeholders to test and develop the new services without barriers restricting valid commercial relationships or slowing progress.

The EV Connect Roadmap has broken the actions into these two phases, recognising that the actions associated with phase one are 'least regrets' and can be delivered with a high degree of certainty. Actions for phase 2 are less certain and have been structured as outcomes with key decision points rather than defined tasks.

Figure 7: Roadmap phasing

Phase	Phase 1	Phase 2
Purpose	Demand management services to a single buyer	Multiple services offered to multiple buyers
When	2023 - 2025	2026-2028
Status	Least regrets – high level of certainty	Uncertain – development needed to confirm actions

The Roadmap actions between 2022 and 2025 cumulate to deliver Phase 1 and form the foundations for Phase 2 which is delivered from 2026 to 2028. The success of Phase 1 is predicated on ensuring EV chargers are smart so they can participate in flexibility services, and that EV's are registered so that EDB can incorporate the new demand into their demand response planning. Phase 2 assumes that the review of the EDB regulated allowance calculation methodology, provides EDBs with allowances to purchase flexibility services.

To inform the creation of the Roadmap actions, the components needed to provide flexibility services have been organised around a framework which reflects a modified IPAG flexibility service process and delivery layers similar to as those used in Europe's Smart Grid architecture[5].

The Framework of flexibility service components has been built for each of the two Roadmap phases. The Roadmap will then be created by developing the steps needed to deliver each component. The framework and delivery layers are provided in the appendices.

Appendix	Description of the framework and delivery layers
B	Overview of the framework and delivery layers
C	Phase 1 Flexibility services: the components of a flexibility service that offers demand management services to a single buyer
D	Phase 2 Flexibility services: the components of a flexibility service where multiple services are offered to multiple buyers

[5] The full Smart Grid architecture is designed for IT solution delivery and is more detailed than is needed for this Roadmap.

4 EV Connect Roadmap

The Roadmap has been built by identifying the actions and steps needed to deliver each component of flexibility services. The actions have been presented by workstreams that reflect each of the delivery layers.

Time frames are indicative, but each step is iterative and connected. EV uptake will differ between networks and network operators may need to accelerate or slow when the Roadmap actions are needed depending on their own network characteristics.

The Roadmap is presented in figure 8. The Roadmap is presented in an alternative timeline format in Figure 9.

A description of each action is provided in Appendix E.

Figure 8: EV Connect Roadmap

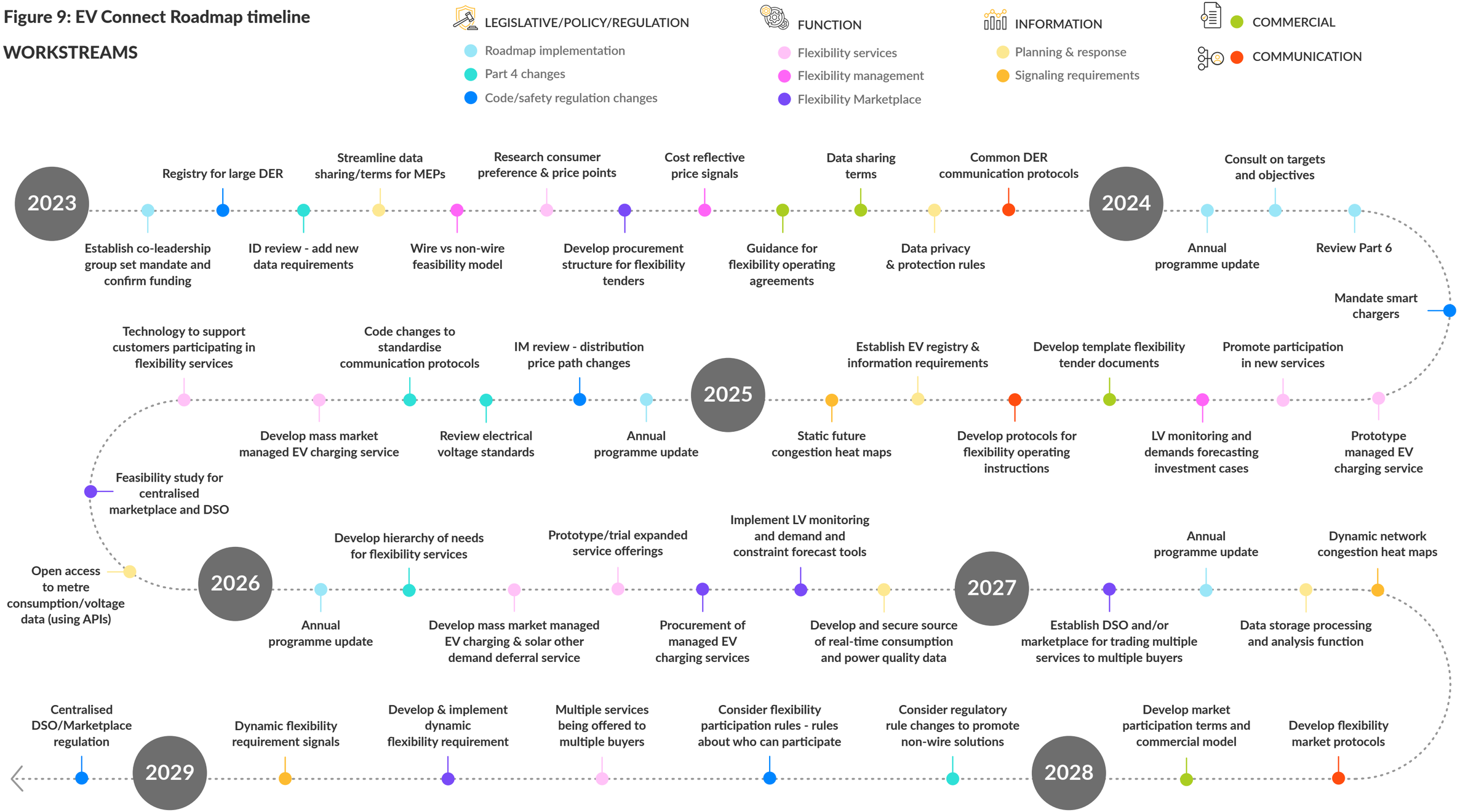
Component layer	Workstream	2023	2024	2025	2026	2027	2028	2029
Phase		Phase 1: Demand management services to a single buyer				Phase 2: Multiple services offered to multiple buyers		
Legislative/Policy/ Regulation	Roadmap implementation	Establish co-leadership group	Consult on targets and objectives	Annual update	Annual update	Annual update	Annual update	Annual update
		Mandate & Funding						
	Part 4 changes	ID review - new data requirements: • Trial updates & results • Flexibility purchases • DER uptake • Static congestion heat maps		IM review – distribution price path changes: • Data purchase • Flexibility services • R&D • Demand forecast • LV management • Equalise opex/capex			Consider regulatory rule changes to promote non-wire solutions	
	Code/Safety regulation changes	Streamline data sharing/terms for MEPs	Mandate/incentivise smart chargers	Review electrical voltage standards	Develop hierarchy of needs for flexibility services		Consider flexibility participation rules – rules about who can participate	Centralised DSO/ Marketplace regulation
		Registry for large DER	Review Part 6	Standardise communication protocols				

Component layer	Workstream	2023	2024	2025	2026	2027	2028	2029
Phase		Phase 1: Demand management services to a single buyer				Phase 2: Multiple services offered to multiple buyers		
 Functions	Flexibility services	Research consumer preference & price points	Prototype managed EV charging service	Develop mass market managed EV charging service	Offer mass market managed EV charging & solar other demand deferral services Prototype/trial expanded service offerings – including market arbitrage, power quality management, services with 2-way power flows		Multiple services being offered to multiple buyers – timing dependent of service development and timing and scope of DSO and marketplace	
			Promote participation in new services	Technology to support customers participating in flexibility services				
	Flexibility management	Cost reflective price signals	LV monitoring and demands forecasting investment cases		Procurement of managed EV charging services		Develop & implement dynamic flexibility requirement	
		Wire vs non-wire feasibility model			Implement LV monitoring and demand and constraint forecast tools		Develop & implement ability to integrate multiple services into demand management response	
	Flexibility marketplace	Develop procurement structure for flexibility tenders		Feasibility study for centralised marketplace and DSO		Establish DSO and/or marketplace for trading multiple services to multiple buyers. Timing and scope dependent on scope feasibility outcomes		

Component layer	Workstream	2023	2024	2025	2026	2027	2028	2029
Phase		Phase 1: Demand management services to a single buyer				Phase 2: Multiple services offered to multiple buyers		
Commercial	Standard terms & conditions	Guidance for flexibility operating agreements Data sharing terms	Develop template flexibility tender documents			Develop market participation terms and commercial model		
Information	Planning and response	Data privacy & protection rules Streamline data sharing	Establish EV registry & information requirements	Open access to meter consumption/voltage data (using APIs)	Develop and secure source of real-time consumption and power quality data	Data storage, processing and analysis function		
	Signalling requirements		Static future congestion heat maps			Dynamic network congestion heat maps	Dynamic flexibility requirement signals – timing and scope dependent on outcomes of centralised marketplace and DSO feasibility study	
Communication	Communication standards	Common DER communication protocols	Develop protocols for flexibility operating instructions			Develop flexibility market protocols		

Figure 9: EV Connect Roadmap timeline

WORKSTREAMS



5 Appendix A:

Roadmap contributors

Organisation			
Aurora Energy Limited	Electricity Networks Association	Network Tasman	Solar City
Commerce Commission	Energy Efficiency & Conservation Authority	Northpower	Transpower
Cortexo	Genesis Energy	Nova Energy	Unison
Concept Consulting	Horizon Network	Octopus	Vector Limited
Contact Energy	The Lines Company	Orion New Zealand	Wellington City Council
Counties Power	Mercury NZ	Our Energy	Wellington Electricity
CTQ Advisors	Meridian Energy	Powerco	WEL Networks Limited
Electricity Authority	Ministry of Business, Innovation and Employment	Retyna Limited	
Electricity Engineers Association	Ministry of Transport	Signature Consulting	

6 Appendix B:

Flexibility service framework and action layers

FLEXIBILITY RESOURCES

OPERATING INSTRUCTIONS

RESOURCES OWNERS

DYNAMIC CONNECTION AGREEMENT

FLEXIBILITY TRADERS

OFFER

FLEXIBILITY MARKETPLACE

REQUIREMENTS & PRICE

FLEXIBILITY USERS

Legislation and regulation: The legislation and regulation needed to support the provision of flexibility services. This includes regulation needed to fund the develop and purchase of services and regulation needed to ensure an open and competitive market for the services.

Functions: The development and provision of flexibility services and the functions needed to incorporate those services into buyer owns processes.

Commercial: The commercial terms and condition to support the trade of flexibility services and the information needed to support them.

Information: The provision of the data and information needed to support the provision of flexibility services.

Communication: A common communication language that will allow information and instructions to be understood and acted on.

7 Appendix C:

Flexibility service components – demand management service to a single buyer

	FLEXIBILITY RESOURCES	OPERATING INSTRUCTIONS ⟷	RESOURCES OWNERS	DYNAMIC CONNECTION AGREEMENT ⟷	FLEXIBILITY TRADERS	OFFER →	FLEXIBILITY MARKETPLACE	REQUIREMENTS & PRICE ←	FLEXIBILITY USERS
	• Mandate smart chargers		• High customer participation • Promote service uptake		• Participation rules • Data provision standards • Hierarchy of needs for flexibility services		• Procurement rules		• Funding to purchase services • R&D funding • Cost effective prices • Regulatory rules that equalise capex/opex
			• Template commercial terms • Template operational terms		• Standard procurement/ tender templates and terms • Template commercial terms				
					• Aggregated DER resources • Aggregated demand response				• LV monitoring • Demand forecasting • Constraint forecast • Integrate non-wire services
	• Shared consumption data • DER location & details				• Congestion heat map • Operating instructions		• Flexibility requirements • Price		
	• Communication protocols • Connection protocols				• Communication protocols				• Communication protocols

8

Appendix D:

Flexibility service components – multiple services offered to multiple buyers

	FLEXIBILITY RESOURCES	OPERATING INSTRUCTIONS ⟷	RESOURCES OWNERS	DYNAMIC CONNECTION AGREEMENT ⟷	FLEXIBILITY TRADERS	OFFER →	FLEXIBILITY MARKETPLACE	REQUIREMENTS & PRICE ←	FLEXIBILITY USERS
	• Mandate smart chargers		• Majority of EV's and hot water users participating • Promote service uptake		• Participation rules • Data provision standards		• Market participation rules		• Funding to purchase services • Cost effective prices • Equalisation capex/opex • Regulatory that promotes non-wire solutions
			• Template commercial terms • Template operational terms		• Standard procurement/ tender templates and terms • Template commercial terms				
					• Aggregated DER resources • Aggregated demand response (expanded service types)				• Real time LV monitoring • Real time demand forecasting • Real time constraint forecast • Integrate non-wire services
	• Shared real time consumption data • DER location & details				• Dynamic congestion heat map • Operating instructions		• Dynamic flexibility requirements • Dynamic price		• Operating instructions
	• Communication protocols • Connection protocols				• Communication protocols				• Communication protocols

9 Appendix E:

Roadmap actions

Each action is described in detail in the following sections. The detailed description includes who (which stakeholder group) is best placed to lead the delivery.

9.1. Leadership

These actions will establish a joint leadership team with a government authority (potentially The Electricity Authority) that has the mandate to make the necessary supporting regulatory and funding changes. The leadership team will be responsible for delivering the Roadmap - to drive progress, set outcomes and report (annually) on progress.

Action		Purpose	Description	Who is best to deliver
1	Establish co-leadership group	To lead the delivery of the Roadmap actions.	Establish a central leadership group to drive objectives, set outcomes and report (annually) on progress. A joint leadership team with a government authority (potentially The Electricity Authority) and industry representation.	Selected government authority (potentially The Electricity Authority).
2	Mandate & Funding	To ensure the work programme has the funded needed to implement and the mandate needed to make the supporting regulatory changes.	Select a government agency to co-lead the work programme that has the mandate or influence to make the regulator changes needed. The Electricity Authority has the mandate to make code changes and its close cooperation with the Commerce Commissions would allow it to influence any related price/quality changes that are needed.	Selected government authority (potentially The Electricity Authority).
3	Consult on targets and objectives	Providing the future programme leadership with an opportunity to confirm the scope of the programme.	It is likely that the future owner of the Roadmap actions will want to confirm the actions and scope before proceeding.	Leadership group
4	Annual update	Annual programmes updates	To provide industry stakeholders with annual programme updates and any programme refinements or schedule changes.	Leadership group

9.2. Legislative/Policy/Regulation - Part 4 changes

EDB's and Transpower's price and quality paths are regulated by Part 4 of the Commerce Act. This work stream includes updating the information disclosures, so they include information needed to support future flexibility service development and to change the allowance calculation to allow the trial, development and eventual purchase of flexibility services. Later actions include consideration of whether regulatory rules are needed to promote non-wire solutions.

Action		Purpose	Description	Who is best to deliver
5	ID review - new data requirements	For EDB's to disclosure information needed to support the implementation of flexibility services.	Information to support the implementation of flexibility services includes: • Trial updates & results • Flexibility purchases • DER uptake • Static congestion heat maps	Commerce Commission with input from industry
6	IM review – distribution price path changes	To ensure EDBs are funded to trial and develop the integration of flexibility services and to purchase flexibility services in the future. Price path changes are also needed to remove any incentives to favour investments in wire solutions over non-wire solutions.	Changes to the price quality path includes: • Funding to purchase consumption data • Funding to purchase Flexibility services • Funding for research and development • Funding to develop demand and constraint forecasting • Funding to develop the capability to integrate flexibility services into a networks demand response tool • Funding to develop LV monitoring and management • Equalise opex/capex expenditure	Commerce Commission with input from industry
7	Consider regulatory rule changes to promote non-wire solutions	To ensure that networks consider non-wire solutions when making network investment decisions.	Consider whether EDBs will need to demonstrate that they have considered non-wire solutions when making network investments. This action has been included as a place holder to consider whether any regulatory intervention is needed.	Commerce Commission with input from industry

9.3. Legislative/Policy/Regulation - Code/Safety regulation changes

A number of changes will be needed to the Electricity Participation Code or to Safety Regulations to support the introduction of flexibility services and to ensure there are no barriers to participation.

Action		Purpose	Description	Who is best to deliver
8	Streamline data sharing/terms for MEPs	To streamline the sharing of consumption data. This is an essential step in the development of flexibility services.	Consumption data is still difficult to collect. Refine the Code to provide immediate and quick access to consumptions data. The data sharing terms in the code still require an EDB to have agreements with each retailer and there are restrictions on combining data from different retailers. Future Code changes should consider supporting common APIs or a central data registry to make data sharing even easier.	Electricity Authority with input from stakeholders
9	Registry for large DER	To provide visibility of large DERs like EV chargers.	The location and operating characteristics of large DER is needed so networks can plan and prepare for the additional demand caused by these devices.	Electricity Authority with input from stakeholders
10	Mandate/incentivise smart chargers	To ensure that DER can participate in future flexibility services.	For flexibility services to be a viable non-wire alternative to traditional network re-enforcement, they must have the scale needed to effectively shift peak demand. To participate in flexibility services, EV chargers must be able to communicate with flexibility providers and their use must be able to be controlled.	Relevant government agency with input from stakeholders
11	Review Part 6	To ensure Part 6 remains fit for purpose as the number and complexity of distributed generation connections increases.	Reviews Part 6 with a focus on the application response timeframes and cost recovery framework.	Electricity Authority with input from stakeholders
12	Review electrical voltage standards	Electrical (Safety) Regulation's voltage restrictions (which his currently +/- 6%).	Give consideration to applying a +10%/-6% voltage range like that applied in Australia. This could increase hosting capacity by 15%.	Electricity Authority with input from stakeholders

Action		Purpose	Description	Who is best to deliver
13	Standardise communication protocols	Ensure all flexibility service participants communicate in a common language.	Provide standard communication protocols for all flexibility service participants across the value chain.	Relevant government agency with input from stakeholders
14	Develop hierarchy of needs for flexibility services	To provide a hierarchy of needs that will ensure network operators have access to flexibility services in grid or network emergencies.	Without the confidence of calling on flexibility services in grid or network emergencies (where demand is about to exceed capacity), it is unlikely that network operators will have confidence to rely on flexibility services as an alternative to traditional network re-enforcement.	Electricity Authority with input from stakeholders
15	Consider flexibility participation rules – rules about who can participate	To ensure that flexibility services are being offered in a competitive market-place and customers are receiving the maximum value for participating in flexibility services.	Consider whether some stakeholders should be restricted from offering flexibility services as they may have an unfair competitive advantage and/or their participation restricts competition. This action has been included as a placeholder to consider whether any regulatory intervention is needed.	Electricity Authority with input from stakeholders
16	Consider centralised DSO/Market	Consider whether central body (s) should be created to provide a market for trading flexibility services and/or to provide DSO functions.	Central regulatory bodies maybe needed to: • To provide a marketplace to trade multiple flexibility services to multiple buyers • To provide a central distribution system operator function to co-ordinate complex demand management responses It may be more cost efficient to develop centralised services that provide complex trade and co-ordination functions.	Electricity Authority with input from stakeholders

9.4. Function - Flexibility services

Other judications, like the UK, have been funding EDBs to develop, trial and test flexibility services for the last five years. They have now reached maturity and scale required to provide an effective alternative to building traditional infrastructure. Careful trailing and testing is needed to understand how reliable flexibility services could be used in New Zealand and to understand the level of confidence that EDBs can rely on them to meet the regulatory quality standards. The development of flexibility services starts with research to understand consumer preferences and the development of a managed EV charging service using one-way power flows. The later actions include the development of a wider range of services that deliver the full value of the consumer value stack (as illustrated in Figure 4).

Action		Purpose	Description	Who is best to deliver
17	Research consumer preference & price points	Understand consumer preferences and price points. Design flexibility services that match consumer preferences and have high levels of participation.	For flexibility services to be a viable alternative to traditional wire solutions, they must have high consumer participation to provide the scale needed. Flexibility services must be offered in a form that consumers want to participate in.	Flexibility traders
18	Prototype managed EV charging service	Develop trials and pilots to test different aspects of a flexibility service and possible services.	Stakeholders will need to develop the processes and tools to provide their part in offering, purchasing and using flexibility services. Use trials and tools to develop and test different functions. Regulated businesses should share the results of the trails to accelerate the develop of the services and to avoid duplication.	Flexibility traders/EDBs/ Transpower/retailers
19	Promote participation in new services	Promote consumer participation to provide the scale needed for flexibilities to become a viable alternative to traditional wire solutions.	Consider whether additional, association level, promotion is needed in addition to flexibility service provider's own marketing.	EECA, ERANZ and ENA
20	Develop mass market managed EV charging service	Develop a managed EV charging flexibility services that can be offered to the mass market.	Managed EV charging offers the single largest opportunity to manage peak demand on both the distribution and transmission networks. A managed EV charging service requires the development of tools to directly control smart chargers and to aggregate the response for all customer participating.	Flexibility traders/ Transpower/EDBs

Action		Purpose	Description	Who is best to deliver
21	Technology to support customers participating in flexibility services	Develop tools to assist and encourage consumers to participate in flexibility services.	Tools and applications could be used to help consumers track how their devises are being used and the value being provided. If a flexibility service needs consumer interaction, applications could be used to streamline and facilitate the exchange of data.	Flexibility traders
22	Offer mass market managed EV charging & solar other demand deferral services	Offer flexibility services that defer demand to the mass market.	Flexibility services are offered to all consumers. Flexibility buyers have the tools and processes to incorporate those services into their own operations.	Flexibility traders
23	Prototype/trial expanded service offerings – including market arbitrage, power quality management, services with 2-way power flows	Continue to trial and develop flexibility services – expand service offering to capture the different types of value represented in the customer value stack.	All flexibility service participants will need to continue to trial and refine the tools and processes to offer, purchase and use flexibility services.	All flexibility service participants
24	Multiple services being offered to multiple buyers – timing dependent of service development and timing and scope of DSO and marketplace	Offer the expanded service range to the mass market	Offering a wider range of services will allow customers to recognise the full value stack of services illustrated in Figure 4. The exact requirements of this actions still need to be developed – this action is a placeholder for a future requirement.	Flexibility traders

9.5. Function - Flexibility management

EDB's will need to develop the tools and processes to support the integration of flexibility services into their demand management response. This workstream starts with modelling to understand when non-wire solutions will become feasible alternatives to wire solutions and the development of LV monitoring and capacity constraint forecasting that will inform when flexibility services will be needed. This workstream is dependent on new regulatory allowances needed to fund the changes.

Action		Purpose	Description	Who is best to deliver
25	Cost reflective price signals for network operators	To reflect the value of flexibility services to sellers.	The price for flexibility service should reflect the value of that service to the potential buyer. For example, an EDB will price the value of shifting peak demand to a less congested period as the value of deferring network re-enforcement.	EDBs
26	Wire vs non-wire feasibility model	To develop the tools to assess the viability of non-wire solutions as an alternative to traditional wire solutions	The feasibility model should allow network operators to assess: • Impact on quality targets • Operational performance risk assessment • Price/cost impact • Financial viability under the regulatory rules	Network operators
27	LV monitoring and congestion forecasting investment cases	Development of a business case for the ability to monitor congestion and power quality on the LV network. The business case should also include the ability to forecast future LV demand and congestion.	The ability to monitor LV congestion and power quality and to forecast future demand and congestion will allow networks to signal when and where flexibility services will be needed.	EDBs
28	Procurement of managed EV charging services	Networks are actively procuring EV demand management services as a demand management tool.	Networks are starting to purchase simple flexibility services using simple procurement tools like market tender. These early services could be being provided under restricted terms as the services are refined. Uptake will depend on the availability of regulatory funding to purchase the services.	Network operators

Action		Purpose	Description	Who is best to deliver
29	Implement LV monitoring and demand and constraint forecast tools	Implement the LV monitoring investment recommended in the business case.	Implementation will be dependent on the successfully securing funding through the regulatory allowances. The LV monitoring capability could be purchased as an asset and some aspects could be purchased as a service.	EDBs
30	Develop & implement dynamic flexibility requirement	Refine the precision of network congestion forecasts, incorporating real time data that will allow networks to immediately see the impact that flexibility services are having on network performance. This will improve the accuracy of flexibility price signals.	Improving the ability to monitor the effects of flexibility services and the price signals calling on flexibility services will provide networks with more confidence in using non-wire solutions. This will allow networks to reduce any capacity buffers in place and further reduce network investment. The exact requirement of this action still needs to be developed – this action is a placeholder for a future requirement.	EDBs
31	Develop & implement ability to integrate multiple services into demand management response	Refine and improve an EDBs ability to incorporate a wider range of flexibility services. This could include services that improve power quality and services with two-way power flows that offset peak demand.	Allowing EDBs to call on a wider range of services will allow customers to recognise the full value stack of services illustrated in Figure 4. The exact requirement of this action still needs to be developed – this action is a placeholder for a future requirement.	EDBs

9.6. Function - Flexibility marketplace

The marketplace for flexibility services will evolve with the services that it will trade. Initially this will be simple demand management response services purchased by a single buyer. The marketplace for these services will be a simple tender offered to potential flexibility service providers. Complex market mechanisms will not be needed. When services evolve to the point where there are multiple buyers bidding on a range of different services, a market platform maybe needed to manage the trading.

Action		Purpose	Description	Who is best to deliver
32	Develop guidance on procurement structure for flexibility tenders	Provide templates and guidance to streamline the flexibility procurement process.	The procurement process could be streamlined if participants used standard agreements and processes. Limiting this action to providing guidance will help maintain low implementation costs and avoid creating barriers to future services.	Electricity Authority with input from stakeholders
33	Feasibility study for centralised marketplace and DSO	Assess whether a marketplace is needed to trade a wider range of flexibility services to multiple buyers.	The assessment should establish whether a centralised trading platform is needed so that customers can recognise the maximum value from participating in flexibility services – that they are recognising the full value stack. The exact requirement of this action still needs to be developed – this action is a placeholder for a future requirement.	Electricity Authority with input from stakeholders
34	Establish DSO and/or marketplace for trading multiple services to multiple buyers. Timing and scope dependent on scope feasibility outcomes	Implement the feasibility study recommendation.	Implement the feasibility study recommendation.	Electricity Authority with input from stakeholders

9.7. Commercial - Standard terms & conditions

Standard terms and conditions could be used to streamline the purchase of flexibility services. The form of the terms and conditions will depend on the maturity of the services being sold.

Action		Purpose	Description	Who is best to deliver
35	Guidance for flexibility operating agreements	To provide template and guidance on developing the operating terms for flexibility services.	To streamline the procurement process and to help promote competition.	ENA or Electricity Authority with input from stakeholders
36	Data sharing terms	Standard commercial terms and conditions for purchasing consumption data from MEP or other providers.	To streamline the procurement process and to help align costs with regulatory allowances.	ENA
37	Develop template flexibility tender documents	To provide template and guidance on procuring flexibility services.	To streamline the procurement process and to help promote competition.	ENA
38	Develop market participation terms and commercial model	Develop terms and conditions for participating in purchasing or selling flexibility services in a centralised market	The exact requirement of this action still needs to be developed – this action is a placeholder for a future requirement.	Electricity Authority with input from stakeholders

9.8. Information - Planning and response

Purchasers of flexibility services need accurate consumption information (the size, location and timing of future consumption) to support their demand management and planning functions. The information will be used to forecast when and where flexibility services will be needed and at what price non-wire solutions could provide an attentive to traditional wire solutions.

Action		Purpose	Description	Who is best to deliver
39	Data privacy & protection rules	Ensure data privacy rules are in place and understood before data is shared between flexibility service participants. Support MBIEs work programmes to develop a data privacy and protection framework.	EDBs will need to develop and improve their data privacy capability as they are given access to customer data like electricity consumption, or the location and details of new devices being installed.	MBIE
40	Streamline data sharing	Immediate review of the data sharing mechanism in the Code	Correct the current weaknesses in the recent Code changes: • Streamline what's still are cumbersome process • Include MEP in the obligations and process • Allow data to be combined	Electricity Authority with input from stakeholders
41	Establish EV registry & information requirements	Establish a national registry with the location and size of large DER	Large DER have the potential to significantly impact the security of supply and power quality. Network operators need this information to effectively manage network demand.	Electricity Authority with input from stakeholders
42	Open access to meter consumption/voltage data (using APIs)	Assess options to implement shared data arrangements. Consider applying APIs that will allow seamless data sharing.	APIs that use a common communication language would provide similar levels of data access as a central data registry at a lower cost.	Electricity Authority with input from stakeholders
43	Develop and secure source of real-time consumption and power quality data	Consider the best source of real time data.	Real time consumption data could be provided by meter providers or directly from DER in the future. Decide what the best source will be before investing.	Electricity Authority with input from stakeholders
44	Data storage, processing and analysis function	Consideration of who is best placed to store, process and analysis consumption data.	The size of consumption data sets will increase significantly as data is recorded at 5-minute increments. The storage and analysis of large data sets is expensive, and it may be inefficient for multiple parties to duplicate the development of this capability.	ENA/ERANZ

9.9. Information - Signalling requirements

An EDB will assess what flexibility services are needed as part of their overall network management plans and will calculate the price at which those services can be offered, a price which reflects the network investment that can be deferred. EDBs will then signal these requirements to flexibility service providers. These signals will evolve with the flexibility services they are calling on.

Action		Purpose	Description	Who is best to deliver
45	Static future congestion heat maps	To indicate to flexibility providers where flexibility services will be needed on a distribution network.	This will provide a useful guide for Flexibility Service providers. However, care must be taken when using the heat map in isolation. The need and value of flexibility services will also be influenced by: • Impact of other demand management tools • Planned network re-enforcement underway. Network re-enforcement may be needed even with demand management tools due to the size of the extra capacity needed. • An efficient price reflecting the value of deferring investment.	EDBs
46	Dynamic network congestion heat maps	Refine the work heat maps to provide a more precise measure of network congestion.	Incorporate real time congestion data	EDBs
47	Dynamic flexibility requirement signals – timing and scope dependent on outcomes of centralised marketplace and DSO feasibility study	Refine the price signal for flexibility services to reflect the more precise measures of network congestion.	Price signals will change for different services and for different times and locations on the network.	EDBs

9.10. Communication - Communication standards

As illustrated in Appendix C and D, the provision of flexibility services requires co-ordinated actions across the electricity system. This will require a common language/ communication protocol to ensure service requests can be understood and acted on.

Action		Purpose	Description	Who is best to deliver
48	Common DER communication protocols	Standard communication protocols to ensure that DERs can communicate with flexibility participants.	Implementers of this action will need to balance standardisation with avoiding rules that will restrict product development.	Electricity Authority with input from stakeholders
49	Develop protocols for flexibility operating instructions	Standard communication protocols for communicating operating instructions to flexibility providers and participating DERs to act on.	Implementers of this action will need to balance standardisation with avoiding rules that will restrict product development.	Electricity Authority with input from stakeholders
50	Develop flexibility market protocols	Standard communication protocols for buyers and sellers participating in the flexibility service market.	Implementers of this action will need to balance standardisation with avoiding rules that will restrict product development.	Electricity Authority with input from stakeholders