Evoenergy's Demand Management Innovation Allowance (DMIA) Compliance Report

Regulatory year 2020-2021

October 2021

evoenergy

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1. INTRODUCTION AND PURPOSE

This compliance report has been prepared by Evoenergy for reporting to the Australian Energy Regulator (AER) under the Demand Management Innovation Allowance Mechanism (DMIAM).

This report for the 2020-2021 regulatory year is considered suitable for publication (with no confidential information included).

As specified in Section 2.3 (3) of the DMIAM Guidelines, this annual DMIAM compliance report includes the following required information in the sections indicated in Table 1:

Table 1: Required information under DMIAM Guidelines and references to sections in this report

DMIAM Compliance Reporting 2.3 (3)	Information Requirement	Reference to Sections in this Report
(a)	the amount of the allowance spent by the distributor	**Section 2.3**
(b)	a list and description of each eligible project on which the allowance was spent	**Section 2.2**
(c)	a summary of how and why each eligible project complies with the project criteria	**Section 2.2**
(d)	for each eligible project on which the allowance was spent, and in a form that is capable of being published separately for each individual eligible project, a project specific report that identifies and describes: i) the nature and scope of each demand management project or program, ii) the aims and expectations of each demand management project or program, iii) how and why the eligible project complies with the project criteria; iv) the distributor's implementation approach for the eligible project; v) the distributor's outcome measurement and evaluation approach for the eligible project; vi) the costs of the project or program: 1. incurred by the distributor to date as at the end of that regulatory year; 2. incurred by the distributor in that regulatory year; and 3. expected to be incurred by the distributor in total over the duration of the eligible project. vii) for ongoing eligible projects: 1. a summary of project activity to date; 2. an update of any material changes to the project in that regulatory year; and 3. reporting of collected results (where available). viii) for eligible projects completed in that regulatory year: 1. reporting of the quantitative results of the project; 2. an analysis of the results; and 3. a description of how the results of the eligible project will inform future demand management projects, including any	**Sections 3-7**

	lessons learnt about what demand management projects or techniques (either generally or in specific circumstances) are unlikely to form technically or economically viable non-network options. ix) any other information required to enable an informed reader to understand, evaluate, and potentially reproduce the demand management approach of the eligible project.	
(e)	Where an eligible project has extended across more than one regulatory year of the regulatory control period, details of the actual expenditure on each such project or program in each regulatory year of the regulatory control period to date.	**Section 2.3**
(f)	A statement declaration signed by an officer of the distributor delegated by the chief executive officer of the distributor certifying that the costs being claimed by each demand management project: i. are not recoverable under any other jurisdictional incentive scheme, ii. are not recoverable under any other state or Australian Government scheme, and iii. are not otherwise included in forecast capital expenditure (capex) or operating expenditure (opex) approved in the AER's distribution determination for the regulatory control period under which the mechanism applies, or under any other incentive scheme in that distribution determination.	**Section 2.4**

2. DMIA PROJECT SUMMARIES

This section provides a summary of the projects and project costs over the 2020-2021 regulatory year for which DMIAM expenditure was incurred.

2.1 Project Criteria

For ease of reference, project criteria for eligibility under DMIAM Guidelines Section 2.2.1(1) is included below:

An eligible project must:

(a) be a project or program for researching, developing or implementing demand management capability or capacity; and

(b) be innovative, in that the project or program:

i) is based on new or original concepts; or

ii) involves technology or techniques that differ from those previously implemented or used in the relevant market; or

iii) is focused on customers in a market segment that significantly differs, from those previously targeted by implementations of the relevant technology, in relevant geographic or demographic characteristics that are likely to affect demand; and

(c) have the potential, if proved viable, to reduce long term network costs.

2.2 Project Summaries

As required in Sections 2.3(3)(b) and 2.3(3)(c) of the AER DMIAM Guidelines, Table 2 provides a list, description and summarises how and why each eligible project complies with the DMIAM Project Criteria.

Table 2: Project list, description and compliance with the DMIAM project criteria

Project	Description	How and Why Project meets DMIAM Criteria
Realising Electric Vehicles to Grid Services (REVS)	The Realising Electric Vehicle-to-Grid Services (REVS) project is aimed at unlocking the full economic and grid benefits of Vehicle-to-Grid (V2G) services in Australia. REVS is an ARENA funded project[1]	The project researches, develops and implements a demand management capability for Evoenergy for a new class of DER assets, namely V2G enabled vehicles,

[1] https://arena.gov.au/news/world-leading-electric-vehicle-to-grid-trial-in-act/

	led by ActewAGL Retail in conjunction with the ACT Government, JETCharge, ANU, SG Fleet, Nissan, Accenture, and Evoenergy. The project will see 51 bi-directional V2G enabled fast Electric Vehicle (EV) chargers installed in commercial buildings, all providing Frequency Control Ancillary Services (FCAS). **Evoenergy's involvement in the project is limited to managing demand implications of V2G operation of electric vehicle (EV) fleets installed in commercial buildings.**	to partake in network load management while also operating in the national market. The REVS project provides Evoenergy the unique opportunity to manage demand implications of V2G enabled vehicles and explore innovative DM capabilities of this new technology. See Section 3.3 for details on how the project meets the DMIAM criteria.
Distributed Energy Resources Integration and Automation project	This project is an ARENA funded project[2] led by Evoenergy to simulate the utilisation and control of DER to ensure that the network is maintained within technical limits. This allows for deferral of the need for grid augmentation investment and at the same time increase network capacity to host more DERs. To achieve this Evoenergy is using the existing Schneider Electric EcoStruxture Advanced Distribution Management System (ADMS), a new instance of the Schneider Electric Distributed Energy Resource Management System (DERMS), the Evoenergy IoT Hub and the Greensync deX system.	This project aims to investigate the potential application of dynamic demand response for residential batteries for network support services by engaging with customers with an existing solar and/or battery system that is VPP capable. See Section 4.3 for details on how the project meets the DMIAM criteria.
Distributed Energy Resources Lab (DER Lab)	The DER Lab project is a joint initiative by ITP Renewables and The Australian National University along with Evoenergy and University of New South Wales to build a physical lab that will enable users to test DER device capability to provide services. This project has received $1.5 million investment from the ACT Government's Priority Investment Program and Evoenergy's commitment in the project is providing in-kind support through time and labour for the duration of the project	The project researches and develops demand management capability for new and innovative DER assets to test the functionality through new monitoring and control mechanisms in a physical lab. This will enable Evoenergy to test these new demand management measure from customers' DER before being deployed in the network with by third parties.

[2] https://arena.gov.au/projects/der-integration-and-automation-project/

	The DER Lab will facilitate rapid prototyping and testing of different combinations of new control, monitoring and communication systems for use with distributed energy and storage solutions.	See Section 5.3 for details on how the project meets the DMIAM criteria.
EVGrid Trial	This project aims to demonstrate the role that Distribution Network Service Providers (DNSPs) can play in coordinating Electric Vehicle (EV) charging. It will do this by investigating technology and customer behaviour in dynamically managing EV charging following network conditions. This project aligns with our strategic intent to support rapid uptake of EVs while utilising existing electricity distribution network infrastructure efficiently and avoiding unnecessary network expenditure especially on the low voltage network.	The EVGrid Trial is a project for developing and demonstrating demand management (DM) capabilities required to efficiently manage peak electricity demand from residential electric vehicle (EV) charging in line with customer expectations. See Section 6.3 for details on how the project meets the DMIAM criteria.
Ginninderry Residential Battery Trial	This project seeks to provide battery subsidies to 75 households connected to a single distribution substation in Ginninderry which is a fully electric development with mandated solar for all dwellings. Through this project, Evoenergy is collaborating with battery owners to alleviate network congestion during peak demand periods. This is being achieved by a combination of manual intervention through smart devices and through the trial of a new cost-reflective tariff that smart devices automatically respond to. The project would be the first of its kind in Australia, allowing each household to own the battery with shared management from Evoenergy for DM services.	The project is developing and implementing demand management capability for managing demand in fully electric developments and areas with high rooftop solar uptake. This project will play an important role in helping evolve the way we manage network demand and ensure our energy network continues to be resilient, reliable, and cost efficient. See Section 7.3 for details on how the project meets the DMIAM criteria.

2.3 Project Cost Summary

Total DMIA expenditure for regulatory year 2020/21 is $252,173. All costs are net of any project partner contribution.

Table 3: Project Cost Summary

Project	Project Status at June 2021	Costs in 2019-2020 Regulatory Year	Costs in 2020-2021 Regulatory Year	Total Costs till end of 2020-201 Regulatory Year
Realising Electric Vehicles to Grid Services (REVS)	**Ongoing – continuing**	[redacted]	[redacted]	[redacted]
Distributed Energy Resources Integration and Automation project	**Concluded**	[redacted]	[redacted]	[redacted]
Distributed Energy Resources Lab (DER-Lab)	**Ongoing – continuing**	[redacted]	[redacted]	[redacted]
EVGrid Trial	**Ongoing – new**	-	[redacted]	[redacted]
Ginninderry Residential Battery Trial	**Ongoing – new**	-	[redacted]	[redacted]

2.4 Statement on costs

In submitting this compliance report, Evoenergy confirms that the costs being claimed by each demand management project:

i) are not recoverable under any other jurisdictional incentive scheme,

ii) are not recoverable under any other state or Australian Government scheme, and

iii) are not otherwise included in forecast capital expenditure (capex) or operating expenditure (opex) approved in the AER's distribution determination for the regulatory control period under which the mechanism applies, or under any other incentive scheme in that distribution determination.

3. REALISING ELECTRIC VEHICLES TO GRID SERVICES (REVS)

This project is a continuing DMIA project from last financial year. The following project report provides details of the project activities up until the end of the 2020-2021 regulatory year. The project is ongoing in the 2021-2022 regulatory year but has faced delays due to various factors including charger certification delays and Covid-19 pandemic. The overall project was costed at around $6.26 million with ARENA contributing $2.4 million and Evoenergy's contributing around [redacted] of the overall funding.

3.1 Project nature and scope

The Realising Electric Vehicle-to-grid Services project, or REVS, will demonstrate the feasibility of EVs instantly discharging their vehicle batteries when the national grid needs extra power.

Fifty-two EVs will take part in the trial, which is the largest demonstration of vehicle-to-grid (V2G) services in Australia. The cross-sector project covers the whole electricity and transport supply chains and will create roadmaps and recommendations to deploy V2G technology at a national scale

3.2 Project aims and expectations

The REVS project seeks to support the reliability and resilience of the electricity grid, unlocking economic benefits making electric vehicles a more viable and appealing transport option for fleet operators. The outputs from the project are expected to increase the recognition and understanding of V2G services, and to increase the confidence of all stakeholders in the practicality, viability and reliability of V2G services.

3.3 How and why project complies with the project criteria

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The Realising Electric Vehicle-to-Grid Services (REVS) project researches, develops and implements a demand management capability for V2G enabled vehicles to partake in network services and operate in the ancillary market. **Evoenergy's involvement in the project is limited to managing demand implications of V2G operation of electric vehicle (EV) fleets installed in commercial buildings.** Charging EVs, particularly through fast-charging stations, poses a significant challenge for electricity distribution networks. Bi-directional V2G enabled fast chargers further exacerbate these challenges, especially if they are providing FCAS where they can potentially, within a few seconds, introduce demand on the network which is twice their nameplate capacity. There are several use-cases for V2G enabled EV fleets and the REVS project provides Evoenergy the unique opportunity to manage demand implications of V2G and

	explore innovative DM capabilities of this new technology without investing in a considerably costlier trial led by Evoenergy itself.
Be innovative, in that the project or program: **i. is based on new or original concepts; or** **ii. involves technology or techniques that differ from those previously implemented or used in the relevant market; or** **iii. is focused on customers in a market segment that significantly differs from those previously targeted by implementations of the relevant technology in the relevant geographic or demographic characteristics that are likely to affect demand**	The project involves technology – vehicle to grid – has not been previously used in the ACT for any network or market services. Evoenergy's network will be the first Australian distribution network to allow for a V2G enabled chargers to be connected to the network thereby allowing for EV owners to further monetise their assets. While the broader project is primarily focussed on providing FCAS from commercial EV fleets, Evoenergy's involvement is focussed and limited to managing demand implications of the provision of these services at scale. V2G enabled EV chargers have not previously been deployed anywhere in Australia and as such their interactions with network demand have not previously been investigated or trialled. ***Demand Management of commercial sites with V2G enabled EV fleets*** When bi-directional V2G enabled EV fast chargers provide FCAS, each charger monitors frequency locally and whenever frequency deviates outside the Normal Operating Frequency Band (NOFB), all chargers respond automatically and simultaneously. At a commercial site, in aggregate, this coincident response can potentially increase demand by twice the total maximum capacity of the EV chargers within seconds - at most within 3 seconds for Fast FCAS delivery. This poses to be a considerable increase in maximum demand at commercial sites. For example, one of the government buildings in REVS has 15 V2G enabled chargers being installed. The maximum demand for the site currently is 320kVa and these chargers, while providing FCAS, can potentially increase instantaneous demand by over 200kVA, and the maximum demand by over a 100kVA. To mitigate the impact of V2G operations of EV fleets, that is, to manage significant sudden increases in demand, Evoenergy needs to advise fleet operators of local network constraints so FCAS bidding (and response) can be maintained within safe network operating levels. The network would otherwise need to be augmented to cater to the cumulative capacity of the EV chargers, in addition to the maximum demand of the site. Evoenergy is achieving this by calculating and communicating safe operating limits as Operating Envelopes for these

	commercial sites. An example is included in Figure 1. (Default levels are included to limit demand in case of loss of communication with the chargers.) ***V2G Chargers are a new technology*** The V2G charger is unlike any current bi-directional inverter in the market today that has been installed in a distribution network. EV chargers are inherently different to solar and battery inverters as the resource, the EV, may not always be available and the demand impact is influenced by the usage of the vehicle. The V2G chargers being supplied for the project is a 7kW single phase charger with a smart connection and control hardware and software that is pre-programmed for working exclusively with a V2G capable vehicle. Connection requirements for other inverters are well established[3] but the same requirements do not currently apply to EV chargers. Applying Embedded Generation requirements to bi-directional EV charges at commercial sites would require them to go through cumbersome and costly network technical studies which would result in excessive limits being applied to their operation. This approach would inhibit innovation and provide inefficient outcomes for customers which would be against the local government's policies and the National Electricity Objective (NEO).
Have the potential, if proved viable, to reduce long term network costs.	In the local context, Evoenergy expects that the provision of FCAS through commercial V2G enabled EV fleets is going to deployed at scale in the near future. The Australian Capital Territory (ACT) Government is committed to significantly expand the number of zero emission vehicles in the ACT. - One of the initiatives to support EV uptake detailed in the Parliamentary and Governing Agreement of the 10th Legislative Assembly for the ACT[4], is to enact regulation to require charging infrastructure for new multi-unit residential and commercial buildings and investigate measures to support retrofitting of charging infrastructure in existing buildings. - The ACT Government Zero Emissions Vehicles Action Plan 2018–21[5] outlines a priority as electrification of

[3] https://www.evoenergy.com.au/developers/embedded-generation

[4] https://www.cmtedd.act.gov.au/__data/assets/pdf_file/0003/1654077/Parliamentary-Agreement-for-the-10th-Legislative-Assembly.pdf

[5] https://www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf

	transport and reducing the emissions from the transport sector in the ACT. According to the action plan, at least 50% of all newly leased ACT Government fleet passenger vehicles will be zero emissions vehicles in 2019–20. **Demand management techniques developed as part of REVS are directly applicable in managing demand introduced by EVs, especially through V2G operations of EV fleets at commercial sites. They would not only help avoid unnecessary network augmentation in the long term to cater to this additional demand but also help leverage these resources to provide demand response.** Demand profiles for sites with solar and battery inverters is well defined and inverter operation is well understood by DNSPs. With V2G chargers, among other factors, vehicle availability and use must also be considered in addition to default charging/discharging behaviour and energy and ancillary market participation. Beyond actively managing demand implications of V2G operation, the project also provides Evoenergy the opportunity to define - connection requirements for V2G chargers that would help maximise network utilisation; - demand profiles for sites with V2G chargers to be incorporated into internal systems, including the Advanced Distribution Management System (ADMS) for efficient operation and planning of the distribution network leading to lower network costs and in turn, lower costs to all customers; and - provide a credible DM ready option to be deployed in urban/commercial settings as urban load growth in town centres increase in the ACT.

3.4 Implementation approach

The project will be largely implemented in ACT Government's office buildings along with targeting the fleet vehicles in the buildings. This section of the customer base has not been targeted for any similar purposes and could potentially lead to a seamless integration of V2G enabled vehicles into the network providing reduced costs to customers and better utilisation of the network. Evoenergy is proactively engaging with the project partners to partake in the project to get early insights into the technical and commercial aspects of these V2G enabled vehicles and bi-directional chargers. Evoenergy is also potentially looking into whether the charger platforms and market interaction can be controlled and orchestrated by considering the network limits at the connection points via an operating envelope. The inverter based bi-directional chargers can also be potentially mapped onto

Evoenergy's Advanced Distribution Management System (ADMS) to enable real time visibility and signalling for aggregated control.

Milestone	Deliverables
Milestone 1	Ordering of the V2G compatible chargers.
Milestone 2	Ordering of 15 V2G vehicles.
Milestone 3	Testing of V2G system capabilities and the data streams. Meeting requirements for AEMO FCAS services.
Milestone 4	Ordering of 36 V2G vehicles. Installation of V2G compatible chargers, in one directional configuration.
Milestone 4A	Testing of EV charger capabilities beyond frequency services such as EV charger's response to selected grid disturbances, reactive power support, voltage management, and peak shaving.
Milestone 5	V2G system bidding into AEMO from the 51 Vehicles.

3.5 Outcome measurement and evaluation approach

The project outcome measurement will be assessed by evaluating the extent to which the aims and objectives are met as well as meeting the project delivery milestones as outlined in the implementation approach. As the demand management implications for V2G vehicles are a key learning for Evoenergy, the data stream from the V2G vehicles and bi-directional chargers' usage patterns under market conditions will be provided to Evoenergy. Multiple workshops were conducted to understand the use of the data sets as well as the communication protocols and standards of the operating envelope and the maximum network limits at different fleet locations (ACT Government buildings including ACT Health buildings). Analysis of this data, together with evaluation of customer survey results, will underpin the evaluation of the project.

The key outcomes that the project will be measured against include the following:

- Evoenergy will facilitate the first V2G charger installation in an Australian jurisdiction for commercial consumers, showcasing a streamlined connection process and approval.
- The project will highlight the technical and commercial viability of V2G capable fleet and provided Evoenergy with the regulatory changes required for DNSPs to efficiently plan and roll out investment for this new DER class.
- The project will build options for future Demand Management capability in ACT for Evoenergy as the industry explores interoperability and regulatory readiness.
- The REVS project will showcase Evoenergy's Strategy to transition to a Distribution System Operator (DSO).

3.6 Project Activity and Results

During the 2020-2021 financial year, the project faced numerous delays. This was mainly due to the certification delay for the bi-directional charger from Wallbox. As a first mover in this V2G sector, the REVS project is far ahead in learnings than other projects in terms of charger certification and connection processes. The Wallbox charger was unable to complete certification during the financial year due to differences from the European equivalent standard and had to be independently certified for AS/NZS 4777 standard. Only after certification could the bi-directional chargers be

shipped from overseas to Canberra. With the shipping delays and the Covid restrictions in various states and international countries – this process was also delayed with ARENA agreeing to extend the project timelines for multiple months.

The current standard AS/NZS 4777 is largely a developed for solar and stationary battery inverters, which deal with earth-connected loads. V2G can be categorised as effectively a grid-connected battery, but it is not necessarily earth-connected because it is mobile. The new 2020 version of the standard, under which REVS is testing, categorises V2G chargers as multiple mode inverters (those which can operate grid-interactive or stand-alone) rather than having a dedicated standard for V2G, which has led to the certification challenges for the REVS project.

The project consortium also released various lessons learnt reports and social research associated with V2G projects. Evoenergy contributed to these reports and was an active member in the consortium participating in weekly meetings and developing key demand management use cases for operating envelope testing at the various fleet locations. During the last financial year, Evoenergy developed a charging and discharging profile for particular sites (distribution transformer level limits) to test the control algorithm for the bi-directional chargers and their operations. This is being developed to be communicated in 2030.5 style parameters via a utility server to the charging infrastructure through ANU and Jet Charge's developments. This will be key in demonstrating how V2G enabled vehicles can provide demand management responses while also observing network constraints so as to defer any potential augmentation. This outcome will lead to faster returns for customers with this technology while also reducing the overall costs for electricity consumers within the ACT by avoiding augmentation costs.

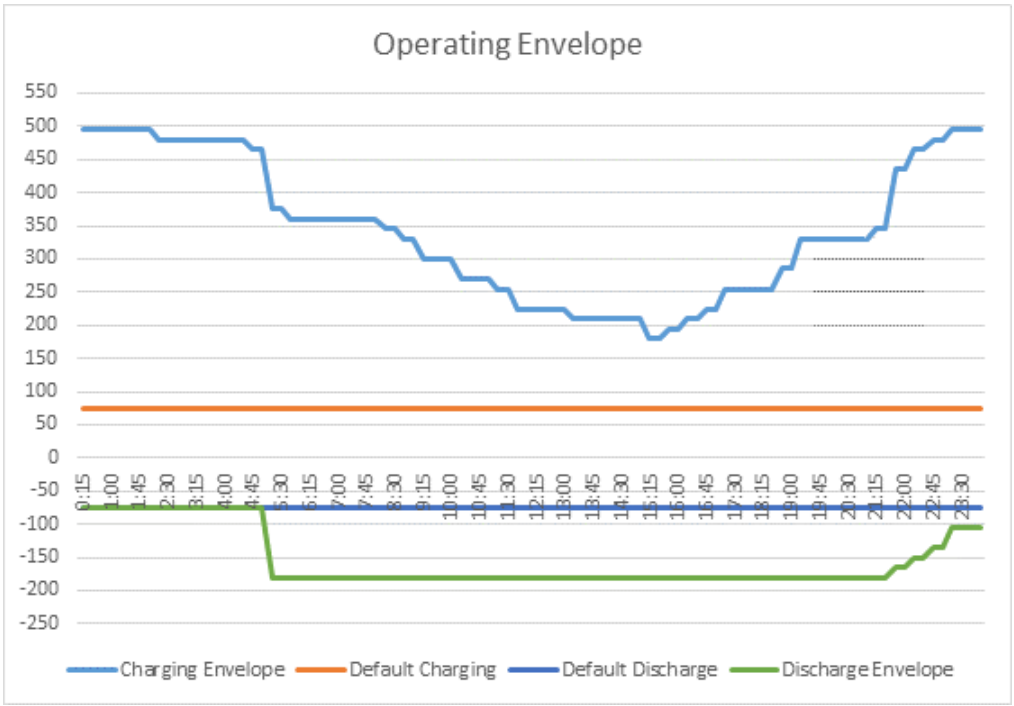

Figure 1: Operating Envelope for commercial site installing 15 V2G enabled EV chargers

Evoenergy also intends to use the learnings from this project to develop an EV connection policy to enable greater uptake of EVs while requiring a minimum set of capabilities from Electric Vehicle Supply Equipment (EVSE) in commercial and potentially residential sites.

3.7 Other Information

General information about the project can be found on the:

- Project website: https://secs.accenture.com/accenturems/revs/ and from ANU-BSGIP: https://bsgip.com/research/realising-electric-vehicles-to-grid-services/
- Project page on the ARENA website https://arena.gov.au/projects/realising-electric-vehicle-to-grid-services/

If you have a specific information request to assist in understanding or evaluating this project please contact demandmanagement@evoenergy.com.au .

4. DISTRIBUTED ENERGY RESOURCES INTEGRATION AND AUTOMATION

This project is a continuing DMIA project from the last financial year. The following project report provides details of the project activities up until the end of the 2020-2021 regulatory year. The project has concluded as of June 2021 and this will be the final year that the project is being reported. The overall project was costed at around $4.1 million with ARENA contributing $2.05 million and Evoenergy's DMIA contribution around [redacted] of the overall funding.

4.1 Project nature and scope

This project was a two-year research and development project (2019-2021) on the pathway for progressive enablement of distribution-connected DERs. The project delivery will occur through simulated use cases to identify network constraints (thermal/load constraints) and manage them using the DERMS and deX platforms by calling on the DER in the network.

4.2 Project aims and expectations

The project will demonstrate a market platforms' capability to integrate with aggregator controlled DER while performing functions to enable the network platforms and DER management platforms to signal, control and dispatch DER within the network in order to alleviate load and demand constraints in the network in an automated and integrated setting.

The overall aims of the project include the below:

1. Improve distribution networks capability to host DER at higher levels of penetration.
2. Enable market operators to manage the power system with a high share of DER while maintaining reliability and system security.
3. Increase the visibility, predictability or control of DER for network service providers (NSPs) or other relevant entities to optimise power system operation within secure technical limits.
4. Increase the visibility, predictability or control of network characteristics and behaviour to improve the efficiency of distribution network connection processes for DER or to optimise investment.
5. Facilitate the integration of ADMS-DERMS and market software for NSPs.
6. Increase hosting capacity on the network and improve business cases through enabling a commercial market for VPPs and DER services

Ultimately, this will provide DNSPs with alternate options to manage network constraints without the need for large network augmentation projects. Flexible or dynamic connection agreements could be the natural expansion of this trial and will also reduce the need to constrain DER customers seeking to export excess power into the grid

4.3 How and why project complies with the project criteria

This project showcases how Evoenergy, and by extensions other DNSPs, can implement Demand Management with potential to reduce long-term network costs by automating the signalling and deployment of more DER through network management systems via integrations through cloud based IoT integrations and provide financial returns for customers

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The project researches and demonstrates a simulation project for understanding demand management capabilities of distributed energy resource (DER) including: **1. Reducing peak demand** **2. Deferring asset augmentation using non-network options** **3. Maintain supply reliability** **4. Maximise integration of renewable generation in LV network through managing hosting capacity.** This project showcases how Evoenergy, and by extensions other DNSPs, can implement DM with potential to reduce long-term network costs by automating the signalling and deployment of more DER through network management systems via integrations through cloud based IoT integrations and provide financial returns. The project will provide Evoenergy **learnings** into the **technical and commercial capabilities required from platforms to integrate DER in the ACT network**. The project is innovative in that this project is based on new and original concepts and this project will use two leading industry platforms to demonstrate a coordinated approach to utilising a fleet of DERs within technical (network limits) and commercial (market prices) boundaries. These **dynamic operating envelopes** in real-time have not been researched and deployed in such manner and is unique and innovative in their approach. The project will research and develop demand management capability for Evoenergy and other DNSPs to manage network peak demand and increase hosting capacity.
Be innovative, in that the project or program: **i. is based on new or original concepts; or** **ii. involves technology or techniques that differ from those previously implemented or used in the relevant market; or** **iii. is focused on customers in a market segment that significantly differs from those previously targeted by implementations of the relevant technology in the relevant geographic or demographic characteristics**	The project intends to increase the visibility, predictability and control of DER for networks service providers (NSPs) and other relevant entities to optimise power system operation within secure technical limits. The project activity of simulating three use cases has the overall objective to deliver reduction in demand on the grid and test the viability of the communication standards and protocols. By offering reliable and cost competitive sources of demand reductions or voltage support services, battery VPPs have the potential to help avoid or defer network investment. The project use cases show **how thermal constraints – peak demand/load on the network feeders and transformers can be forecast and be assessed, analysed and relieved in real time** using the Demand Management

that are likely to affect demand	capabilities provided by DER in the LV network through aggregator channels. Finally, the DER customers that provide the response to the demand management and demand response signals can monetise their assets through market pricing as well. The project involves Evoenergy coordinating the integration of a DER management platform, namely DERMS – which is different to an aggregator platform with a market facing and DER registration platform called deX via an Internet of Things (IoT) Hub. This integration with a market capable platform **has not been completed by any other DNSP within Australia** as this is not a DER aggregator but rather a platform that can provide assets in the network with financial benefits for responding to **real time signals from the network to alleviate constraints**. *This addresses criteria (i) and (ii) of the DMIA requirements*. This analysis and integration with three distinct platforms each performing different functional aspects in a whole of system simulation providing LV network real time management of demand and constraints **is unprecedented and is innovative in all aspects and has not been previously conducted in the ACT and the NEM**. With this project, DNSPs can deploy or license these platforms and provide value to the DER customers within their jurisdictions without having to go through additional trials. The project will make public the integrations and lessons learnt from the project through ARENA and project website channels. ***This addresses criteria (iii) of the DMIA requirements.***
Have the potential, if proved viable, to reduce long term network costs.	The simulation project will explore DM opportunities from interplay between financial and technical drivers for DER assets for networks and customers in an increasingly decentralised energy ecosystem. The project also has the potential to integrate with any third-party aggregator so that they understand the requirements from the network to receive and send dispatch and control signals to their DER assets for DM services. This results in a **harmonised and standardised approach for demand management, load constraints alleviation and increasing hosting capacity** for other DNSPs thereby reducing the potential long-term cost of innovations and network expenditure to conduct more trials and pilots. Communication and interoperability standards and protocols will enable DNSPs, aggregators and retailers as well as AEMO to communicate with DER devices. The standardisation of architecture for this communication is a complex task. Dynamic operating envelopes could be

	beneficial to DER owners than static limits or constraints because it enables greater optimisation of DER services. The ESB is working with ARENA on how to support the nationally consistent uptake of operating envelopes across DNSPs and further work on this will emerge over the coming years. This project will assist with determining how Evoenergy can communicate to the DER in the network using protocols and mechanisms for demand management from batteries and solar PV systems deployed in the network. Newer suburbs within the ACT already have mandated solar PV installations (e.g., Denman Prospect, Ginninderry etc) and with increased electricity demand needs from gas switching from government incentives and policies, the demand management responses from these DER in these suburbs will potentially be required in a seamlessly integrated and automated fashion which this project simulates. When deployed in such fashion, **these platforms will provide peak load management where DER uptake is high** and in return increase the return for DER asset owners (average mum and dads) while **showcasing network efficiency in utilising non-network options for wider demand management capabilities in relatively fail safe operations in day to day network management.**

4.4 Implementation approach

The Low Voltage (LV) model that is currently existing on the Evoenergy's production system was imported to the DERMS platform for the trial. A part of the network was selected which consists of all the required components to suit our objectives of this project. For this project, Evoenergy selected the Woden Zone Substation and the downstream HV feeder called 'Streeton' for the simulation with 25,000 customers. The Streeton feeder incorporates greenfield and brownfield areas which has one of the highest penetrations of DERs within the ACT. The feeder also supplies parts of greenfield estate called Denman Prospect which has mandatory solar PV on each detached dwelling thereby making it an ideal selection for this project.

The LV model in production within Evoenergy already consisted of existing DER and some of them were added for the purpose of the project. DERMS used PV system and batteries as resources to resolve violations in the system, however electrical vehicles were also modelled for the situational awareness and the analysis of their impact on the grid.

All DERs and DER groups were modelled on DERMS. All controllable (VPP and autonomous) DERs were simulated by deX. All DERs that are not controlled were represented on DERMS. The historical data for this part of the network was obtained and integrated to predict their behaviours, calculate consumption forecast and generate battery profiles.

The project integrations were designed as shown below.

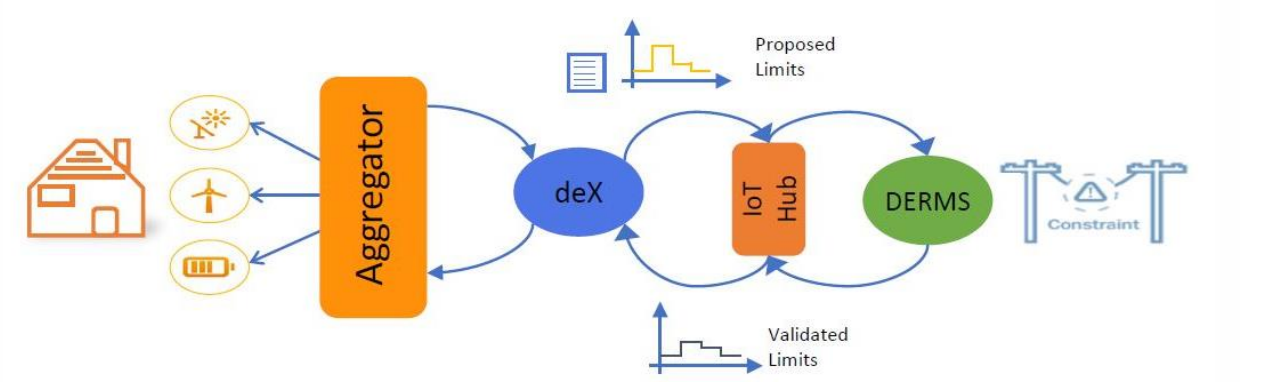

Figure 2: Design of the DER Integration and Automation project

The overall simulation exercises conducted during the duration of the project had the following overall capabilities which were implemented through Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) and numerous iterations for debugging and scenario analysis.

- The DERMS module to validate intended DER behaviour, effectively determining 'operating limits' for connected DER
- DERMS model would identify constraints and publish these to market.
- deX Marketplace will evaluate offers to generate new DER behaviour schedules
- DERMS will evaluate new schedules to resolve potential constraint and set new operational limits for DER which will be engaged by deXMarketplace within the financial parameters

The architecture of the analysed system is shown below, consisting of five layers:

Layer 1: EcoStruxure DERMS – centralised system that utilises DERs to optimise the distribution grid

Layer 2: IoT hub – a platform that enables communications between multiple systems

Layer 3: deX – a DER Registration platform

Layer 4: VPP – DER aggregator (simulated for this project)

Layer 5: DERs (simulated for this project)

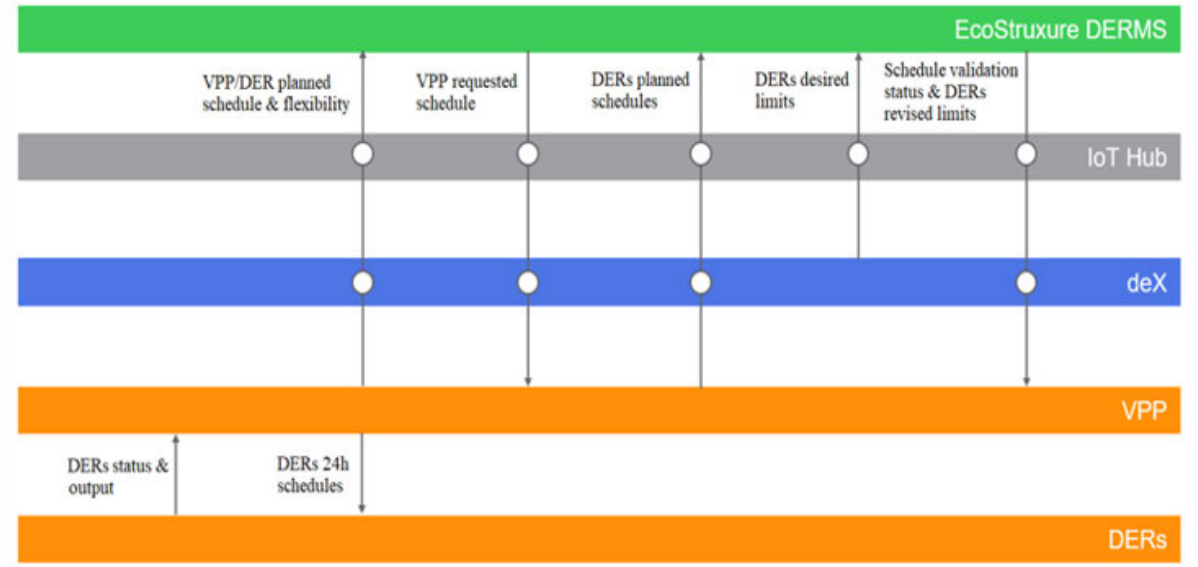

Figure 3: High level architecture for project

4.5 Outcome measurement and evaluation approach

The project outcome measurement will be assessed by evaluating the extent to which the aims and objectives are met as well as meeting the project delivery milestones. The project had 5 milestones as agreed with ARENA and these were continuously reported during the project lifecycle.

Description	Evoenergy Deliverables
Phase 1 – Initiate and setup	1. Negotiate and sign bilateral supply agreements with consortium 2. Establish a work plan and costings, negotiate and allocate internal budgets
Phase 2 – Design	1. Project manage and coordinate the design phase to facilitate system integration; 2. Conduct scoping exercise based on 5-day onsite technical workshop; 3. Review design documents and facilitate alignment with network data; 4. Develop design documents detailing system architecture
Phase 3 – Integrate and Deliver	1. Coordinate and project manage the integration and delivery phase; 2. Develop the IoT Platform interface between deX and the integration between IoT Platform interface to the Schneider ADMS -DERMS platform
Phase 4 – Completion of SAT and Delivery **Phase 5 – Knowledge Sharing**	1. Deploy DERMS system environment staging on site; 2. Supervise and sign off on site acceptance testing (SAT) 3. Report on outcomes and knowledge share

The project learning was to be evaluated against the milestones and the objective to understand the data that DNSPs collect, and the financial and electrical flows that may underpin future market models, and validate the performance of the DERMS model to be able to support the dynamic operation of the network, involving markets.

The overall learning and evaluations against the expected aims have been discussed further in the ARENA Knowledge sharing report available here: https://arena.gov.au/knowledge-bank/der-integration-and-automation-project-final-report/

4.6 Project Activity and Results

As part of the project, Evoenergy and the consortium conducted the following activities at various stages of the project.

- Expert advisory committee constituted (SAPN and EQL) and regular meetings were held (with ARENA representation).
- Project specific website designed

- Knowledge sharing of project to ARENA internal staff and at energy storage conferences completed through presentations and demos.

The simulations in the project were completed for the below use cases. This occurred in conjunction remotely with Evoenergy's internally developed IoT Hub, ADMS-DERMS module and the deX platform. The consortium tested and evaluated the outcomes from the use cases below to achieve the overall project outcomes which have been detailed in the ARENA Knowledge Sharing Report.

Number	Use Case	Purpose
1	DERMS initiates dispatch request (via IoT Hub to deX) to DERs to avoid upstream capacity constraint	Use DERMS for avoiding predicted grid constraints (overload, reverse flow) on feeder head section and HV/MV supply transformer.
2	Assessment of VPP call by third party - Individual DER dispatch and constraint identification	Use DERMS for validation of planned VPP behavior as response to call by 3rd party (e.g. Retailer) in order to maintain grid reliability and power quality
3	Avoidance of Network Violation from Natural DER Behavior - Individual DER dispatch and constraint identification	Use DERMS to adjust DER typical behavior, and avoid local grid issues caused by high DER penetration

The overall project showcases the minimum viable product for the project and the use cases that were considered at the initiation of the project. Since early 2018 when the project was first initiated with ARENA, the industry landscape has moved in relation to DER. The multiple projects and standards that have become the norm for DER orchestration are valid but were not considered for this project. This project highlights the opportunities in utilising dynamic control to maximise a customer's access to, and utilisation of, existing network capacity. For the benefits identified in this project to be realised in a real-life context, the percentage of DER that is able to provide these functions should be maximised. This could be achieved through a number of mechanisms including regulatory obligations, incentives (e.g., export limits, or tariffs) or others.

A short summary of some of the observations and future scope of works are detailed below:

- Platforms in DER orchestration will require the ability to correlate schedules and timings for DER limits (dynamic operating envelopes) being passed between systems
- All systems will need visibility of suppliable and consumable limits of DER system capability.
- In order to reduce confusion, specific messages for accepting or rejecting a service request will be needed between platforms.
- A Polling/Publishing method is required, where the data is exchanged between Network Management System and a Market platform, when data is ready to be sent instead of a set time cycle.
- The DER integrations will require the ability to provide scheduled behaviour and flexibility (upper and lower bounds) for consumption by network management systems.
- Network Management systems should be able to target DER output to a setpoint value (not in scope for this project, possibility for a next phase)
- DER aggregators and platform will require the ability to revert to a default safe behaviour in event of loss of communications (not in scope for this project, possibility for a next phase).

- The platforms could be required to aggregate and record/report the total energy constrained and the devices list that are being engaged. This is to verify from a DNSP point of view, the value of the generation/restriction being applied. This will assist in comparing against the network vs customer benefit in terms of investment (i.e., cheaper to pay through DER contracts or better to invest and remove the constraint causing issue)
- To reflect the dynamic nature of the distribution network configuration, it is essential that DER group membership can be updated over time. Dynamic membership complements the non-exclusivity functionality, by ensuring that the membership of DER to DER group(s), reflects the capability of those resources to address network issues associated with that group. For example, a resource that moves from one feeder to another as a result of network reconfiguration, should be removed from any groups of network areas that it no longer belongs to added to any new groups for network areas that it is now connected to. The membership of resource to DER groups should be updated and provided by network systems on a periodic basis.

4.7 Other Information

General information about the project can be found on the:

- Project website: https://www.evoenergy.com.au/emerging-technology/initiatives/der-integration-and-automation
- Project page on the ARENA website https://arena.gov.au/projects/der-integration-and-automation-project/ ; and

The final report and information on the project has also been published on the ARENA website (https://arena.gov.au/knowledge-bank/der-integration-and-automation-project-final-report/).

If you have a specific information request to assist in understanding or evaluating this project please contact demandmanagement@evoenergy.com.au .

5. DISTRIBUTED ENERGY RESOURCES LAB (DER-LAB)

This project is a continuing DMIA project from last financial year. The following project report provides details of the project activities up until the end of the 2020-2021 regulatory year. The project is ongoing in the 2021-2022 regulatory year but has faced delays due to various factors including charger certification delays and Covid-19 pandemic.

5.1 Project nature and scope

The DER Lab project is an ITP Renewables led project for the development of a lab located at ANU to enable industry to test and troubleshoot the interconnectivity and communications of technologies that monitor, control and coordinate distributed electrical generation, storage and demand response assets. The project was initiated by ITP Renewables and The Australian National University and has received $1.5 million in funding from the ACT Government's Priority Investment Program.

The scope of the project for Evoenergy includes providing steering committee level advice on the various stages of the project including the setup, network and DER assets procurement and operationalisation to essentially mimic a distribution network configuration for modelling and testing of third party equipment. The lab will be an open-access facility for third party hardware/software developers, universities, and network and market operators. Evoenergy's contribution to the project is around [redacted] of the overall project funding.

5.2 Project aims and expectations

The vision for the DER Lab is to establish, and grow over the long term, the leading facility in Australia for research, rapid prototyping, testing, and verification and certification of the integration of DER devices into the distribution system thereby reducing trial and testing costs for both vendors and network providers.

The project aims to lift availability of testing facilities for DER devices including control and monitoring equipment to drive increased, compliance, interoperability and performance of DER assets. Evoenergy aims to have increased confidence in new technology by gaining acceptance/performance tests within a controlled environment that is representative of a distribution network. The project aim is to develop protocols for multi-technology solutions to avoid early technology lock-in, streamline research and development and maximise the number of products which can be used across Australian networks. The DER - Lab hopes to become a national focal point for the ecosystem of DER developers, researchers, and utilities.

5.3 How and why project complies with the project criteria

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The DER Lab was initiated by ITP Renewables and The Australian National University and received $1.5 million investment from the ACT Government's Priority Investment Program. The project researches and develops demand management capability for DER assets to test the functionality to monitor and control DER before being deployed with customer assets by third parties. This is an early stage laboratory for DER equipment to verify their

	operating standards, settings and protocols in a controlled environment that does not cause any damage to the connected electricity network. The project will help Evoenergy achieve the high level of distributed generation that its customers desire while minimising the costs of network augmentation. It provides an avenue for Evoenergy to engage, inform, and support innovative technologies while they are being developed, tested, and operated in a controlled environment.
Be innovative, in that the project or program: **iv. is based on new or original concepts; or** **v. involves technology or techniques that differ from those previously implemented or used in the relevant market; or** **vi. is focused on customers in a market segment that significantly differs from those previously targeted by implementations of the relevant technology in the relevant geographic or demographic characteristics that are likely to affect demand**	Evoenergy's involvement in the DER-Lab is limited to informing technology providers that operate at the DER Lab of the network requirements, needs and opportunities so innovative DER technologies can be leveraged for - demand management in the future as opposed to posing a challenge for efficient management of the network; and - developing innovative cost reflective tariffs based on capabilities of future DER technologies Through previous trials with Home Energy Management Systems (HEMS), Demand Management Systems (DMS), and Virtual Power Plants (VPPs), Evoenergy has gained valuable insights and has helped local technology providers refine and further develop their products to the point where they can be leveraged to efficiently manage demand on the network, increase network utilisation, and lower costs for all customers. While this collaboration with industry has been beneficial for all parties involved, especially to Evoenergy, each trial has been an extensive, costly engagement. Involvement with the DER-Lab project is a proactive and innovative demand management initiative by Evoenergy where we share learnings and insights from our previous trials so once they are deployed on the network, they operate in a way that help manage demand and increase utilisation of the network, and are readily available for Evoenergy to engage in demand management programs and be used as non-network options where needed. This project has not been previously implemented outside of certification labs and even then, are not dedicated to DER assets in particular. The project targets a segment of the DER market in technology providers who will provide end use customers and utility operators a verified product for roll-out in their sectors.

	Relevant standards also do not exist for HEMS and DMS. Similarly, new technologies will emerge, and standards will follow but development of these technologies need to be informed by network needs before they get deployed at scale. As detailed above, behind the meter technologies have a material impact on the network but Evoenergy, as the DNSP, has limited control and visibility on how and where these are deployed. Blanket limitations on export from DER would be an inefficient way of managing the network and is against the local government policies, Evoenergy's vision of delivering sustainable energy solutions that our customers want, and the NEO. Besides, DER, such as batteries and EVs import as well. We cannot limit import from devices behind the meter, in customers' premises. From Evoenergy perspective, we get limited diversity in demand from these DER, especially when these assets are orchestrated by an aggregator or another third-party, or respond to frequency excursions outside the NOFB. Evoenergy expects this project to minimise future spend on trials of new technologies as Evoenergy will get early insights into and opportunities to inform development of these new technologies through the DER-Lab.
Have the potential, if proved viable, to reduce long term network costs.	The project will help reduce long term network costs by helping Evoenergy - avoid the need to trial new technologies once they are deployed in the lab; - mitigate demand implications of new technologies; - increase participation in Evoenergy's broad based DM programs; and - provide new DM options for inclusion in non-network options analysis in network planning. In addition, the ACT Government policy of providing residential battery subsidies via the Next Generation Energy Storage (Next Gen) Program[6] and the Zero-interest loans schemes[7,8] for DER uptake has already seen numerous DER technology providers approach Evoenergy to build integrations into Evoenergy's operational systems

[6] https://www.environment.act.gov.au/energy/cleaner-energy/next-generation-renewables

[7] https://www.actsmart.act.gov.au/what-can-i-do/homes/sustainable-household-scheme

[8] https://www.actsmart.act.gov.au/what-can-i-do/homes/sustainable-household-scheme

	without any significant customer uptake of their technologies. While each of these systems are unique and do not have common standards yet, the DER-Lab is a viable alternative for these vendors to engage with network requirements and showcase their demand management capabilities and operating protocol standards for a much lower cost compared to setting up a pilot with Evoenergy. The DER-Lab is a perfectly suited facility where networks requirements for DM can be exposed to the wider market in technically safe environment for customer equipment to be tested and proven prior to deployment on the network.

5.4 Implementation approach

In its simplest configuration, the lab environment can be powered directly from the mains, providing typical Australian distribution network conditions (50 Hz AC power with 230 V +10%/-6% nominal voltage).To unlock the full functionalities of the lab as a fail-safe environment with custom grid conditions, it is vital that the lab environment be decoupled from the national power system.

Some of the tests that the lab is designed to enable include:

- The integration of a battery control device with various batteries
- The behaviour of DER devices under voltage disturbances
- The performance of Vehicle-to-Grid based frequency support
- The islanding and reconnection of a grid forming inverter based microgrid
- Exploring the behaviour of Virtual Power Plants in weak grid conditions
- Power Hardware-in-the-Loop (PHIL) studies of inverter control systems

The Lab provides users with a wide range of Australia's most popular DER devices. This includes one AC solar string, 5 DC solar strings, 11 solar inverters, 4 battery inverters, 2 hybrid inverters, 7 batteries, and an EV charger. It also features a 5 kW programmable solar simulator and three 6.5 kVA programable four-quadrant loads (and generators).

Evoenergy is providing in-kind support for the project as part of the steering committee for the project. This committee which includes Evoenergy has the authority to:

- Approve project management plans for the DER-Lab project and approve any changes to the project scope
- Approve conceptual design, technical design and operational design for the DER-Lab project.
- Ensure that the project is consistent with priorities and objectives of the ACT Priority Investment Program
- Oversee and make recommendations on the allocation of project resources
- Ensure an appropriate risk management framework is in place for the project;
- Make recommendations to the Project Manager and Team Leaders on all matters relating to the implementation;
- Receive project reports, and in conjunction with the take action to support the project meeting planned milestone dates and deliverables;

5.5 Outcome measurement and evaluation approach

The project is a two-year project which will involve the construction of a lab facility within the ANU campus in the Engineering building. This project will enable Evoenergy to provide a pathway for early stage innovations from the network and third parties to interact in a simulated network with real DER assets and provide clarity to networks and other parties on the validation of their products. In addition, Evoenergy will be able to steer interested parties to the DER Lab to provide verifiable results to their test regimen and network specifications.

Evoenergy will gain:

- Knowledge of emerging devices that can assist with DER integration into the network.
- Knowledge of control protocols that can easily communicate to Evoenergy current ADMS and IoT hub specifications as well be able to keep abreast of new standards that are in development for DER technologies.

Th evaluation for this project will be that the lab contains as far as practicable, all the necessary hardware, software and skilled technicians required to test, develop, integrate and coordinate DER technologies. It would be comprised of real DERs, such as solar PV and batteries, real demand loads, and Demand Response Enabled Devices (DREDs), on a real network. The project will establish an access fee model (and/or if appropriate, accreditation fee model) through industry consultation in with a significant proportion of industry lab users who will be fee paying in order to re-coup operational costs.

5.6 Project Activity and Results

During the last financial year, Evoenergy assisted and helped the consortium evaluate various technical and operational queries in relation to the physical lab that was being constructed at the ANU. This also involved in providing guidance on compliance against the embedded generation guidelines for the equipment that was being installed on site. Evoenergy viewed the site as a unique connection due to the fact that different DER such as batteries and inverters would be connected and disconnected depending on testing regimes from third parties. Evoenergy conducted on-site visits of the site prior to testing and also for commissioning of the generating equipment. Unfortunately, due to the Covid-19 pandemic, large periods of the last financial year was written off with construction stopped at ANU and the project having to extend its milestones with ACT Government approvals. As such there has been little development to report on in this DMIA report apart from the commissioning activities. The DER lab continued to be built and the DER equipment was procured during the financial year with a view to conduct a launch of the site within the first quarter of the 2021-2022 financial year. The significant delays in the project is evident in Evoenergy's overall in-kind commitment this reporting year (2020-21 FY) being markedly lower compared to previous year.

Upon completion, the project will enable third party hardware/software developers, universities, and network and market operators to troubleshoot the interconnectivity and communications of technologies that monitor, control and coordinate distributed electrical generation, storage and demand response assets which will lead to enhanced customer experience with DER assets and also reduce network expenditure to trial and test new technologies that may or may not be viable.

This will foster further Demand Management innovation in the electricity network from DNSPs, aggregators, retailers and other DER OEMs leading to faster commercialisation of technologies for

customer needs and meeting network requirements while having the potential to reduce long term network costs.

5.7 Other Information

General information about the project can be found on the:

- Project website: https://der-lab.net.au/

If you have a specific information request to assist in understanding or evaluating this project please contact demandmanagement@evoenergy.com.au .

6. EVGRID TRIAL

This is a new project for developing demand management capabilities required to manage peak electricity demand from residential electric vehicle (EV) charging.

The project is a collaboration between five DNSPs - comprising Jemena Electricity Networks (JEN), AusNet Services, United Energy, TasNetworks and Evoenergy - and JET Charge, a technology provider for EV charging. JEN is leading the consortium. The project has received $1.55m funding from the Australian Renewable Energy Agency (ARENA) under the Advancing Renewables Program[9].

Evoenergy is participating in the trial to investigate the integration of Electric Vehicles (EVs) within the electricity network in the ACT. The project will run over three regulatory years (2020/21, 2021/22, 2022/23) with a total budget of $3.39m. Evoenergy's total DMIA commitment for the project over the three years is [redacted] which is only about [redacted] of the total project budget.

6.1 Project nature and scope

EV charging or transport electrification has the potential to improve electricity network efficiency by increasing network energy throughput leading to a reduction in network charges ($ per kWh) to all customers but the benefit can only be realised if no/limited additional network investment is required to enable EV charging. If not managed efficiently, even non-EV owners will bear the burden of the cost of additional network capacity required to charge EVs.

This project is exploring future impacts of EV charging on the network and the viability and customer response to various demand management interventions by the DNSP, through recruitment of 176 EV owners and testing the concept of managing EV charging dynamically with real-time assessment of available network capacity. As such, the project has the potential to improve the efficiency of future network investments, accommodate more EVs in the network without augmentation, mitigate supply risks on capacity constrained parts of the network, and decrease cost for all customers.

The project is co-funded by ARENA and conducted through a consortium of 5 DNSPs with a view to increase the collective learning of multiple DNSPs. The project is designed such that all insights and learnings from the project are published and shared widely across the industry.

6.2 Project aims and expectations

Key objectives of the trial are to:

- understand the impact of uncontrolled EV charging on the local network;
- understand what and when spare capacity is available in the existing network, and how the available spare capacity can be used to charge EVs; and
- demonstrate the role that DNSPs can have in managing residential EV charging to derive optimal outcomes for the network and all customers connected to the network.

Secondary objectives include:

- understanding customer behaviour regarding EV charging and willingness for participation in multiple forms of EV charging demand management programs; and
- understanding load forecast for managed EV charging and estimating incremental investment required in future after spare network capacity is fully utilised.

[9] https://arena.gov.au/news/electricity-networks-gear-up-to-manage-electric-vehicle-demands-on-the-grid/

6.3 How and why project complies with the project criteria

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The EVGrid Trial is a project for developing and demonstrating demand management (DM) capabilities required to efficiently manage peak electricity demand from residential electric vehicle (EV) charging in line with customer expectations.
Be innovative, in that the project or program: **i.** is based on new or original concepts; or **ii.** involves technology or techniques that differ from those previously implemented or used in the relevant market; or **iii.** is focused on customers in a market segment that significantly differs from those previously targeted by implementations of the relevant technology in the relevant geographic or demographic characteristics that are likely to affect demand	The project is trialling an innovative DM approach for managing residential EV charging load at peak demand times. This approach involves monitoring the distribution substation and forecasting non-EV load for real-time assessment of available network capacity. This assessment is then used to dynamically adjust charge rates of chargers connected to the substation. This ensures that network capacity is optimally utilised and minimises the need for network augmentation to support mass EV uptake and the resulting charging load in the future. The project has a strong customer focus to ensure that any demand management techniques developed are in line with customer expectations and preferences. The project will collect EV charging data for 12 months, conduct several customer surveys and offer different incentives for participation at different stages of the trial. These aspects of the project will help understand customer behaviour regarding EV charging and willingness for participation in different forms of EV charging DM programs, ensuring customer participation when these DM programs are rolled out on scale. As EV uptake increases, EV charging load at times of peak demand on the network is an emerging challenge for DNSPs across the country. It is of particular relevance in the ACT as the local Government has a strong focus on increasing EV uptake to support the Territory's aim of achieving net-zero carbon emissions by 2045. While there are other energy market focussed trials being conducted elsewhere, Evoenergy is not aware of any instance where this DNSP led technique of demand management is being used for managing EV charging load anywhere in Australia.
Have the potential, if proved viable, to reduce long term network costs.	In the local context, Evoenergy expects mass uptake of EVs in the near future. The ACT Government Zero Emissions Vehicles Action Plan 2018–21[10] outlines the Territory's commitment to significantly expand the number of zero emission vehicles (ZEVs) in the ACT. To accelerate uptake of ZEVs, the ACT Government is offering

[10] https://www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf

	- $15,000 interest free loans[11]; - stamp-duty exemption; and - free vehicle registration for 2 years. Other initiatives to support ZEV uptake detailed in the Parliamentary and Governing Agreement of the 10th Legislative Assembly for the ACT[12] are to - target all new vehicles sales to be ZEVs by 2030; and - enact regulation to require charging infrastructure for new multi-unit residential and commercial buildings and investigate measures to support retrofitting of charging infrastructure in existing buildings. **Demand management capabilities developed as part of this project are directly applicable in managing demand introduced by both residential and commercial EV charging. They would not only help avoid unnecessary network augmentation in the long term to cater to this additional demand but also help leverage these resources to provide demand response. It also means that the outcome of this project will allow Evoenergy to reduce its long-term network cost by efficiently utilising its existing assets.** Beyond the main DM objectives of the project, it will also provide Evoenergy with charging data from EVs with and without intervention which will be leveraged to define demand profiles for sites with EV chargers which will be - incorporated into internal systems, including the Advanced Distribution Management System (ADMS) for efficient operation and planning of the distribution network; - used to explore tariff options to drive charging behaviour without direct control; and - provide a credible DM ready option to be deployed in both residential and commercial settings.

6.4 Implementation approach

The project was formally kicked off in January 2021 after receiving ARENA approval. The project has 4 milestones and will be run over three regulatory years, 2020/21 to 2022/23.

Milestone 1: Project Design and Customer Acquisition

Milestone 1 activities and reporting to ARENA was completed in May 2021. ARENA has since reviewed and approved all milestone deliverables. In this stage, Evoenergy refined the scope and design of the project in consultation with industry experts and project partners. The project

[11] https://www.climatechoices.act.gov.au/policy-programs/sustainable-household-scheme

[12] https://www.cmtedd.act.gov.au/__data/assets/pdf_file/0003/1654077/Parliamentary-Agreement-for-the-10th-Legislative-Assembly.pdf

website[13] was launched, customer recruitment was completed, and system architecture for the software platform (Figure 4) was finalised.

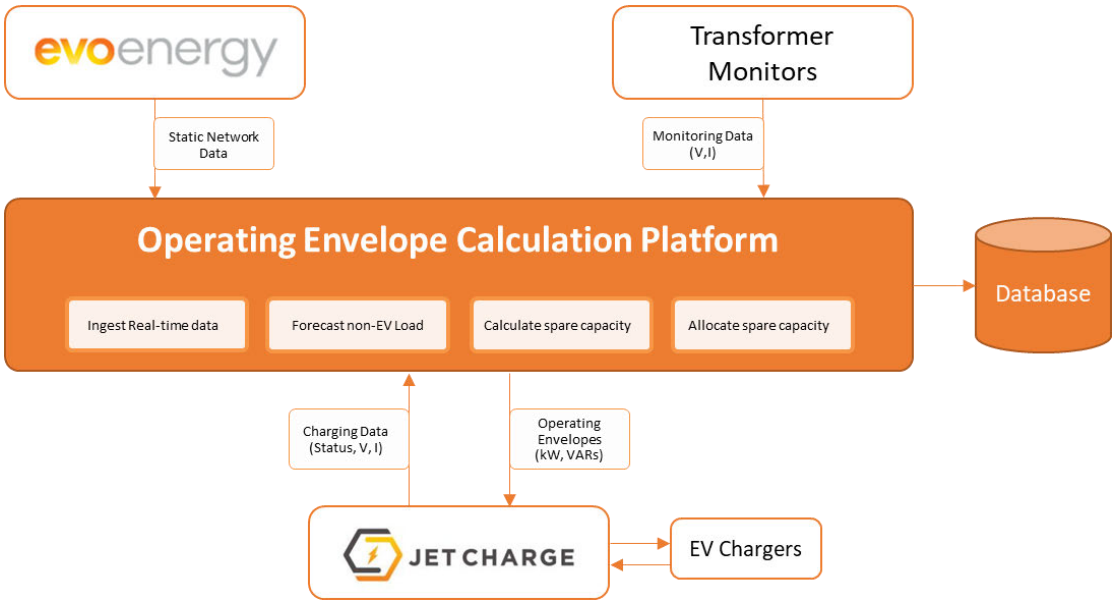

Figure 4: High-level system architecture of software platform

Milestone 2: Software Development and Installation of Hardware

Milestone activities are currently underway with a target completion of February 2022. These deliverables include development and testing of the software platform (Figure 4), installation of charging equipment at the residences of participating customers, procurement and installation of distribution substation transformer monitors, and initial customer surveys.

Milestone 3: Demand Response Events and Customer Surveys

Several demand response events will be conducted in this milestone with varying levels of customer incentives. These events will be coupled with customer surveys to understand customer preferences, experience, and willingness for participation in different forms of EV charging DM programs. Target completion of this milestone is end of May 2022.

Milestone 4: Project Completion and Knowledge Sharing

The final milestone is targeted to be completed by end of calendar year 2022. This milestone will include publication of a final project report capturing details of the extent to which the project achieved the target objectives, challenges and highlights of the project, and conclusions and recommendations from the project. All milestones of the project have a strong knowledge sharing component. The final report will also include details of the knowledge sharing activities undertaken during the project and an analysis of their effectiveness.

6.5 Outcome measurement and evaluation approach

The project is expected to deliver on the objectives detailed in Section 6.2. Project results will be evaluated against these objectives and the outcome will be included in the final project report published in Milestone 4. Through the course of the project, Evoenergy will collect data from charging

[13] https://www.evgrid.com.au/

equipment and transformer monitors. Analysis of this data, together with evaluation of customer survey results, will underpin the evaluation of the project.

After delivery of the final milestone and publication of the report, Evoenergy will conduct further analysis to ensure all possible learnings from the project are embedded in Evoenergy's planning and operation of the network.

6.6 Project Activity and Results

Key updates from the project till end of regulatory year 2020-2021 include:

- Project setup including internal approvals, ARENA approval, and commercial and legal arrangements with project partners – Complete
- Detailed project scope and design – Complete
- Customer recruitment and onboarding – Complete

Milestone 2 activities detailed in Section 6.4 are underway. Focus for regulatory year 2021-2022 will be delivery of milestones 2 and 3, also detailed in Section 6.4.

6.7 Other Information

General information about the project can be found on the:

- Project website: https://www.evgrid.com.au/ ;
- Project page on the ARENA website: https://arena.gov.au/projects/jemena-dynamic-electric-vehicle-charging-trial/ ; and
- Evoenergy website: https://www.evoenergy.com.au/emerging-technology/initiatives

Further reports and information on the project will also be published on the ARENA website (https://arena.gov.au/projects/jemena-dynamic-electric-vehicle-charging-trial/).

If you have a specific information request to assist in understanding or evaluating this project please contact demandmanagement@evoenergy.com.au .

7. GINNINDERRY RESIDENTIAL BATTERY TRIAL

Ginninderry is a greenfield development in the ACT which is expected to grow to a total of 11,500 dwellings over the next 30 years. As part of its sustainable vision, the Ginninderry Joint Venture (Ginninderry JV between Riverview Projects and the ACT Government's Suburban Land Agency) aims to reduce greenhouse gas emissions, electricity demand to the grid, and energy costs to residents. This is achieved through a fully electric development with mandatory requirements for solar panels, home energy management systems (HEMS), and energy efficient appliances. Evoenergy intends to explore how residential battery storage systems could be used in the Ginninderry development to manage electricity demand within an environment of a fully electric development with 100% solar PV (photovoltaics) uptake.

To this end, Evoenergy has been successful in securing a $250,000 Renewable Energy Innovation Fund (REIF) grant from the ACT Government[14] which is primarily being used to subsidise battery systems for 75 customers. In exchange for the subsidy, trial participants are allowing Evoenergy to manage their batteries' operations for the duration of the trial. Existing commercial arrangements with Distributed Energy Resources (DER) aggregators are being leveraged for real-time data and control of these batteries, both directly through control signals and indirectly using price signals through cost reflective tariff trial. In addition to the REIF grant, [redacted] are being contributed for the Trial by the Ginninderry JV. Evoenergy's spend under DMIA for the regulatory year 2020/21 was [redacted]. The trial is expected to conclude in the regulatory year 2023/24. Evoenergy's total DMIA commitment for the project over the three years is around [redacted] of the total project budget.

7.1 Project nature and scope

The Ginninderry Residential Battery Trial seeks to provide battery subsidies to 75 households connected to a single distribution substation in Ginninderry Stage 1 of Neighbourhood 1. The trial would be the first of its kind in Australia, allowing each household to own the battery with shared management from Evoenergy for demand management services.

With the knowledge gained from this trial Evoenergy will continue to innovate with residential batteries at a larger scale and explore how we can provide residents with incentives for providing services to the network. These incentives can be in the form of cost-reflective network tariffs, battery subsidies, and/or network support payments.

The primary aim of this project is to perform a trial for:

- using distributed energy resources (DER) in a no gas scenario to assist with demand management and quality of supply management to optimise network investment that will help lower cost impact of decarbonisation to all customers in the ACT; and
- obtaining valuable data, insights, and operational experience from leveraging residential batteries for optimising PV hosting capacity of the network.

The Trial is intended to run over three regulatory years (2020/21 – 2022/23). The results will be studied by Evoenergy and Ginninderry JV during and after the trial and will be used to inform both parties' strategic policies for the future.

[14] https://www.evoenergy.com.au/about-us/media-centre/2020-09-11-ginninderry-battery-trial-builds-on-our-future-focus

Additionally, Evoenergy is leveraging this unique project to engage with the community and recruit trial participants to a new network electricity trial tariff[15] that may be suitable for the future ACT electricity network. The data recorded and analysed through the trial will be used to determine whether an additional tariff(s) may be introduced to Evoenergy's suite of network electricity tariffs in the 2024-2029 regulatory period.

The objective is to introduce a tariff (or tariffs) that will enable Evoenergy to apply advanced pricing techniques to improve network utilisation and enable efficient integration of DER. This objective will be achieved by providing customers (particularly those with solar PV and a battery) with clearer pricing signals, thereby providing customers with the opportunity to manage their electricity network bill to a greater extent than they are currently able to.

7.2 Project aims and expectations

The project aims to achieve a range of demand management outcomes. The key objective is to gain a better understanding of the way in which future energy customers equipped with solar, battery, energy efficient appliances and HEMS devices will interact with the network. This in turn will enable Evoenergy to potentially achieve the following:

- **Automating demand management using price signals**: Tariff based DER orchestration for improved network utilisation through response of HEMS and other smart devices to price signals (sent via the trialled tariff).
- **DER data in the ADMS**: Validation of data acquisition capability of the ADMS from multiple DER aggregators for operational and planning purposes.
- **Tariff optimisation**: Improved understanding of the way in which HEMS respond to network price signals which could then potentially be used to refine the electricity tariff structure.
- **Reduced or deferred network augmentation**: Improvements in network utilisation through manual and automated orchestration of DER within the Evoenergy network, especially in areas with high electrification and/or high solar PV uptake.
- **Model estate development framework**: A viable non-network option for developers and a framework for close collaboration with developers and the ACT Government for carbon neutral developments supporting the Territory's aim for net-zero carbon emissions by 2045.
- **Customer value proposition for demand management**: Experience in recruiting domestic customers in demand management programs and devising incentive structures to maximise participation.

Secondary objectives include increasing benefits to the customers to increase participation in DM programs, including:

- Access to a highly cost reflective tariff that their HEMS ingest and automatically optimise battery operation for. This will enable them to save on their network electricity bills and maximise returns from their solar and storage assets with minimal requirement for behaviour change.
- An additional battery subsidy with the flexibility to choose any battery, inverter, and provider in the ACT Government's Next Generation Energy Storage Program (Next Gen).
- Access to data and tools to make more informed decisions regarding their energy use.

[15] https://www.evoenergy.com.au/emerging-technology/initiatives/residential-tariff-trial

- Efficient management of their battery system, both through active intervention and through tariffs, which may otherwise be standing idle while also providing demand management services to the network with no or minimal cost to them.

7.3 How and why project complies with the project criteria

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The project is developing and implementing demand management capability for managing demand in fully electric developments and/or areas with high solar PV uptake. Through this project, Evoenergy is collaborating with battery owners to alleviate network congestion during peak demand periods. This is being achieved by a combination of manual intervention through HEMS devices and through the trial of a new cost-reflective tariff that HEMS devices automatically respond to. The tariff is designed to support the local electricity grid and provide customers with more control over their electricity bills. This project will play an important role in helping evolve the way we manage network demand and ensure our energy network continues to be resilient, reliable, and cost efficient.
Be innovative, in that the project or program: **i.** is based on new or original concepts; or **ii.** involves technology or techniques that differ from those previously implemented or used in the relevant market; or **iii.** is focused on customers in a market segment that significantly differs from those previously targeted by implementations of the relevant technology in the relevant geographic or demographic characteristics that are likely to affect demand	Ginninderry, being a fully electric development with no gas connections and having a 100% solar PV uptake, brings future DM challenges of decarbonisation through electrification and high penetration of solar in the network forward in time. This provides Evoenergy a unique opportunity to trial innovative DM programs that will help optimise network investment in the future. Thus the project meets criteria (iii) of being an innovative project. The project is serving as a trial to ensure effective utilisation of Demand Management Opex approved for the Strathnairn Zone Substation deferral[16] as part of Evoenergy's 2019-2024 regulatory determination. Main concept that is being trialled is to procure demand management at no or minimal cost to the customer by throttling the discharge of their battery during the evening peak. This may be done initially through manual intervention through the HEMS platform and later automatically by sending price signals to the HEMS device through the trial tariff. Similarly, the charging of the battery during the day will also be throttled to manage peak export on the network. As the concept of using residential batteries for capex deferral is new and both the techniques being utilised are different from those

[16] https://www.aer.gov.au/system/files/Evoenergy%20-%20Operating%20Expenditure%20-%20Appendices%206.1-6.2%20-%20Updated%20April%202018%20v2.zip

	previously implemented in orchestrating DER, the project meets criteria (i) and (ii) of being an innovative project.
Have the potential, if proved viable, to reduce long term network costs.	The ACT Government has set a target to reach net-zero carbon emissions by 2045. In the Parliamentary and Governing Agreement of the 10th Legislative Assembly for the ACT[17] the Territory has also committed to - Legislate to prevent new gas mains network connections to future stages of greenfield residential development in the ACT in 2021-22. Future stages of Jacka and Whitlam suburbs will be all-electric. - Commence a transition project to advance all-electric infill developments, with a goal of no new gas mains network connections to future infill developments from 2023. The ACT Government is also offering incentives for customers to install rooftop solar, including $15,000 interest free loans[18]. In the absence of innovative DM programs to manage peak demand, both fully electric developments and developments with mandated solar PV, will drive network investment that will raise costs for all customers. By bringing and addressing these challenges forward in time, this project, if proved viable, will reduce long term costs for all customers by providing credible non-network options for managing network congestion due to decarbonisation through electrification and high solar PV penetration. This will help co-optimise costs of DM and investment in the network while supporting the Territory's net-zero by 2045 goal.

7.4 Implementation approach

The project is being implemented in close collaboration with the Ginninderry JV. Eligible customers have the option to participate in the trials either by

- registering their existing smart battery energy storage systems; or
- purchasing a new subsidised battery energy storage system from any of the Next Gen providers.

For the first option, the customer receives the rebate directly from Evoenergy. Under the second option, the Next Gen provider offers the Evoenergy subsidy to the customer and subsequently claims the rebate from Evoenergy.

Once a customer is fully onboarded with a suitable system installed, they provide Evoenergy with the right to manage the operation of their system through their HEMS device or platform. Evoenergy will manage the battery to avoid congestion on the network. The intention is to operate the battery

[17] https://www.cmtedd.act.gov.au/__data/assets/pdf_file/0003/1654077/Parliamentary-Agreement-for-the-10th-Legislative-Assembly.pdf

[18] https://www.climatechoices.act.gov.au/policy-programs/sustainable-household-scheme

such that charging is throttled during the day to alleviate peak exports on the network and discharging is throttled during the evening peak to manage peak demand on the network. Evoenergy expects that in most instances this operation of the battery will introduce no or negligible additional cost for the customer. Either way the cost incurred would be miniscule compared to the battery subsidy.

Second stage of the trial would offer the customer a chance to participate in Evoenergy's residential battery tariff trial[19]. In this stage, the same DM outcome (described above) would be achieved through the HEMS automatically optimising the battery's operation to minimise cost for the customer and as a result providing DM services to the network.

7.5 Outcome measurement and evaluation approach

As described in Section 7.4, the techniques being trialled are aimed at achieving the ultimate outcome of avoiding congestion on the network. Figure 5 is a simple illustration of the comparison between operation of an uncontrolled battery and the ideal operation aimed to be achieved through this project.

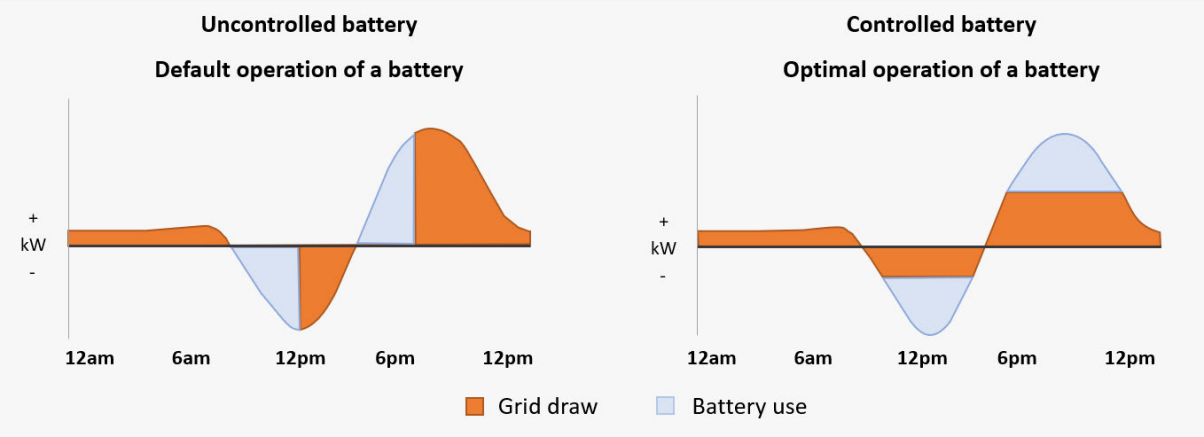

Figure 5: Grid import and export of uncontrolled and controlled battery

The uncontrolled battery charges at maximum capacity in the early morning and reaches 100% state of charge (SoC) before peak solar generation. Even if all solar customers have batteries, most will reach SoC before midday and thus batteries contribute little in the way of alleviating peak coincident exports on the network. Similarly, in the evening, uncontrolled batteries discharge at their full capacity (as required) to meet the house load, again minimally contributing to peak demand on the network, if at all.

Evoenergy currently procures granular data of more than 1000 batteries in the ACT from DER aggregators/HEMS providers. Data from both battery management techniques (active intervention and tariff orchestration) will be compared against uncontrolled batteries on the network to assess viability of these DM approaches as credible non-network options for capex deferral by evaluating effectiveness in managing demand and congestion on the network. The ideal DM outcome will also help alleviate expenditure required to manage quality of supply in future fully electric, 100% PV uptake parts of the network, for example by avoiding the need for On Load Tap Changing (OLTC) transformers.

[19] https://www.evoenergy.com.au/emerging-technology/initiatives/residential-tariff-trial

7.6 Project Activity and Results

The project is currently in its initial stages of customer recruitment. Evoenergy expects to begin trials in summer 2021/22.

7.7 Other Information

General information about the project can be found on the Evoenergy website: https://www.evoenergy.com.au/emerging-technology/initiatives

If you have a specific information request to assist in understanding or evaluating this project please contact demandmanagement@evoenergy.com.au .