

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

Regulatory year 2022-2023

October 2023

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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 2022-23 regulatory year is considered suitable for publication (with confidential information redacted).

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 2022-2023 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.
Project Converge	Project Converge aims to demonstrate new distributed energy resources (DER) orchestration capabilities known as 'Shaped Operating Envelopes' which will allow Distribution Network Service Providers (DNSPs) to improve network congestion management, minimise network expenditure and improve DER market bidding into energy and ancillary service markets. It is a joint project with ANU, Zepben, ARENA, ACT Government and ARENA as well as associated Aggregators.	This project showcases how Evoenergy, and by extensions other DNSPs, can implement Demand Management with potential to reduce long-term network costs by increasing the efficient use of existing network infrastructure. It does through an innovative mechanism called SOE (Shaped Operating Envelopes) where network data gathered from aggregators and the DNSP are used to calculate the most efficient use of the existing network allowing customers to maximise their financial returns and minimise network costs. 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	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.

	project is providing in-kind support through time and labour for the duration of the 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 is doing 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 2022/23 is \$116,511. All costs are net of any project partner contribution.

Table 3: Project Cost Summary

Project	Project Status at June 2023	Costs in 2019-2020 Regulatory Year	Costs in 2020-2021 Regulatory Year	Costs in 2021-2022 Regulatory Year	Costs in 2022-2023 Regulatory Year	Total Costs till end of 2022-23 Regulatory Year
Realising Electric Vehicles to Grid Services (REVS)	Concluded	██████	██████	██████	██████	██████
Project Converge	Ongoing – Continuing	N/A	\$N/A	██████	██████	██████
Distributed Energy Resources Lab (DER-Lab)	Concluded	\$██████	██████	██████	██████	██████
EVGrid Trial	Concluded	-	\$██████	██████	██████	██████
Ginninderry Residential Battery Trial	Ongoing – continuing	-	██████	██████	██████	██████

*The EV Grid Project is an ARENA funded project and additional milestone payments recovered in the 2022-23 has led to positive recovery for this project for this financial year.

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 2022-2023 regulatory year. The project has concluded in the 2022-2023 regulatory year but had 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. <i>Demand Management of commercial sites with V2G enabled EV fleets</i> 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.) <i>V2G Chargers are a new technology</i> 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 established² 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 be 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 ACT³, 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 2018–21⁴ outlines a priority as electrification of

² <https://www.evoenergy.com.au/developers/embedded-generation>

³ https://www.cmtedd.act.gov.au/_data/assets/pdf_file/0003/1654077/Parliamentary-Agreement-for-the-10th-Legislative-Assembly.pdf

⁴ 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.
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3.4 Implementation approach

The project has been 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. Over the last financial year, Evoenergy has been 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 has also provided network limits of the connection points to trial whether the charger platforms and market interaction can be controlled and orchestrated via an operating envelope.

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 incremental progress to transition to a Distribution System Operator (DSO).

3.6 Project Activity and Results

During the 2022-23 financial year, the project achieved completion and finalisation in its project outcomes. The mainly delay in the project in the previous financial year was due to the certification delay for the bi-directional charger from Wallbox. The Wallbox Quasar V2G systems was approved under AS/NZS 4777.2:2020 standards but could not meet the high bar of CEC inverter listing as it did not meet the specificity of the solar and battery inverters that typically are found in this master list. Evoenergy conducted a risk analysis to ensure that granting an exemption for this system would not negatively impact the safe reliable operation of the network and was sufficiently satisfied as such. An exemption had to be garnered as under Evoenergy's embedded generation guidelines it specifies

that all inverter based generation units need to be listed on the Clean Energy Council's approved master list of inverter for the system to be approved to connect to Evoenergy's network.

As the Wallbox Quasar V2G charger was independently certified for the AS/NZS 4777.2:2020 standard, Evoenergy conducted an internal risk assessment of the project to provide conditional approval to the installation team to commission the V2G inverters. Evoenergy engaged with the project partners and provided an exemption for the CEC product requirement, which expires with the conclusion of the project. 51 V2G chargers were installed and commissioned with Evoenergy maintain a staged approach for the validation of the data and testing of the project controls that were given as part of the exemption process.

In addition, Evoenergy specified 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 has been developed to be communicated in 2030.5 style parameters to the charging infrastructure through ANU and Jet Charge's developments.

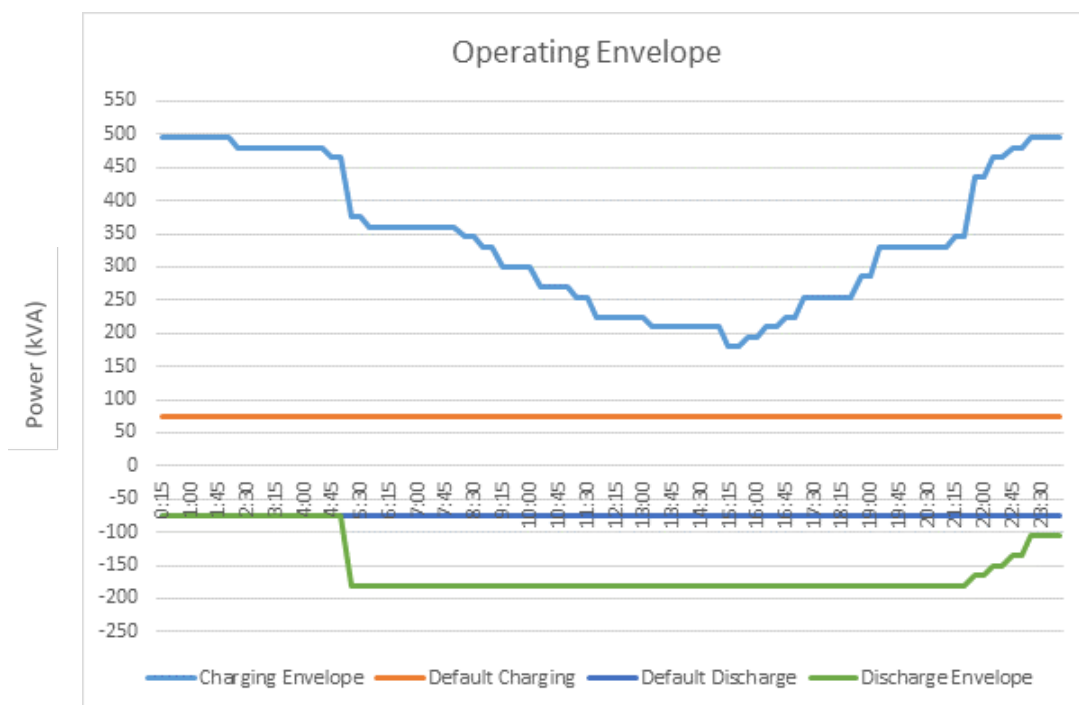


Figure 1: Operating Envelope for commercial site installing 15 V2G enabled EV chargers

The full implementation of the project was completed in the 2022-23 financial year with the project overcoming delays that were both technical and commercial in nature. Evoenergy installed distribution monitoring devices (IoT based) at multiple distribution transformers that supplied electricity to the sites that had installation of over six V2G inverters. This ongoing validation and stage gated approach reduced further risks to Evoenergy and the ensured the management of the innovative technology was in-line with expectations of all project participants.

This project demonstration of V2G enabled vehicles can provide potential 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.

Evoenergy has also used the learnings from this project to develop an internal EV framework and overarching Demand Management (DM) strategy 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. These are being further refined as part of Evoenergy's 2024-2029 Regulatory Proposal and will be published after the Australian Energy Regulator (AER's) final decision in Q2 2024.

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. PROJECT CONVERGE

This project is a new DMIA project with its beginnings in August 2021. The following project report provides details of the project activities up until the end of the 2022-2023 regulatory year. The project is scheduled to conclude in March 2024. The overall project was costed at around \$8.49 million with ARENA contributing \$2.85 million and Evoenergy's DMIA contribution around [REDACTED] of the overall funding.

4.1 Project nature and scope

This project is a three-year research and development project (Aug 2021- March 2024). Project Converge aims to demonstrate new distributed energy resources (DER) orchestration capabilities known as 'Shaped Operating Envelopes' which will allow Distribution Network Service Providers (DNSPs) to improve network congestion management, minimise network expenditure and improve DER market bidding into energy and ancillary service markets.

4.2 Project aims and expectations

Project Converge acknowledges that a network operating at its physical or operational limits is said to be congested because it cannot accommodate additional flows of energy. When congestion occurs within the distribution network, the ability to incorporate DER while also supporting energy reliability and energy security is diminished. New technology capabilities, regulations and market mechanisms are necessary to support the integration and participation of DER in markets for energy and ancillary services without risking congestion.

Project Converge will demonstrate how DER can provide network ancillary services while also bidding into energy markets. These capabilities are expected to allow DER to alleviate grid constraints caused by power quality or physical network constraints and thereby unlock further network capacity without the need for additional network investment.

Project Converge aims to:

- design and develop a system to support the integration of higher penetrations of DER into the ACT distribution network;
- deploy new software systems to demonstrate the Shaped Operating Envelope concept for DER;
- integrate hardware, software and systems to pilot capabilities with over 1,000 existing customer-owned DER assets;
- deliver open-source, royalty free designs and models which can be adopted by other Australian DNSPs;
- deliver a range of knowledge sharing reports and webinars to share lessons with industry.

Project Converge is expected to:

- demonstrate that Shaped Operating Envelopes can extend dynamic operating envelopes to incorporate locally delivered network services, by use of non-network DER solutions, procured through a real-time investment decision making process
- demonstrate that dynamic network services procured from DER assets can potentially minimise or defer network augmentation costs

- demonstrate that network capacity can be maximised to enable DER to participate in energy and ancillary services markets
- identify an approach for DER congestion management and market bidding to inform future regulatory and market changes.

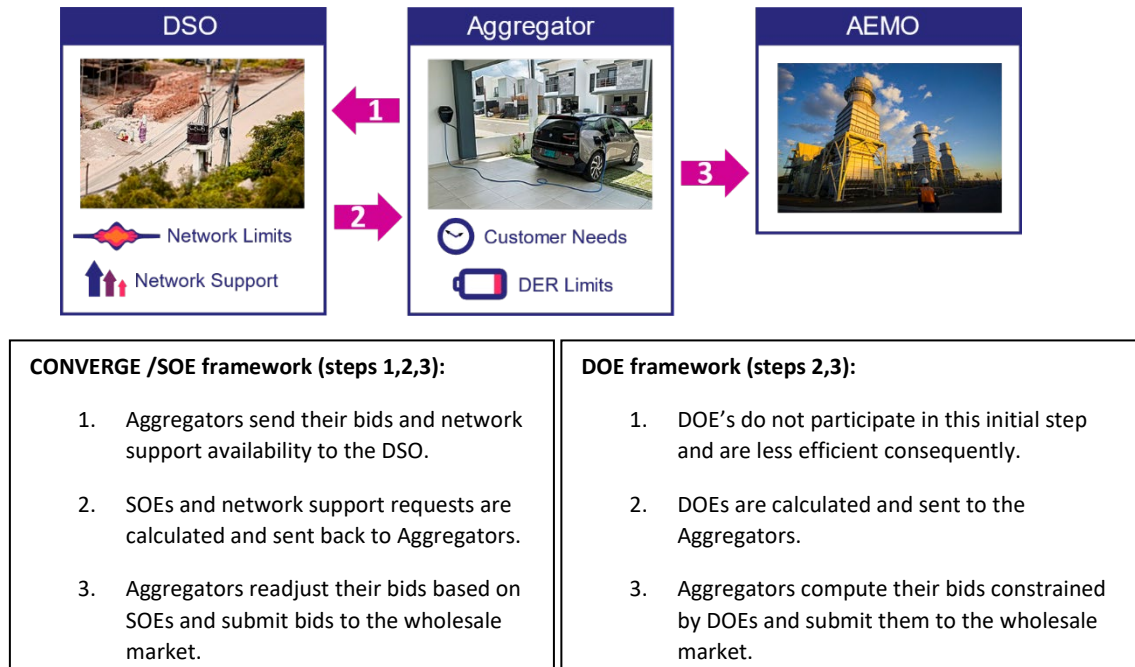


Figure 2: SOE Framework in Comparison to DOE's.

The Converge framework computes SOEs knowing aggregators' bids and network support availability (power and price for both), which allows it to better allocate network capacity to customers. In contrast, DOEs are computed based on "fairness metrics" or "maximum throughput considerations", i.e., without considering the aggregators' intentions/plans.

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 increasing the efficient use of existing network infrastructure. It does through an innovative mechanism called SOE (Shaped Operating Envelopes) where network data gathered from aggregators and the DNSP are used to calculate the most efficient use of the existing network, allowing customers to maximise their financial returns and minimise network costs.

DMIA Criteria	Project Relevance
Be a project or program for researching, developing or implementing demand management capability or capacity	The project researches and demonstrates Shaped Operating Envelopes (SOE) and their ability to provide demand management capabilities such as: 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 operating envelopes. This project showcases how Evoenergy, and by extensions other DNSPs, can implement DM with potential to reduce long-term network costs caused by increased DER through SOE's. 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 a well evolved platform (Evolve) and evolve it to the Converge Platform to demonstrate a coordinated approach to utilising a fleet of DERs within technical (network limits) and commercial (market prices) boundaries. These SOE's 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 that are likely to affect demand	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. Project Converge's objective is to deliver reduction in demand on the grid and test the viability of the SOE's as an evolution on Dynamic Operating Envelopes (DOE). By shaping demand to the full potential of the networks capabilities SOE's have the potential to help avoid or defer network investment. The project shows how dynamic signalling to customers based upon full network and market conditions can defer network augmentation costs and increase customer DER export capabilities and in turn increase customer profit. It does this by using the Demand Management capabilities provided by DER in the LV network through aggregator channels. The DER customers that provide the response to the demand management with the best price can monetise their asset. The project involves Evoenergy coordinating the integration of a DER management platform, namely Converge – which is different to an aggregator or DOE platform with a market cognizant and network aware platform. This integration with a market capable platform has not been completed by any other DNSP within

	Australia as this is not a simple Dynamic Operating Envelope engine 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. <i>This addresses criteria (i) and (ii) of the DMIA requirements.</i> Project Converge allows LV network real time management based upon market and network conditions. This is unprecedented and is innovative in all aspects. Such a trial has not been previously conducted in the ACT or the NEM. With this project, DNSPs can deploy or license this platform 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. <i>This addresses criteria (iii) of the DMIA requirements.</i>
Have the potential, if proved viable, to reduce long term network costs.	Project Converge will not only reduce further augmentation work on the network but will also open greater opportunity for the customer to export to the network and increase their financial return on investment. Project Converge will explore DM opportunities and the interplay between financial and technical drivers for DER assets in an increasingly decentralised energy ecosystem. 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.

4.4 Implementation approach

Operating envelopes represent the technical limits within which a customer or connection point can import and export electricity to the distribution network. These are agreed between networks, customers and AER as part of the customer connection or regulatory process. Dynamic operating envelopes vary the import and export limits based on the available capacity of the local network at different times and locations.

Shaped Operating Envelopes build on the foundation of ‘dynamic operating envelopes’ but are optimised to unlock more value from the distribution network than dynamic operating envelopes by minimising or deferring network expenditure.

A key feature of Shaped Operating Envelopes is the ability for DER to provide network services to improve network congestion management. Shaped Operating Envelopes access ‘real-time’ dynamic network services to manage network congestion as well as support more DER market bidding into energy and ancillary service markets.

Shaped Operating Envelopes involve several steps of interactions between the network, DER and aggregator.

1. DER set a price to provide real and reactive power network services. This allows network services to be procured via an aggregator to unlock additional network capacity.
2. The available network capacity is dynamically distributed using operating envelopes among aggregators based on their respective customer DER pools. Shaped Operating Envelopes are then sent to the Aggregator / DER via the IEEE 2030.5 protocol.
3. Market bids for energy and ancillary services are then made within the Shaped Operating Envelopes into AEMO Market Systems. It is important to note that real power network services procured in Step 1 must also be appropriately bid into AEMO systems in Step 3 to ensure consistency.

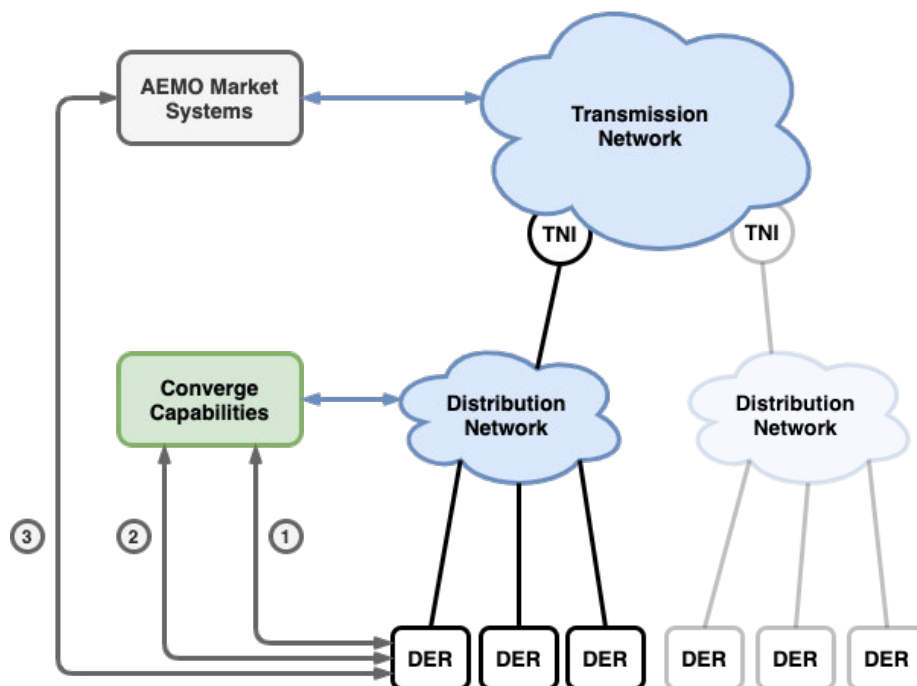


Figure 3: Shaped Operating Envelopes

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
Milestone 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 3. Establish early framework of sandbox development including: a. Data architecture and Design b. 2030.5 Server Order Evidence

Milestone 2 – Development and Integration	1. Begin integration of the Evolve Framework with aggregator(s) and the Recipient’s operational technology environment. 2. Provision of evidence of Shaped Operating Envelope. 3. Begin social science work: a. Social science research design and literature review b. Ethics approval 4. Progress customer enrolment.
Milestone 3 – Workshop and Testing	1. Further refine Shaped Operating Envelope algorithm 2. Commencement of congestion management offline simulation and testing. 3. Commencement of householder interviews and deliberative workshop. 4. Progress customer enrolment.
Milestone 4 – Demonstration and Knowledge Sharing	1. Submission of Knowledge Sharing Documents. 2. Completion of householder social science study. 3. Completion of 1000 customer enrolment. 4. Further refinement of progressed congestion management offline simulation and testing.
Milestone 5 – Communication and Commercialisation	1. Completion of Knowledge Sharing document. 2. Completion of testing with 1000 customers. 3. Provision of completed Shaped Operating Envelopes. 4. Shaped Operating Envelope source code is available on a public software repository and available for use freely under an open source licence.

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 SOE 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: [Project Converge ACT Distributed Energy Resources Demonstration Pilot - Australian Renewable Energy Agency \(ARENA\)](#)

4.6 Project Activity and Results

Project Converge is currently Australia’s largest Operating Envelope Trial with over 1000 customers in the ACT. Evoenergy has engaged two aggregators into the project, Reposit Energy and Evergen to facilitate this customer base.

Evoenergy has been actively involved in several ARENA DEIP Dives where we have had chances to discuss SOE’s with our industry peers and made learnings from our similar DOE projects such as, Project EDGE, Symphony, and Edith. These learning have also been shared further with a webinar and associated Knowledge Sharing Reports. Evoenergy also shared early stage results and learning with the Future Network Forum, sponsored by the ENA while engaging on further work and validations with the peer projects.

One of the key Social Science learnings, at this stage, is how nascent Operating Envelopes are and how intermediaries such as Aggregators and other DNSP’s are still in a mode of learning. Operating Envelopes are a key technology that will be implemented throughout the Australian electricity network and that much effort needs to go into education of all parties. This initial learning stage has

meant it has taken time to get Aggregators and internal stakeholders to understand Operating Envelopes and its implications. Further investigation of these Social Science learnings will be elaborated upon in the final report in March 2024 as will Evoenergy's understanding of the response from our customers.

In terms of technical results, Evoenergy has completed the recruitment of a large customer base and developed the SOE Algorithm to take into consideration the available data. Aggregators are limited, by their design, in how much market data they can share and this has caused Project Converge to evolve its algorithm to facilitate this limitation.

A Real RIT-D Module is being developed which has received positive feedback from stakeholders. A Real Time RIT-D enables Network Planners to look at constraints in the network and compare via a NPV comparison possible of network and non-network solutions. This component of work will be most likely be continued post Project Converge completion due to its value as a Planning tool.

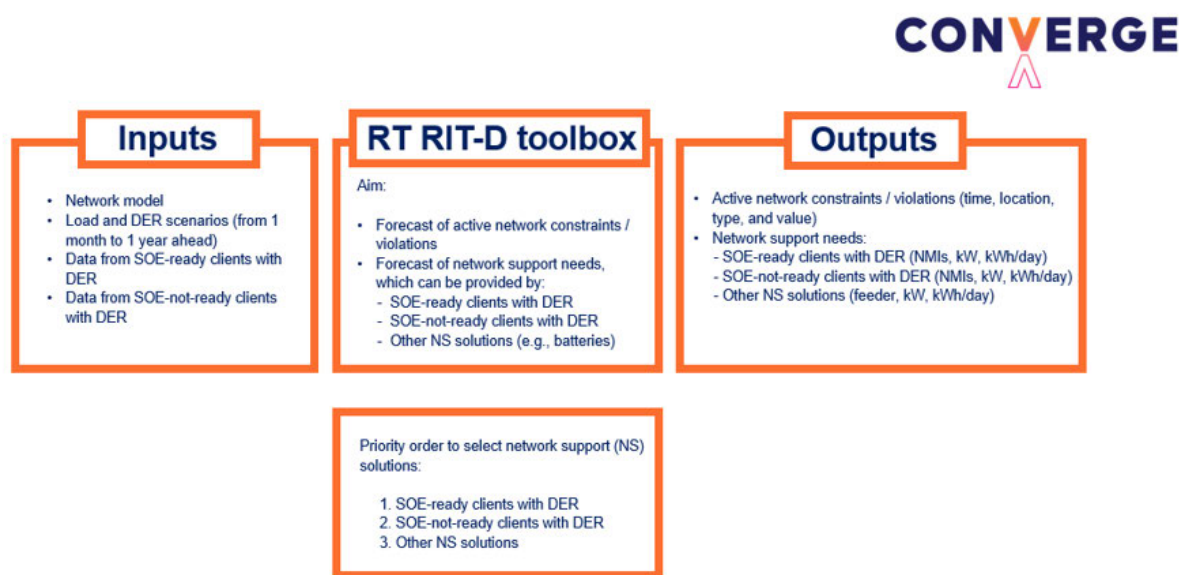


Figure 4: Real Time RIT-D Module

Evoenergy is on track to complete the final milestone (Milestone 4 and 5) and establish testing regimen to begin customer trialling in full force in the 2023/24 financial year. Project completion has been extended to March 2024 to allow a more detailed Social Science component to be completed.

4.7 Other Information

General information about the project can be found on the:

- Project website: [Project Converge - Evoenergy](#)
- Project page on the ARENA website [Project Converge ACT Distributed Energy Resources Demonstration Pilot - Australian Renewable Energy Agency \(ARENA\)](#)

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 2022-23 regulatory year. The project has concluded in the 2022-23 regulatory year and no additional funds will be committed for this project.

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) Program⁵ and the Zero-interest loans schemes^{6,7} for DER uptake has already seen numerous DER technology providers approach Evoenergy to build integrations into Evoenergy's operational systems

⁵ <https://www.environment.act.gov.au/energy/cleaner-energy/next-generation-renewables>

⁶ <https://www.actsmart.act.gov.au/what-can-i-do/homes/sustainable-household-scheme>

⁷ <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.
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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 programmable 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 multi-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 personnel conducted numerous steering committee meetings for this project and provided its distribution network expertise to the project board ensuring that all tasks are met within expected timelines as agreed with the funding partners.

The physical DER Lab required limited engagement from Evoenergy during the 2022/23 financial year as the project was technically completed and the facility engaging 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. The project achieved completion in the 2022/23 year and Evoenergy will not be committing additional resources to this project going forward.

Evoenergy partook in the final review and assessment of the project, identifying further commercial opportunities for the DER Lab to provide its services to the wider Australian energy marker. Evoenergy's remaining funding commitment for this project was realised during this financial year with internal labour and resources being committed to the project engagement and dissemination of knowledge sharing and milestone report reviews for the project partners.

For Evoenergy, the project has fostered further Demand Management innovation in the electricity network, markedly in the ACT as numerous technology vendors that investigated testing their new start-up style innovations were funnelled into the DER lab facility for further controlled testing. This has meant that Evoenergy has spent less time and money on speculative tasks while ensuring only fit-for purpose technology has been safely deployed within the ACT electricity network.

This has ensured the facility has contributed to reducing long term network costs with prudent and efficient investment in the network for demand management based technologies.

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 continuing project 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 Program⁸.

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 █████ which is only about █████ of the total project budget. The project has concluded in 2022/23 with all milestones being achieved with reasonable scope variation as a result of the extension of project timelines.

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 costs 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

⁸ <https://arena.gov.au/news/electricity-networks-gear-up-to-manage-electric-vehicle-demands-on-the-grid/>

- understanding load forecast for managed EV charging and estimating incremental investment required in future after spare network capacity is fully utilised.

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 is collecting EV charging data for 12 months, conducting several customer surveys and offering different incentives for participation at different stages of the trial. These aspects of the project are helping 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 ⁹ and the recently released ACT Zero Emissions Vehicle Strategy ¹⁰ outline the

⁹ https://www.environment.act.gov.au/_data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf

¹⁰ https://www.climatechoices.act.gov.au/_data/assets/pdf_file/0006/2038497/2022_ZEV_Strategy.pdf

	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 - \$15,000 interest free loans¹¹; - stamp-duty exemption; and - free vehicle registration for 2 years. Other initiatives to support ZEV uptake detailed in the ACT Zero Emissions Vehicle Strategy and the Parliamentary and Governing Agreement of the 10th Legislative Assembly for the ACT¹² are to - target 80-90% of all new vehicles sales in the ACT to be ZEVs by 2030; - target all new vehicle sales in the ACT to be ZEVs by 2035; - trial financial incentives to encourage the uptake of ZEVs and electric bikes; 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.
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¹¹ <https://www.climatechoices.act.gov.au/policy-programs/sustainable-household-scheme>

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. Due to COVID related delays in Milestone 2, milestone completion dates have changed and the overall project timeline has been extended by 3 months with the project now ending on 29 April 2023 (previously 29 January 2023). This extension has been reviewed and approved by ARENA.

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 website¹³ was launched, customer recruitment was completed, and system architecture for the software platform (Figure 4) was finalised.

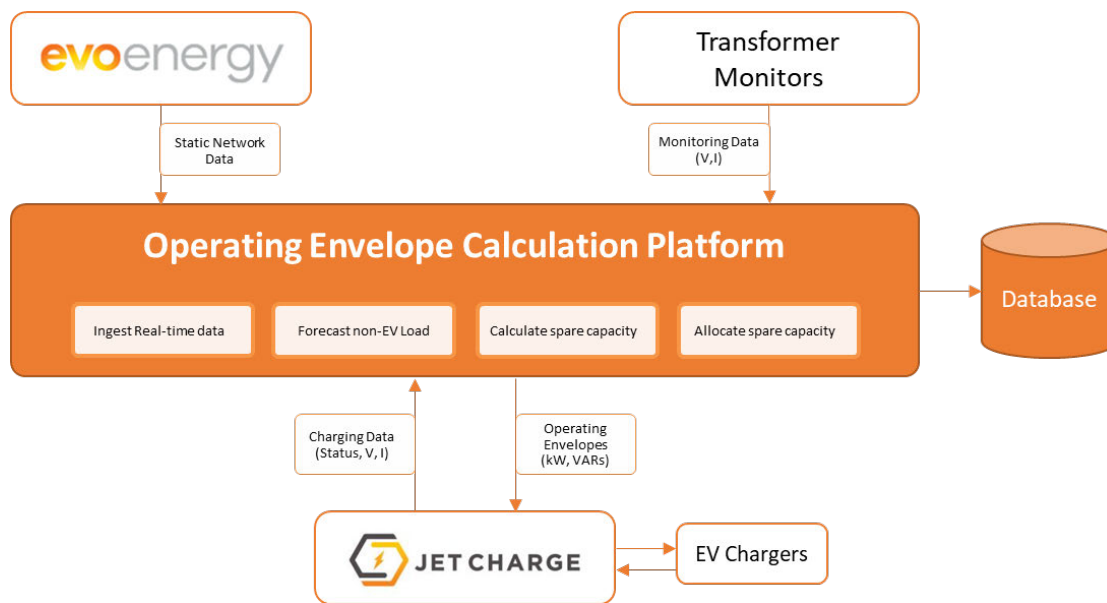


Figure 5: High-level system architecture of software platform

Milestone 2: Software Development and Installation of Hardware

Target date for completion of this Milestone in the project plan was 11 February 2022. Due to COVID related delays, especially in the installation of charging equipment at the residences of participating customers, Milestone activities and reporting to ARENA was completed at the end of May 2022.

Milestone 2 deliverables included development and testing of the software platform (Figure 3), installation of charging equipment at the residences of participating customers, procurement and installation of distribution substation transformer monitor, 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 August 2022.

¹³ <https://www.evgrid.com.au/>

Milestone 4: Project Completion and Knowledge Sharing

The final milestone is targeted to be completed by end of February 2023. 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 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 2022-23 include:

1. Milestone 3 –Demand Response (DR) and Solar Soak (SS) events

For Solar Soak events, the participants were incentivised with the aim to encourage charging during periods of solar generation. The solar soak events had allowed participants to charge as much as they would like as the operating envelope would not be restricted for the EV chargers.

A key learning from the SS events were that initiating the SS event changed the behaviour of the 74% of participants in the Evoenergy network that participated and coordinated their charging to occur during the middle of the day and lingering into the early evening. As such, the duration and timing of the event should be consideration to avoid any additional non-intended peaks which may occur shortly before, during and shortly after the event.

In contrast to solar soak events, demand response events are designed to limit the charging from participants during periods which coincide with peak demand on the network. To test the technology and effectiveness of the DOEs, networks issued DOEs at various limits either adjusting to align to real time network constraints or incrementally ramping up from zero or ramping down to zero.

During the evening peak period given the spread of charging times and infrequent charging pattern of participants, it was unclear to draw a clear line of results as to what the final customer behaviour was as a result of the incentivised event. As with SS events, a key learning of the DR events was that the design of the events and DOEs should consider charging behaviour of EVs as well as the duration and timing of the event to avoid any additional unintended peaks which may occur.

The operating envelopes for the DR and SS events were provided to the EV charger via the DOE platform software that then translated the maximum and minimum current draw for the EV charger based on the power limits provided by each of the DNSPs.

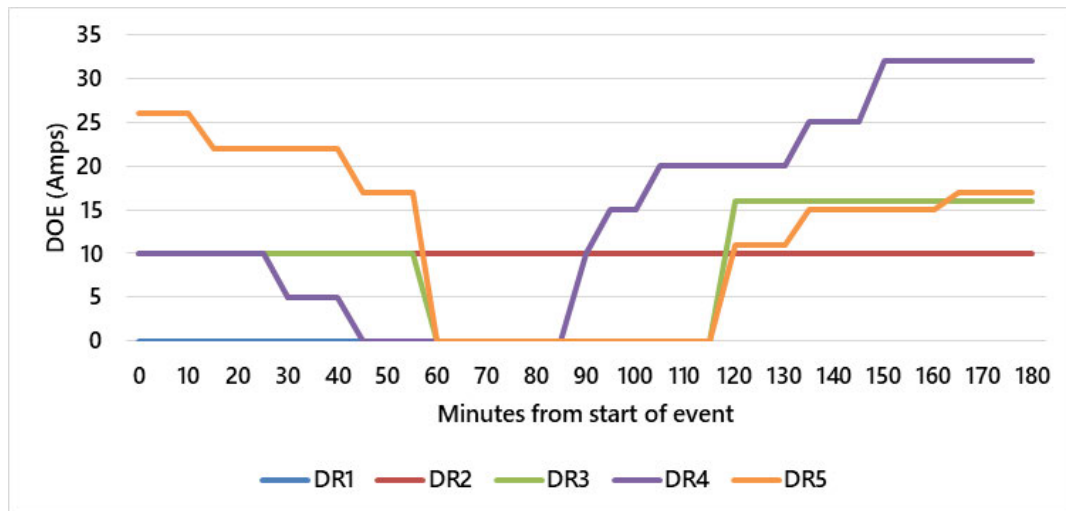


Figure 6: Dynamic Operating Envelopes (DOE) applied for Evoenergy's DR events

2. Milestone 4 – Final report and publication

Through undertaking the trial, Evoenergy and other participating networks have realised the following benefits:

- Understanding of demand reduction gained through holding DR events
- Understanding of the level of consumption encouraged during solar generation periods gained through holding SS events
- Greater understanding of the participants' behaviours and preferences
- Technical capability development
- Reputational benefits.

A major factor for customer participation in the incentivised events was around customer availability and access to their EV charger (for ee.g if they were at home or not). If events are designed to occur in time periods where participants may not be home, networks such as Evoenergy should consider providing sufficient timing to allow participants to plan around their schedule if they want to participate, such as allowing time to arrive home to plug-in their charger or to ensure their charger does not charge prior to a SS event. Additionally based on overall results, the project concluded that, a notice period of around two to three days provided the highest rate of event participation.

Any implementation of the lessons learnt will need to consider the applicability for mass market EV adoption given the small scale of the trial's cohort of participants which are likely to reflect highly engaged early adopters, those that are informed and aware of their charging behaviours and those that have other behind the meter technologies such as solar PV. Future EV owners may not be as engaged or technologically aware which may impact the effectiveness of managed charging via DR and SS events and may also impact the network differently to those within the trial.

The final report for this project is available here: [jemena-ev-grid-trial-knowledge-sharing-report.pdf \(arena.gov.au\)](https://www.arena.gov.au/jemena-ev-grid-trial-knowledge-sharing-report.pdf)

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 Government¹⁴ 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 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 is 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.

Additionally, Evoenergy is leveraging this unique project to engage with the community and recruit trial participants to a new network electricity trial tariff¹⁵ that may be suitable for the future ACT

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

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

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.
- 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 deferral¹⁶ 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 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

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

	Governing Agreement of the 10th Legislative Assembly for the ACT¹⁷ the Territory has also committed to - Legislate to prevent new gas mains network connections to future stages of greenfield residential development in the ACT. 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 loans¹⁸. 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-optimize costs of DM and investment in the network while supporting the Territory's net-zero by 2045 goal.
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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 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

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>

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 trial¹⁹. 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 4 is a simple illustration of the comparison between operation of an uncontrolled battery and the ideal operation aimed to be achieved through this project.

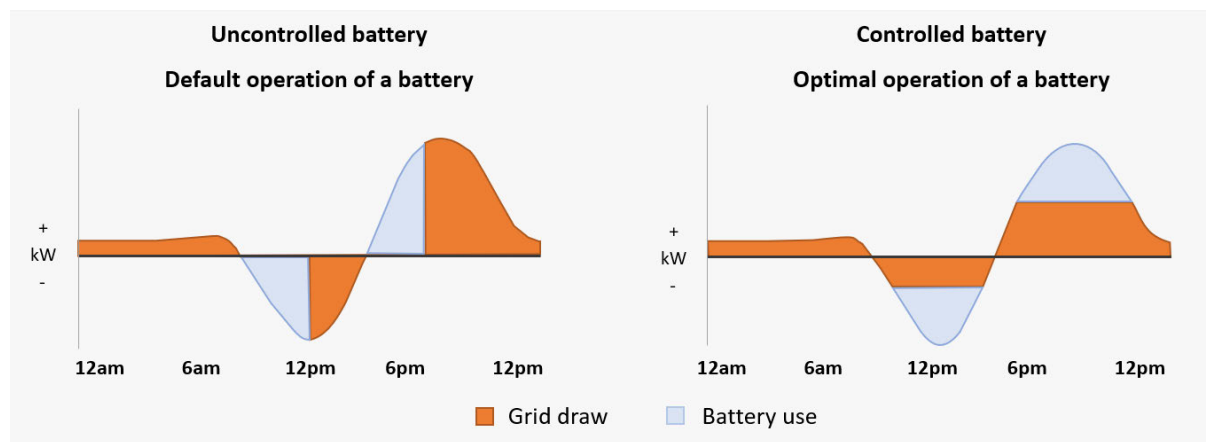


Figure 7: Grid import and export of uncontrolled and controlled battery

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 100% 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.

7.6 Project Activity and Results

Evoenergy was able to navigate a few additional customer recruitment engagements during 2022/23 year. The Next Gen Energy Storage Program Grant from the ACT Government was another co-

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

funding source for this customers in the ACT who would chose to install residential battery systems. During the financial year, the Next Gen program was brought to a close as the program had reached its target of 5,000 batteries in Canberra homes and businesses – and stopped accepting rebate applications²⁰. This was a significant inflection point for the Ginninderry Residential Battery Trial as the customers that were yet to be recruited faced an increase of out of pocket expenses from around \$3000-\$4500 per installation. As such customer recruitment and scope of the project had to be drastically reconsidered.

Evoenergy engaged with the project partners in Ginninderry JV and the ACT Government through whom Evoenergy had sourced additional funding (the REIF grant). Evoenergy considered multiple alternatives of procuring residential batteries through a single supplier as well as seeking additional funds for the project through internal and external sources, but these were ultimately not progressed. Additionally, the participants were mail-dropped and reengaged via the Ginninderry JV database and customer churn had occurred in comparison to the original set of customers that had received briefings and customer support to participate in the trial. Evoenergy also identified that customers that were participating in the trial received a variety of quotes for their battery systems from multiple vendors who ended up with higher prices and out of pocket expenses for the customer. This led to a unfavourable customer experience and ultimately many potential participants withdrew from the purchase of the battery systems and also from partaking in the trial from Evoenergy. Evoenergy also considered altering the scope to include the battery management of grid-connected battery (at the street level) to compare and evaluate against the coordination and management of multiple behind the meter residential scale batteries.

Evoenergy intends to finalise a scope variation for the project through the REIF grant and understand how the objectives of the trial can still be achieved with this alternative scope. To this extent, the project was dormant for a considerable time during the 2022/23 financial year.

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.

²⁰ <https://www.climatechoices.act.gov.au/policy-programs/next-gen-energy-storage>