# Demand Management Innovation Allowance Mechanism Compliance Report 2023-24

October 2024


Essential Energy

essentialenergy.com.au

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# 1. Introduction and purpose

This compliance report has been prepared as required for the application of the Demand Management Innovation Allowance Mechanism (DMIAM) by the Australian Energy Regulator (AER) for Essential Energy's 2019-2024 regulatory control period.

Essential Energy is required to submit an annual compliance report on expenditure under the DMIAM for each regulatory year by no later than 4 months after the end of the regulatory year (see section 2.3 of AER Guidelines for DMIAM – Electricity distribution network service providers, December 2017).

This Essential Energy annual DMIAM compliance report for the 2023-2024 regulatory year fulfils this requirement and is considered suitable for publication. 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 – DMIAM guidelines requirements**

| DMIAM Compliance Reporting 2.3 (3) | Information requirement | References 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 |

| DMIAM Compliance Reporting 2.3 (3) | Information requirement | References to sections in this report |
|---|---|---|
| (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:<br>> the nature and scope of each demand management project or program,<br>> the aims and expectations of each demand management project or program,<br>> how and why the eligible project complies with the project criteria;<br>> the distributor's implementation approach for the eligible project;<br>> the distributor's outcome measurement and evaluation approach for the eligible project;<br>> the costs of the project or program:<br>• incurred by the distributor to date as at the end of that regulatory year;<br>• incurred by the distributor in that regulatory year; and<br>• expected to be incurred by the distributor in total over the duration of the eligible project.<br>> for ongoing eligible projects:<br>• a summary of project activity to date;<br>• an update of any material changes to the project in that regulatory year; and<br>• reporting of collected results (where available).<br>> for eligible projects completed in that regulatory year:<br>• reporting of the quantitative results of the project;<br>• an analysis of the results; and<br>• a description of how the results of the eligible project will inform future demand management projects, including any 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.<br>> any other information required to enable an informed reader to understand, evaluate, and potentially reproduce the demand management approach of the eligible project. | Sections 3 - 7 |
| (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 |

| DMIAM Compliance Reporting 2.3 (3) | Information requirement | References to sections in this report |
|---|---|---|
| (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:<br>> are not recoverable under any other jurisdictional incentive scheme,<br>> are not recoverable under any other state or Australian Government scheme, and<br>> 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 projects summary

This section of the report provides a summary of the Essential Energy projects and project costs over the 2023-2024 regulatory year for which DMIAM expenditure was incurred.

## 2.1 Project eligibility criteria

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

An eligible project must:

- be a project or program for researching, developing or implementing demand management capability or capacity; and
- be innovative, in that the project or program:
  - is based on new or original concepts; or
  - involves technology or techniques that differ from those previously implemented or used in the relevant market; or
  - 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
- have the potential, if proved viable, to reduce long term network costs.

## 2.2 Project list, description and compliance summary

Table 2 provides a list, description and summaries of how and why each eligible project complies with the DMIAM project criteria (as required in Section 2.3 (3) (b) and (c) of the AER DMIAM Guidelines):

**Table 2 – Project list, description and compliance with project criteria**

| Project | Description | How and Why Project meets DMIAM Criteria |
|---|---|---|
| **EV Charging Demand Management** | This is a continuing project from 2022-2023 investigating future consequences of electric vehicle (EV) charging on the Essential Energy network, assessing the feasibility of different demand management interventions and gauging customer preferences.<br>The activity streams for the project include:<br>> Research into electrification of Essential Energy's fleet.<br>> Development of Essential Energy's EV charging Demand Management capability<br>> Research and development of datasets to help for defining and scaling the impact of commercial fleet EV transition.<br>> Development of EV model designed to estimate EV adoption and load profiles for different parts of the network.<br>> Customer journey mapping for EV Charging demand management. | The project aims to research and develop demand management capabilities required to reduce the impact of EV charging on peak demand on the network.<br>The project provides Essential Energy a holistic pathway for implementing demand management for EV charging. It combines EV charging requirements (from electrification of Essential's own fleet, commercial fleets, and residential customers) with modelling and customer research to develop demand management capability and programs that will help optimise network utilisation while meeting customer expectations.<br>See Section 3.2 for details on how the project meets the DMIAM Criteria. |
| **Pole-top Batteries** | Essential Energy is exploring alternative network solutions to better manage the demand for import and export services on the network while minimising network costs and maximising the benefits to our customers. As part of this objective, Essential Energy is trialling demand management using standalone batteries on the network. This is a continuing project from 2022-2023.<br>To build internal capability, and inform demand management opportunities from standalone batteries, this project includes installation of 2 pole-mounted Low Voltage (LV) batteries of sizes 30kW/80kWh and 40kW/85kWh at 2 constrained locations on the Essential Energy distribution network. The project includes utilisation of Dynamic Operating Envelopes (DOEs) to manage these batteries. | The project aims to develop and implement demand management capability of using standalone batteries connected to the distribution network for demand management of both import and export services.<br>The project will help build internal capability of utilising batteries as alternative network solutions for demand management where they are technically and economically feasible.<br>The project will also help Essential Energy quantify the network benefits available from batteries which would help develop demand management programs for third-party owned batteries connected to the network.<br>See Section 4.2 for details on how the project meets the DMIAM Criteria. |

| Project | Description | How and Why Project meets DMIAM Criteria |
|---|---|---|
| **Export Limit Uplift** | This is a continuing project from 2022-2023, aimed at uplifting export limits by leveraging enhanced network visibility and data analytics. This involves integration of advanced technologies to provide actionable insights for demand management of export services.<br><br>Key activities of the projects to support export limit uplift are:<br>> Enhanced network visibility and analytics.<br>> Data driven decision-making for export limit uplift.<br>> Identification of unapproved CER and future CER potential.<br>> Demand responsive network planning. | This project aims to develop and implement demand management capability for export services through network visibility and analytics.<br><br>Enhancing network visibility and utilising advanced analytics to uplift export limits for existing customers is an innovative initiative which is both based on an original concept and involves technology and techniques that have not been trialled or implemented in the past.<br><br>This project has the potential to reduce long term network costs for managing demand for export services by enabling Essential Energy to release spare capacity to customers without additional investment and by enabling targeted investment (where justified) to better manage demand now and into the future.<br><br>See Section 5.2 for details on how the project meets the DMIAM Criteria. |
| **Hosting Capacity** | Essential Energy is developing internal network-wide modelling capability for hosting capacity estimation to enable dynamic connections and to extend strategic network planning from peak demand focused to power flow focused. This is a continuing project from 2022-2023 and involves:<br>> Undertaking a whole of network hosting capacity study, using various scenarios and time-series power profiles of new CER devices, to discover at what levels of load and CER penetration the network assets move out of normal operating conditions and/or voltage violations occur; and<br>> Analysing the benefit of interventions that could be adopted to increase the network's hosting capacity through implementing demand management programs, dynamic connections, strengthening the network, implementing new network asset control schemes, or changing the operating characteristics of CER connecting to the networks. | The project aims to develop capability for estimating network hosting capacity. This capability allows for proactive planning for demand management rather than reactive responses to increased demand. It is also a key enabler for targeted demand management programs and for dynamic connections (for residential customers, commercial EV charging stations, and for standalone batteries).<br><br>Loads connecting to the network are increasingly flexible. Accurately estimating hosting capacity to enable demand management through targeted DM programs and dynamic connections, leads to efficient use of infrastructure and has potential to reduce long term network costs through avoidance of unnecessary network augmentation as energy demand on the network increases.<br><br>See Section 6.2 for details on how the project meets the DMIAM Criteria. |

| Project | Description | How and Why Project meets DMIAM Criteria |
|---|---|---|
| **Tariff Trials** | The small customer tariff trials is a demand management project consisting of two different trials involving NSW customers – the "Tariff trials" and the 'Information-only trials'.<br><br>The 'Tariff trial' works with retail customers to assess the impacts of several different cost-reflective tariffs on customer load profiles to demonstrate a lived-in trial experience for customers.<br><br>The 'Information-only trial' provides simple messaging to customers to help understand whether information alone can influence consumer behaviour. The trial is being held in the areas of Broken Hill and the Queanbeyan regions. | The aspects that make this project innovative compared to tariff trials projects undertaken by other networks to date are:<br>> The tariffs are designed to specifically address network challenges that were identified before the project was started.<br>> The trials have been co-designed with customers and stakeholders.<br>> The business has partnered with retailers to ensure the network tariff is considered in the virtual power plant algorithm and/or mirrored in the associated retail tariff.<br>> The stepped capacity form of the export charge is unique – other networks are trialling basic cents per kilowatt charges.<br>> The partnership with the UNSW to capture demographic and lived experience data will add significant depth to the trial results, especially around how the trials impact different types of customers.<br>> A critical peak price has not been applied to small customers – this component is being trialled at the express request of stakeholders to test whether customers respond better to a reward (peak time rebate) or a penalty and also whether different types of customers fair better under one component compared to the other.<br>> Whilst peak time rebates have been trialled by networks in the past, most offers now only exist at a retail level. |

## 2.3 Project cost summary

Essential Energy incurred total costs of $2.197 million in the 2023-2024 regulatory year on a total of five ongoing projects. Table 3 provides a project cost summary outlining the amount of the allowance spent during all regulatory years in the regulatory control period 2019-2024 (Section 2.3 (3) (a) and (e) of the AER DMIAM Guidelines):

Project costs include research and development of projects, implementation costs, project management and other related project costs from Essential Energy staff labour time or procurement of good or services from external parties. All costs are net of any project partner contributions.

**Table 3 – Project cost summary**

| Project | Project status at end of June 2023 | Incurred project costs 2019-2020 | Incurred project costs 2020-2021 | Incurred project costs 2021-2022 | Incurred project costs 2022-2023 | Incurred project costs 2023-2024 |
|---|---|---|---|---|---|---|
| EV Charging Demand Management | Ongoing | N/A | N/A | N/A | $197,958 | $111,882 |
| Pole Top Batteries | Ongoing | N/A | N/A | N/A | $134,155 | $859,677 |
| Export Limit Uplift | Ongoing | N/A | N/A | N/A | $864,031 | $159,989 |
| Hosting Capacity | Ongoing | N/A | N/A | N/A | $167,553 | $241,778 |
| Tariff Trials | Ongoing | N/A | N/A | $250,970 | $1,103,256 | $823,878 |

## 2.4 Statement on costs

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

- are not recoverable under any other jurisdictional incentive scheme;
- are not recoverable under any state or Australian Government scheme; and
- are not otherwise included in forecast capital expenditure or operating expenditure 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. Electric Vehicle (EV) Charging Demand Management

EV Charging Demand Management is an ongoing DMIAM project introduced in the 2022-2023 regulatory year. Essential Energy is exploring EV demand management because if managed well, the increased energy supplied for EV charging can help ensure that network assets are optimally utilised, while minimising the need for network augmentation to cater to the increased energy demand.

## 3.1 Project background and activities

Essential Energy aims to actively facilitate growth in EV adoption, supporting the electrification of transport while optimising network utilisation. The energy demand for EV charging on Essential's network is estimated to be up to 500GWh by 2029 and up to 2500GWh by 2037. The New South Wales (NSW) Government has introduced rebates and incentives to further accelerate EV uptake in NSW[1]. If unmanaged, this growth in demand will require significant augmentation, especially in the distribution network. Effective demand management of EV charging increases network utilisation and minimises the need for augmentation, reducing cost impacts of EV charging for all customers while maintaining a safe and reliable network.

This project aims to investigate the future consequences of EV charging on the Essential Energy network, assessing the feasibility of different demand management interventions and gauging customer preferences. The activity streams for the project include:

- Research into electrification of Essential Energy's fleet to support jurisdictional and national emissions reduction objectives while limiting the need for augmentation (ongoing).
- Research and development of datasets to help develop an understanding into defining and scaling the impact of commercial fleet EV transition on Essential Energy's network (ongoing).
- Development of EV model designed to estimate EV adoption and load profiles for different parts of the network (completed).
- Customer journey mapping for load control including EVs to improve customer outcomes by personalising customer experience and allowing improved, customer-centric decisions making in demand management programs (completed).
- In 2023-2024, Essential Energy provisioned a trialling facility in Port Macquarie which is being used to support this project. The facility includes 4 electric vehicle chargers from 2 different manufacturers, 2 bidirectional chargers, one high speed charger (planned), and advanced monitoring and control equipment. The facility is co-located with other testing technologies (not part of this project) which would allow Essential Energy to simulate various residential and commercial usage scenarios and test a range of demand management techniques.

## 3.2 Project criteria compliance

**Table 4 – EV Charging Demand Management project criteria compliance**

| DMIAM criteria | Project compliance |
|---|---|
| Be a project or program for researching, developing or implementing demand management capability or capacity | The project aims to research and develop demand management capabilities required to reduce the impact of EV charging on peak demand on the network. |

[1] https://www.energy.nsw.gov.au/nsw-plans-and-progress/government-strategies-and-frameworks/electric-vehicle-strategy

| DMIAM criteria | Project compliance |
|---|---|
| Be innovative, in that the project or program:<br>- is based on new or original concepts; or<br>- involves technology or techniques that differ from those previously implemented or used in the relevant market; or<br>- 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 innovative as it provides Essential Energy a holistic view of implementing demand management for EV charging in line with customer preferences. It combines EV charging requirements (from electrification of Essential's own fleet, commercial fleets, and residential customers) with modelling and customer research to develop demand management capability and programs that will help optimise network utilisation while meeting customer expectations.<br>Essential Energy's network and customers are unique and nationally developed forecasts are not readily applicable due to the predominantly regional nature of the network. The research and modelling techniques utilised in development of the EV model are innovative in forecasting EV uptake and load profiles with respect to customer types and locations (urban, inner regional, outer regional, remote, and very remote). Essential Energy has also developed an EV charger connection guide and a network-specific capacity tool that is designed to assist in identifying the most suitable locations for EV charging on our network[2].<br>The project has a strong customer focus in utilising customer journey mapping research for developing demand management programs that will meet customer expectations and preferences now and into the future. |
| Have the potential, if proved viable, to reduce long term network costs. | By gaining insights into the residential EV uptake and commercial fleet EV transition, strategies and demand management programs can be developed to optimise charging schedules and charging locations. This proactive approach enables better distribution of the EV charging load, preventing overloads during peak times, avoiding new peaks in demand, and minimising strain on the grid. This in turn will lead to reducing unnecessary network augmentation and increasing network utilisation, reducing network costs for all customers. |

## 3.3 Project Costs

The table below shows Essential Energy's project expenditure for each regulatory year since the commencement of the project and total expenditure to date.

**Table 5 – Project costs for EV Charging Demand Management**

| Budget Item | 2022-2023 | 2023-2024 | Total expenditure |
|---|---|---|---|

[2] https://www.essentialenergy.com.au/our-network/electric-vehicles/electric-vehicle-charging-connection-guide

| | | | |
|---|---|---|---|
| DMIAM spend – EV Charging Demand Management | $197,958 | $111,882 | $309,840 |

# 4. Pole-top Batteries

The Pole Top Battery Trial is an ongoing DMIAM project which commenced in the 2022-2023 regulatory year and the following sections provide details of the project activities up until the end of the 2023-2024 regulatory year.

## 4.1 Project background and activities

Essential Energy is exploring alternative network solutions to better manage the demand for import and export services on the network while minimising network costs and maximising the benefits to our customers. As part of this objective, Essential Energy is looking to test demand management using standalone batteries on the network.

The location at which a Battery Energy Storage Systems (BESS) is connected on the network influences its capacity to deliver network services such as managing load and generation peaks and supporting voltage. BESS are unique in their capability in both increasing the hosting capacity on the network and in improving quality of supply for customers. Storage capacity on the network enables increased renewable energy generation and resultant lower emissions.

Currently, the grid side low voltage (LV) battery market is immature. Through past trials Essential Energy has uncovered the difficulties in aligning behind the meter batteries' capacity and operation to network needs and benefits are often limited to the customers that own these assets. Standalone batteries controlled by the network offer greater flexibility and have the potential to deliver benefits for all customers.

To address the identified market gap, build internal capability, and inform demand management opportunities from standalone LV batteries, this project has installed 2 pole-mounted LV batteries of sizes 30kW/80kWh and 40kW/85kWh at 2 constrained locations on the Essential Energy distribution network[3]. Essential Energy intends to utilise Dynamic Operating Envelopes (DOEs) to control these batteries.

The key objectives of the trial are to:

- Provide network services from the batteries to manage peak and minimum demand and power quality issues to avoid or defer traditional network investment.
- Test the operation of standalone batteries and build internal capability to deploy and utilise batteries as alternative network solutions where technically and economically feasible.
- Test capability of grid interactive power electronic equipment to support network reliability, power quality, and hosting capacity.
- Quantify the network benefit available from standalone batteries to develop demand management programs for third-party batteries.
- Develop the technical standards and operating protocols required to deploy LV batteries at scale.
- Learn from development and application of DOEs.
- Increase capability and application of network voltage management settings.

[3] On 20 October 2022, Essential Energy received a ring-fencing waiver for a 35 pole-top batteries project with a retail partner from the Australian Energy Regulator (AER). This DMIAM project does not include any costs incurred for said project and is purely focussed on trialling (an additional) 2 Essential Energy owned pole-top batteries for demand management on constrained parts of the network.

## 4.2 Project criteria compliance

**Table 6 – Pole Top Battery project criteria compliance**

| DMIAM criteria | Project compliance |
|---|---|
| Be a project or program for researching, developing or implementing demand management capability or capacity | The project aims to develop and implement demand management capability of using standalone batteries connected to the distribution network for demand management of both import and export services.<br><br>The project will help build internal capability of utilising batteries as alternative network solutions for demand management where they are technically and economically feasible.<br><br>The project will also help Essential Energy quantify the network benefits available from batteries which would help develop demand management programs for third-party owned batteries connected to the network. |

| DMIAM criteria | Project compliance |
|---|---|
| Be innovative, in that the project or program:<br>- is based on new or original concepts; or<br>- involves technology or techniques that differ from those previously implemented or used in the relevant market; or<br>- 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 considered innovative because it explores the utilisation of pole-top batteries on the network as alternative network solutions for demand management for both import and export services while also delivering learnings for the development of demand management programs for third-party owned batteries connected to the network.<br><br>The integration and use of LV batteries, especially smaller pole-top batteries, into the network is currently a concept not extensively examined by Distribution Network Service Providers (DNSPs). While there have been limited trials on LV batteries connected to distribution substations, smaller pole-top batteries are unique in the level of support they can provide in the LV network both for demand management and for voltage management (which in turn helps with managing demand for export services) with a relatively smaller investment. A large part of Essential Energy's network services rural, remote customers where network support on the LV network from pole-top batteries has immense potential to better manage demand and voltage, increase hosting capacity (improving export service provision), and potentially avoiding costly augmentation on these parts of the network.<br><br>Implementation of closed-loop control on LV batteries through Dynamic Operating Envelopes (DOEs) is also a novel part of this trial.<br><br>The complexities of engineering in installing, operating, and managing the batteries make this project a significant step in advancing the understanding of this innovative concept for Essential Energy. |
| Have the potential, if proved viable, to reduce long term network costs. | Utilising batteries as alternative network solutions for demand management has immense potential to reduce long term network costs, especially in remote areas. The demand management capability that will be developed as part of this trial can also be used for procuring demand management from third-party owned batteries which also has the potential to reduce network costs for all customers as these batteries are expected to be deployed at scale in the coming years. |

## 4.3 Project activities

Key project activities include:

- Project plan and initiation (completed in 2022-2023)
- Vendor selection (completed in 2022-2023)
- Site identification (completed in 2023-2024).
- DOE development (ongoing, started in 2023-2024).
- Battery planning, procurement and installation (completed in 2023-2024).
- Trialling batteries for demand management and network support (ongoing, started in 2023-2024).

## 4.4 Costs of the project

The table below shows Essential Energy's project expenditure for each regulatory year since the commencement of the project and total expenditure to date.

**Table 7 – Project costs for Pole Top Battery Trial**

| Budget Item | 2022-2023 | 2023-2024 | Total expenditure |
|---|---|---|---|
| DMIAM spend – Pole Top Battery Trial | $134,155 | $859,677 | $993,832 |

# 5. Export Limit Uplift

Export Limit Uplift is an ongoing DMIAM project introduced in the 2022-2023 regulatory year and the following sections provide details of the project activities up until the end of the 2023-2024 regulatory year.

## 5.1 Project background and activities

Increased uptake of rooftop solar and larger typical size of new solar systems has led to many customers' solar generation being curtailed year-round because of their rooftop solar system being larger than their approved export limit.

Even though power quality issues may only occur for a few hours on a few days each year, the number of residential customers facing export limits is increasing. Prior to 2018, around 98 percent of new rooftop solar applications for residential customers had no export limit applied. Since then, the proportion of new solar applications placed on export limits continues to increase with the split at the start of the project (2022-2023) shown in the figure below.

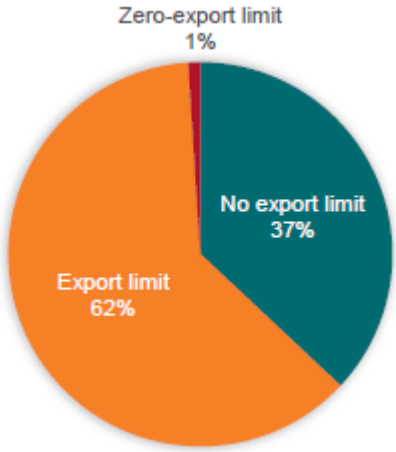


**Figure 1 Current limits on residential customer exports on Essential Energy's network**

Currently the visibility required to make informed decisions during network connection, planning and expansion does not exist in our LV network.

The current levels of Customer Energy Resources (CER) penetration are causing voltage fluctuations outside Australian standards for some customers and due to limited visibility of the LV network, Essential Energy is unable to monitor voltage levels to ascertain which customers may be able to export more than their current export limits.

This project aims to uplift export limits by leveraging enhanced network visibility and data analytics. The nature of this project involves the integration of advanced technologies to provide actionable insights for demand management of export services.

Key objectives and activities of the projects are:

- **Enhanced network visibility and analytics:** Improving network visibility through integration of real-time data (from behind-the-meter devices, smart meters, and transformer monitors) enabling informed decision making for uplifting export limits. This also includes installation of 150 behind-the-meter energy monitoring devices in targeted areas which is providing both Essential Energy and the customers with visibility of appliance-level load data for 2 years.
- **Data driven decision making:** Analysing historical data and forecasting demand to optimise the timing and magnitude of uplifting export limits.

- **Network compliance and future CER potential:** Utilising third-party software to identify (unapproved) CER installations, and available roof space for future installations using aerial imagery and artificial intelligence.
- **Demand responsive network planning:** Strategic network planning based on insights from network visibility and analytics for identification of areas for targeting network augmentation and export limit uplifts for existing and new customers.
- In 2023-2024, Essential Energy initiated a trial of a third-party Consumer Energy Resource Management System (CERMS) which may allow communication with legacy solar systems through bespoke integrations. If successful, this could allow export limit uplift on legacy solar systems through flexible exports.

## 5.2 Project criteria compliance

**Table 8 – Export Limit Uplift project criteria compliance**

| DMIAM criteria | Project compliance |
|---|---|
| Be a project or program for researching, developing or implementing demand management capability or capacity | This project aims to develop and implement demand management capability for export services through network visibility and analytics. |
| Be innovative, in that the project or program:<br>- is based on new or original concepts; or<br>- involves technology or techniques that differ from those previously implemented or used in the relevant market; or<br>- 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 | Enhancing network visibility and utilising advanced analytics to uplift export limits for existing customers is an innovative initiative which is both based on an original concept and involves technology and techniques that have not been trialled or implemented in the past. Two innovative aspects of the project are detailed below:<br>- **Enhanced network visibility and analytics:** Essential Energy completed a targeted analysis to assess spare capacity on the network to uplift export limits on existing customers. This analysis is then verified by incorporating data from multiple sources into a third-party network analytics platform to monitor network performance. The network analytics platform will also help monitor the impact of increased export limits as they are progressively rolled out.<br>- **Network compliance and future CER potential:** Another third-party software is being trialled to identify unapproved CER installations and to estimate roof space available for future installations. This innovative approach will help improve connection compliance and inform equitable uplift of export limits for both existing and future customers. It will also help target investments where they are economically justified based on the potential curtailment alleviation. |

| DMIAM criteria | Project compliance |
|---|---|
| Have the potential, if proved viable, to reduce long term network costs. | If proven viable, this project has the potential to reduce long term network costs for managing demand for export services by enabling Essential Energy to release spare capacity to customers without additional investment and by enabling targeted investment (where justified) to better manage demand for export services now and into the future. |

## 5.3 Costs of the project

The table below shows Essential Energy's project expenditure for each regulatory year since the commencement of the project and total expenditure to date.

**Table 9 – Project costs for Export Limit Uplift**

| Budget Item | 2022-2023 | 2023-2024 | Total expenditure |
|---|---|---|---|
| DMIAM spend - Export Limit Uplift | $864,031 | $159,989 | $1,024,020 |

# 6. Hosting Capacity

Hosting Capacity is an ongoing DMIAM project introduced in the 2022-2023 regulatory year and the following sections provide details of the project activities up until the end of the 2023-2024 regulatory year.

## 6.1 Project background

Long established assumptions serving as inputs into the design and construction of electricity networks no longer hold, due to a mix of changes including the direction of energy flows, timing of energy flows, demand patterns, demand flexibility, as well as overall energy consumption.

To effectively manage demand, new concepts and techniques are needed for the planning and operation of electricity networks to ensure the assets are not overloaded and that voltage and other quality of supply requirements are being met.

Essential Energy understands these challenges and is developing internal network-wide modelling capability for hosting capacity estimation using Zeppelin Bend (Zepben's) Energy Workbench to enable dynamic connections and extend strategic network planning from peak demand focused to power flow focused. This involves:

- Undertaking whole of network hosting capacity studies, using various scenarios and time-series power profiles of new Consumer Energy Resources (CER) devices, to discover at what levels of load and CER penetration the network assets move out of normal operating conditions and/or voltage violations occur; and
- Analysing the benefit of interventions that could be adopted to increase the network's hosting capacity through implementing demand management programs, dynamic connections, strengthening the network, implementing new network asset control schemes, or changing the operating characteristics of CER connecting to the networks.

The project also involved Ignite Data Solutions to provide simulated, historic usage (export and import) for all customers connected to Essential Energy's 140,000 distribution substations at 30min increments for the five-year period between 2017 and 2022. With limited penetration of smart metering infrastructure on Essential Energy's network (limited network visibility), synthetic load synthesis capability was used to substitute availability of interval data that would ordinarily provide 30-minute energy consumption.

Synthetic load profile estimations are progressively being refined to improve hosting capacity accuracy.

## 6.2 Project criteria compliance

**Table 10 – Hosting Capacity project criteria compliance**

| DMIAM criteria | Project compliance |
|---|---|
| Be a project or program for researching, developing or implementing demand management capability or capacity | The project aims to develop capability for estimating network hosting capacity. This capability allows for proactive planning for demand management rather than reactive responses to increased demand. It is also a key enabler for targeted demand management programs and for dynamic connections (including flexible exports). |

| DMIAM criteria | Project compliance |
| --- | --- |
| Be innovative, in that the project or program:<br>- is based on new or original concepts; or<br>- involves technology or techniques that differ from those previously implemented or used in the relevant market; or<br>- 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 | Hosting capacity capability is key enabler for demand management (DM) through targeted DM programs and dynamic connections.<br>**Dynamic Connections**<br>Essential Energy is implementing hosting capacity technology that has not been used before to enable dynamic connections for residential customers, commercial EV charging stations, and for standalone batteries.<br>- **Residential Customers:** Initially the hosting capacity will be used to generate dynamic operating envelopes (DOEs) for CER. In the future, this may be extended to level 2 residential electric vehicle (EV) charging and potentially other behind-the-meter flexible loads.<br>- **Commercial EV Chargers:** Hosting capacity software will generate DOEs to provide flexible network access to commercial EV charging stations, reducing connection costs for customers and minimising the need for network augmentation.<br>- **Standalone batteries:** Hosting capacity enables DOE generation for standalone batteries at all voltage levels. Batteries are a flexible resource and do not require complete network access (maximum charging and discharging) at all times of the day. Providing DOEs helps reduce connection costs, network augmentation, and provides system level benefits for all customers.<br>Additionally, anticipating demand through capacity estimation, and implementing demand management in time (through DM programs and dynamic connections), contributes to a positive user experience. Customers are less likely to encounter outages, or other issues related to insufficient network capacity.<br>The project is considered innovative in that it explores the use of new techniques for electrical network modelling and enables dynamic connections (flexible network access) by being power flow focussed and utilising synthetic load profiles to overcome limited network visibility. |

| DMIAM criteria | Project compliance |
|---|---|
| Have the potential, if proved viable, to reduce long term network costs. | Loads connecting to the network are increasingly flexible. Accurately estimating hosting capacity to enable demand management through targeted DM programs and dynamic connections, leads to efficient use of infrastructure and has potential to reduce long term network costs through avoidance of unnecessary network augmentation as energy demand on the network increases. It also enables sharing value with customers that can flexibly operate their equipment in a way that benefits the network, ultimately reducing costs for all customers. |

## 6.3 Project activities

**Hosting capacity development**

- Data acquisition
- Model development and validation
  - In 2023-2024, additional resources were allocated for uplifting the data quality of network connectivity data
- Base case analysis to validate that the models were producing the correct outputs of power and voltage for electrical network and consumer behaviours
- Hosting capacity analysis under Integrated System Plan (ISP) scenarios
- Intervention analysis

**Synthetic profiles**

- Delivery of historic usage (export and import) for all customers connected to Essential Energy's network
- Data profiling to determine quality and identify patterns
- Data preparation for modelling
- Build and evaluate clustering models
- Synthetic calculation and validation

## 6.4 Costs of the project

The table below shows Essential Energy's project expenditure for each regulatory year since the commencement of the project and total expenditure to date.

**Table 11 – Project costs for Hosting Capacity**

| Budget Item | 2022-2023 | 2023-2024 | Total expenditure |
|---|---|---|---|
| DMIAM spend – Hosting Capacity | $167,553 | $241,778 | $409,331 |

# 7. Small Customer Tariff Trials

## 7.1 Project background

The small customer tariff trials is a continuing project and the following sections provide details of the project activities up until the end of the 2023-2024 financial year. It is a demand management project including  two different trials involving NSW customers – the "Tariff trials" and the "Information-only trials". Following extensive engagement and consultation, tariffs were designed to assist in addressing network challenges (Please refer to the 2021-2022 DMIAM compliance report for how the tariff structures were designed).

The "Tariff trials" worked with retail customers to assess the impacts of several different cost-reflective tariffs on customer load profiles to demonstrate a lived-in trial experience for customers. Tariffs were offered to customers up until the 30 June 2023 and included a Sun Soaker variously combined with Peak Time Rebate (PTR) or Critical Peak Pricing (CPP) and/or Export Charge/Reward, depending on the retailer and customer preference.

For the purposes of the tariff trials, Essential Energy partnered with retailers Amber Electric, Discover Energy and Red Energy where customers had a "live" experience to see if pricing does influence behaviour. Our retail partners passed the distribution costs directly to participating customers through their bills.

The "Information-only trial" has provided simple messaging to customers to help understand whether information alone can influence consumer behaviour. The trial has been held in the areas of Broken Hill and the Queanbeyan regions. It encourages customers to move their loads if possible, to the periods 10am-3pm which may assist in both reducing evening peaks and soak up renewables in the middle of the day. These areas are also matched to a control area with a similar climate but without the information provision.

Essential Energy has partnered with the University of New South Wales (UNSW) Collaboration for Energy and Environmental Markets (CEEM) to undertake social and behavioural research and analyse data and see how these trial tariffs impact different households and businesses from a liveability perspective. Currently UNSW is assessing the impact of the trials and will provide a report in 2024-2025 year.

## 7.2 Project criteria and compliance

The aspects that make this project innovative compared to tariff trials projects undertaken by other networks to date are:

- The tariffs are designed to specifically address network challenges that were identified before the project was started.
- The trials have been co-designed with customers and stakeholders.
- The business partnered with retailers to ensure the network tariff is considered in the virtual power plant algorithm and/or mirrored in the associated retail tariff.
- The stepped capacity form of the export charge is unique – other networks are trialling basic cents per kilowatt charges.
- The partnership with the UNSW to capture demographic and lived experience data will add significant depth to the trial results, especially around how the trials impact different types of customers.
- A critical peak price has not been applied to small customers – this component is being trialled at the express request of stakeholders to test whether customers respond better to a reward (peak time rebate) or a penalty and also whether different types of customers fair better under one component compared to the other.
- Whilst peak time rebates have been trialled by networks in the past, most offers now only exist at a retail level.

## 7.3 Project activities

Overall, there were approximately 275 retail customers on the tariff trials which ran until the end of the regulatory period (June 2024). UNSW has undertaken a number of social surveys throughout the trial capturing demographic data of participants and further semi-structured interviews with trial participants.

They have also completed social surveys for the information only trials including descriptive statistical analysis from survey responses and semi-structured interviews.

**Some initial findings and lessons learned include:**

- The adoption of rooftop solar made households more conscious of when they were using electricity
- Overall, customers expressed a high degree of interest in reducing their consumption of electricity – either for the environmental benefits or for the costs.

**Tariff trial participants**

- Most participants understood the fundamentals of the Sun Soaker tariff
- There are inconclusive export pricing response results to date
- Solar customers are already trying to shift their use
- Simpler tariff structures are easier for residential customers to understand
- There were no significant impacts of the Sun Soaker two-way tariff on either the load or export profiles
- There were no subgroups of customers (by appliance type, attitudes to electricity use or other characteristics such as pet ownership), that convincingly showed greater responsiveness to the Sun Soaker tariff. Although some correlations with household characteristics were evident (see points below), it is not clear why they occurred.

**The information only trial**

For customers in the areas of Broken Hills, Queanbeyan and surrounds who recalled seeing the information materials:

- There was no consistent correlation between information provision and any of the desired outcomes for 10am-3pm (an increase) or 5-8pm (a decrease) loads. Having rooftop solar did not affect the households' load responsiveness to the information bursts.
- Overall, participants indicated in surveys and interviews that they were neutral about the impact of the trial. This was primarily because most owned rooftop solar systems and had already shifted their use of electricity to between 10am and 3pm to maximise solar self-consumption. While some found the trial informative and changed their usage behaviour accordingly, most found it challenging to identify bill savings amid the noise of tariff increases and seasonal variations.
- Positive sentiments about the trial focused on the impact of campaign messaging – and the research interviews themselves – in reinforcing the more 'conscientious' use of electricity.
- A disconnect between participant perceptions of their changed energy use and measured differences to their actual load profiles is common.

**Other observations**

Ongoing reports from UNSW show:

- Peak events; Overall, the impact on load was minimal, even for customers who made a significant effort to reduce their use at those times.
- Findings specific to those with virtual power plants (VPP): Experiences of the VPPs were mixed, with several participants describing a process of 'trial and error' to understand the dynamics of the VPP and the financial value it could deliver them in practice.

**Expected success/non-success of the various tariff components**

Sun Soaker and export price

Based on the implementation experience, Essential Energy has adopted both the Sun Soaker and export price successfully into its Tariff Structure Statement (TSS). Retailers are very supportive of the Sun Soaker tariff, given its broad alignment with wholesale prices. Whilst the final form of the export price will be shaped from the trial outcomes, an export price is expected to be successful.

In practice, the final export price will be paired with a consumption price to form a two-way tariff. As such, the implementation of two-way tariffs will need to be in accordance with the AEMC's 'Access, pricing and incentive arrangements for distributed energy resources' (12 August 2021) rule determination and consider the transition preferences of customers and stakeholders. At this stage, the business is offering a two-way tariff on an opt-in basis from 1 July 2024 which will become the default tariff for all customers from July 2025.

Peak time rebate and critical peak price

Neither the trialled peak time rebate nor the trialled critical peak price have shown significant impact on peak demand so far in the tariff trial. This might change as technology matures and behind-the-meter customer devices respond automatically to price signals.

For now, Essential Energy expects that fixed rebates for exports during the peak time would be relatively simpler to implement for distributors and retailers, while still providing customers with the flexibility to be rewarded for exporting during peak times and reducing congestion on the network.

## 7.4 Costs of the project

The DMIAM spend for the Essential Energy Small Customer Tariff Trials for each regulatory year since the commencement of the project, total expenditure to date, and forecast to completion:

**Table 12 – Project costs for Small Customer Tariff Trials**

| 2021-22 | 2022-23 | 2023-24 | 2024-25 | Total estimated project cost | Total expected to be claimed in the regulatory period | |
|---|---|---|---|---|---|---|
| | | | | | 2019-24 | 2024-29 |
| $250,970 | $1,103,256 | $823,878 | $144,228 | **$2,322,332** | $2,178,104 | $144,228 |