



Demand Management Innovation Allowance Mechanism

Annual Compliance Report, 2023-2024

October 2024

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1 Introduction

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 Ausgrid's 2019-2024 regulatory control period.

Ausgrid 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 Ausgrid annual DMIAM compliance report for the 2023-2024 regulatory year fulfils this requirement and is considered suitable for publication (with no confidential information included). As specified in Section 2.3 (3) of the DMIAM Guidelines, this annual DMIAM compliance report includes the following required information with section references bolded in brackets:

- a) the amount of the allowance spent by the distributor; **[Section 2.2]**
- b) a list and description of each eligible project on which the allowance was spent; **[Section 2.1]**
- c) a summary of how and why each eligible project complies with the project criteria; **[Section 2.1]**
- 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 **[Section 3 to 12]**:
 - i) the nature and scope of each eligible project or program,
 - ii) the aims and expectations of the eligible 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 eligible project:
 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 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 2.2]**
- 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: **[Section 2.3]**
 - 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.

2 DMIA project and cost summary

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

2.1 Project list, description and project criteria summary

The below table provides a list, description and summarises 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):

Project	Description	How and Why Project meets DMIAM Criteria
Completed Projects as of 30 June 2024		
Peak Time Rebate	Ausgrid assessed the cost-effectiveness of a peak time rebate (PTR) as a demand management solution in localised areas of the Ausgrid network area. The project explored whether a rebate offer with customers on peak demand days can be used to alleviate location specific short-term network constraints, to defer or reduce the need for longer term network infrastructure upgrades.	This project was designed to research, develop, and implement DM capability and capacity in the form of peak time rebates as a non-network alternative. It is considered innovative in that the proposed PTR trials will utilise technologies, techniques and processes that differ from those previously used in the market. Specifically, the project leveraged the roll out of smart meters and collaboration with electricity retailers.
Community Battery Feasibility Study & Research	This project aimed to investigate the potential for locally based community batteries paired with an innovative business model to offer both a competitive alternative to traditional local network investment and introduce a novel way to markedly improve equitable access to energy storage for customers. The project involved a feasibility study on the engineering, regulatory and commercial aspects of the community battery concept and to conduct research to explore customer response, awareness, and interest in the concept to inform the development of a potential trial. Over the course of the trial, the project supported ongoing customer engagement activities to maintain engagement and customer experience activities.	This project aimed to build capacity and capability in demand management options, focusing on the potential for local community batteries to be used to cost-effectively address network investments driven by maximum or minimum demand network constraints or other drivers such as voltage management or system reliability or security. The project is considered innovative in that this concept is relatively new and has not been trialled by Ausgrid and within the National Electricity Market which makes the regulatory and commercial aspects of the concept challenging.

Project	Description	How and Why Project meets DMIAM Criteria
<p>Barriers to Electrification Study</p>	<p>This project aimed to build Ausgrid’s understanding of emerging electrification trends which supports electricity networks to explore how and when traditional or innovative demand management techniques and new smart and flexible technology solutions might facilitate efficient integration of new loads to the grid.</p> <p>The project is critical foundational research into electrification to understand how we can prioritise initiatives to implement or trial demand side management and price incentives to address barriers to electrification and reduce long term costs to customers through a pathway for DNSPs to guide efficient investment decisions.</p>	<p>Electrification of vehicle and appliance energy is rapidly emerging as a significant challenge for networks. This project is foundational research to drive and prioritise new and innovative projects that can better manage the electrification transition.</p> <p>The project incorporates findings from primary and secondary research including external stakeholder consultation and will be innovative in evaluating how national and international examples of new demand management techniques or technology could be developed or used on Ausgrid’s network.</p> <p>The study focussed on emerging electrification trends across all customer segments to understand the impact of adopting new technology and the various customer segment and demographic considerations that must be considered.</p>
<p>Ongoing Projects as of 30 June 2024</p>		
<p>Hot Water Load Control</p>	<p>This project was developed to understand the current and future capability of dynamic load control as a demand management solution appropriate for the Ausgrid network. The project explores how Ausgrid, retailers and customers can collaborate to optimise operation of the load control system for the benefit of all consumers.</p> <p>This understanding will be built through internal analysis, collaboration with customers and industry, and load control field trials. Where necessary the trials will include partnerships with third parties including metering providers and energy retailers.</p>	<p>This project aims to research and develop the capability and capacity for using hot water load control as an effective demand management solution. The project is considered innovative as it will explore the use of the latest control technology and platforms for controlling hot water systems through a diversity of smart meter types, metering providers and retailers. The project will engage with a wider range of stakeholders including customers, retailers and metering providers to better understand the intersection of value provided by hot water load control to customers and the energy industry. Approximately 90,000 smart meter customers are with controlled load devices in the Ausgrid network, placing Ausgrid in a unique position to trial a range of different demand management options in collaboration with customers, retailers, and metering providers.</p>

Project	Description	How and Why Project meets DMIAM Criteria
Project Edith Customer Payments	<p>Project Edith has three primary objectives:</p> <ol style="list-style-type: none"> 1. Remove barriers to the participation of customers' energy resources in energy markets through efficient and fair pricing. 2. Allocate distribution network capacity in a decentralised manner and incentivise network support from customers' energy resources. 3. Identify and inform key areas for implementing this model, share insights and engage with the industry. <p>Phase 1 – we demonstrated how dynamic pricing could be communicated to end customers.</p> <p>Phase 2 – expanding to a broader range of customer agents, supported by the DMIA project for customer payments.</p>	<p>Project Edith is demonstrating the effectiveness of dynamic network pricing in enhancing the utilisation of distribution networks. By influencing customer energy resources, dynamic pricing aims to reduce network costs associated with managing minimum and maximum demand, minimise solar export curtailment, and avoid unnecessary network upgrades. The project is critical for Ausgrid, other DNSPs, and AEMO to understand how well dynamic pricing signals can influence customer energy resources and shape the future National Electricity Market.</p> <p>Most of the project funding initially came from Ausgrid's Network Innovation allowance; for FY25, we are using an allocation from our regulatory allowance. The DMIA funds customer savings achieved by optimising the off-market project tariff instead of the listed tariff, as no NSW or national schemes are available to cover this gap. This project is specific to Ausgrid's distribution network and is not covered by our forecasted capital and operating expenditure.</p>
C&I Thermal Load Flex	<p>Ausgrid is seeking to assess the effectiveness of thermal load flexibility of C&I customers (thermal flex) in localised areas of Ausgrid's network. Large loads such as supermarkets, shopping centres and refrigerated distribution centres could potentially offer a material quantum of load flexibility under both peak demand and minimum demand conditions.</p> <p>These loads are substantial in scale and commonplace in the community. The project will explore whether they can potentially offer an economic and reliable source of load flexibility.</p>	<p>The project aims to test whether this option can be used to alleviate location specific short-term network constraints, to defer or reduce the need for longer term network infrastructure upgrades. The project involves partnerships with 3rd party organizations leveraging their relationships with C&I customers and equipment installed at customer sites that enable load flexibility.</p> <p>The project is innovative in testing new market provided flexibility solutions for commercial customers which has not been explored on the network to date and will inform how Ausgrid could leverage and integrate this new demand management capability and capacity over the long-term including evaluating opportunities, challenges and performance of providing this load flexibility.</p>

Project	Description	How and Why Project meets DMIAM Criteria
Heat Pump Hot Water Trial	<p>Ausgrid is seeking to explore the electrification of domestic hot water (DHW) systems and the optimal heat pump hot water (HPHW) operating schedules for demand management. The trial consists of upgrading old hot water systems with HPHW systems at approximately 100 social housing properties to assess different hot water operating schedules and configurations.</p> <p>This DMIA project is supported through RACE for 2030 project, in which Ausgrid is partnering with NSW Land and Housing Commission (LAHC), NSW Aboriginal Housing Office (AHO), UTS, NSW Office of Energy and Climate Change (OECC) and Essential Energy.</p>	<p>Domestic hot water systems account for approximately 25% of energy consumption and 20% of carbon emissions in homes. HPHW systems are anticipated to play a significant role in improving energy efficiency and electrification of DHW systems.</p> <p>Without an understanding of the impacts associated with HPHW systems and their optimal charging schedule, it is not possible to design effective demand management and electrification strategies to manage hot water systems.</p> <p>The concept of charging HPHW systems at different times to address maximum and minimum demand constraints is a relatively new area that has not yet been thoroughly investigated. The project will also assess potential demand impacts associated with electrification of hot water systems, which is a recent development in the industry.</p>

2.2 Project cost summary

Actual project costs incurred are collected from project codes in Ausgrid’s SAP reporting system. The amounts claimed are those booked to each project in the regulatory year. Costs include research and development of projects, implementation costs, project management and other related project costs from Ausgrid staff labour time or procurement of good or services from external parties. All costs are net of any project partner contributions.

Ausgrid incurred costs in the 2023-2024 regulatory year on a total of eight ongoing projects with a total of \$794,708 claimable costs under the DMIAM. The below table 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). Note the overall total spend in prior years are for all projects in that year and so project totals in column may be less than the overall total for year.

Project	Project status at end of June 2024	Incurred project costs	Incurred project costs	Incurred project costs	Incurred project costs	Incurred project costs
		2019-2020 (excl GST)	2020-2021 (excl GST)	2021-2022 (excl GST)	2022-2023 (excl GST)	2023-2024 (excl GST)
Stand Alone Power Systems	Complete June 2020	\$23,291	\$0	\$0	\$0	\$0
Power2U (Demand management for replacement needs)	Complete June 2022	\$311,450	\$420,579	\$4,811	\$0	\$0
Battery Demand Response (VPP) Trial	Complete June 2022	\$290,314	\$355,410	\$241,676	\$29,763	\$0
Cost Reflective Pricing Research	Complete June 2023	\$38,029	\$175	\$5,216	\$0	\$0
Digital Energy Futures	Complete March 2023	\$174,565	\$105,610	\$41,931	\$24,037	\$0
Electric Vehicle Demand Research	Complete June 2023	\$202,134	\$33,722	\$73,345	\$103,817	\$0
Project Edith CSIP-Aus Specification Extension	Complete July 2023	\$0	\$0	\$0	\$166,294	\$0
Peak Time Rebate	Complete August 2023	\$40,786	\$193,488	\$323,418	\$400,099	\$73,912
Community Battery Feasibility Study and Research	Complete January 2024	\$267,578	\$58,670	\$10,438	\$12,474	\$13,900
Barriers to Electrification Study	Complete January 2024	\$0	\$0	\$0	\$162,222	\$218,007
Hot Water Load Control	Ongoing	\$0	\$14,296	\$65,752	\$20,804	\$24,701
Project Edith Rapid Demonstration - Customer Payments	Ongoing	\$0	\$0	\$0	\$5,037	\$404,888
C&I Customer Thermal Flexibility	Ongoing	\$0	\$0	\$0	\$4,785	\$5,413
Heat Pump Hot Water Trial	Ongoing	\$0	\$0	\$0	\$0	\$48,782
TOTAL		\$1,348,147	\$1,181,951	\$766,587	\$929,332	\$789,603

2.3 Statement on costs

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

1. are not recoverable under any other jurisdictional incentive scheme,
2. are not recoverable under any other state or Australian Government scheme, and
3. 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 Hot Water Load Control

This Demand Management Innovation Allowance (DMIA) project was introduced in the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. The project will be ongoing into the 2024-2025 regulatory year.

3.1 Project nature and scope

This project was developed to understand the current and future capability of dynamic load control as a DM solution appropriate for the Ausgrid network and to explore how Ausgrid, retailers and customers can collaborate to optimise operation of the load control system for the benefit of all consumers. This understanding will be built through internal analysis, collaboration with customers and industry and load control field trials. Where necessary the trials will include partnerships with third parties including metering providers and energy retailers.

Ausgrid currently has over 350,000 customers that are actively using controlled load, which predominantly supply electricity to domestic hot water storage systems, although other loads such as electric vehicles, pool pumps and small business appliances can also be connected to these controlled load tariffs. We estimate that on a typical day the thermal energy storage potential in the hot water tanks connected to Ausgrid's controlled load tariff is in the range of 3 to 6 GWh, which is equivalent to around 300,000 to 600,000 household batteries of 10kWh usable electrical storage capacity.

The technology currently used by Ausgrid to control the on and off electricity supply times to appliances connected to the controlled load tariffs is currently mixed. The majority of load control devices in Ausgrid's network still use the traditional "ripple" control system but Ausgrid also uses separate time switches and load control devices within electricity meters.

Since the introduction of the Power of Choice metering reforms in 2017 there has been an increase in the number of customers that have a load control device in the smart meter. Over 120,000 customers now have a smart meter-based load control device. As smart meters are owned by independent metering providers, the switching times are not directly controlled by Ausgrid but rather specified in the controlled load tariff conditions in *Ausgrid's ES7 Network Pricing Guide*. Metering providers can remotely alter the control schedules of smart meters in a more dynamic manner, which allows a wider range of demand management solutions for off peak hot water systems.

3.2 Project aims and expectations

The primary objective of this project is to explore the optimal operation of controlled load hot water to identify appropriate dynamic operating terms and schedules and the resultant tariff conditions necessary. The project will also seek to understand the efficacy of using hot water load control to better manage local voltage. Additionally, the project will aim to explore the regulatory mechanisms that may assist in effecting optimal operation.

3.3 How and why project complies with the project criteria

This project aims to research and develop the capability and capacity for using hot water load control as an effective demand management solution. The project is considered innovative in that it will explore the use of the latest control technology and platforms for controlling hot water systems through a diversity of smart meter types, metering providers and retailers and will engage with a wider range of stakeholders including customers, retailers and metering providers to better understand the multiple values provided by hot water load control to customers and the energy industry.

3.4 Implementation approach

The project is planned to take place over two to three years from 2021 to 2023-2024 as follows:

Phase 1 - Scoping study (data analysis, technology, and market assessments)

The first phase of the project allows for the preparations needed to develop a detailed scope for a second phase of the project. At the end of phase 1 the scope for phase 2 will be reviewed and updated as part of a DMIA implementation proposal. Additionally, there is anticipated to be a Network Innovation component of the project which will be scoped with implementation to be funded from the network innovation program separate to the demand management innovation mechanism funding.

The first phase activities included:

- Analysis of hot water load control and solar customer information to determine suitable trial locations, including penetration of smart meters, retailers and solar penetration and identification of locations with potential emerging network constraints.
- Technology assessment of smart meter control functionality in the market.
- Market assessment of metering provider and retailer commercial models and arrangements
- Customer research to better understand customer perceptions, understanding and responses to appliance load control and controlled load tariffs in general.

Phase 2 – Trials

The exact scope of Phase 2 is aims to expand the number of trials in collaboration with metering providers and retailers. This includes running one or more trials in selected areas of Ausgrid’s network over the next regulatory year. The trials will build on successful demonstrations for moving a portion of overnight hot water controlled-load energy into the daytime, leading to the introduction of the solar-soak time schedule for Controlled Load 1.

The scope of the Phase 2 trials with Retailers will seek to test capability of innovative technology and approaches to orchestrate Controlled Load within the parameters of network guidelines to inform continual monitoring and improvement of the requirements set out in the ES7 Pricing Guide. This aims to support new innovative approaches while continuing to manage local and system network minimum and maximum demand.

Phase 3

The requirement for Phase 3 trials will be evaluated following Phase 2 trials with the intention to continue working with metering providers and retailers in Ausgrid network areas.

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. Expected outcomes from the project include:

- Understanding the potential for using more dynamic control of appliances through the controlled load tariffs as a demand management solution
- Running a series of trials in collaboration with customers, retailers and metering providers that aim to explore the practical implementation of using dynamic control of appliances through the smart meter.

3.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-2024, total project expenditure to date and the total expected project costs by the completion of the project.

Table 1 - Project costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$24,701	\$125,553	\$315,000

3.7 Project Activity and Results

3.7.1 Summary of project activity to date

The project activity to date has consisted of conceptual development as well as commencing the phase 1 data analysis, technology and market assessment activities as outlined in the implementation approach.

Overview of project activities carried out in the regulatory years of 2021-2023:

- In August 2021 Ausgrid approached a metering provider to initiate a trial of controlled load schedule changes via smart meters. Testing schedule agreements were signed between Ausgrid and the metering provider governing the over-ride function of 638 meters to enable the modification of controlled-load scheduling as part of the trial. The trial was scheduled to take

place between October 2021 and April 2022. Ausgrid applied the controlled-load schedule change. A portion of the daily energy normally consumed by hot water systems during overnight periods only was shifted into the daytime. At the end of the trial, Ausgrid downloaded the participating customers' interval data and carried out post-trial analysis to verify the load shift impact results. The successful demonstration led to the introduction of the solar-soak time schedules applied to Controlled Load 1 from 1 July 2024.

- Through 2022-2023, the focus of the research activities was to estimate the impact of modifying the controlled load switching times on customers and the Ausgrid network. This included the changes adopted in the updated ES7. Specifically, we focused on three research activities: (i) estimate the impact of a second operation window on heat losses and customers' electricity bills, (ii) study the impact of reducing the randomisation period of OP1 customers, and (iii) estimate the potential of OP1 customers to absorb the energy exported by solar PV systems. Research findings are reported in more detail in the FY23 DMIA Compliance Report.

Overview of project activities carried out in the regulatory year of 2023-2024:

- Continuation of activities to undertake controlled load research, including stakeholder engagement with Retailers and Metering Providers to establish Phase 2 trials that will support insights and findings to be undertaken in the next period (2024-2025).
- Ongoing Ausgrid participation in the RACE for 2030 SolarShift project¹ as an industry partner. The UNSW led project in partnership with Endeavour Energy, Solar Analytics, NSW Office of Energy and Climate Change (OECC), and Energy Smart Water (ESW), is exploring coordinated control and operation of Domestic Electric Water Heating Systems (DEWH) for soaking up excess solar generation, through different solutions.
- Stakeholder engagement on Heat Pump technologies and the co-development of the UTS led Heat Pump Hot Water trial (see Section 10. Heat Pump Hot Water Systems).

3.7.2 Project Research Findings

The focus of the research activities in 2023-2024 has mainly consisted of stakeholder engagement to establish Phase 2 trials that will test Retailer and Metering Provider capabilities for innovative approaches to orchestrating controlled load for customers and the Ausgrid network.

Further insights and findings will be collected in 2024-2025 as these trials are underway, supported by real-world data to explore the practical implementation of using dynamic control of appliances through the smart meter.

3.7.3 Update on material changes to the project

There were no material changes to the planned activities during 2023-2024. Planned Phase 1 activities were concluded in 2022-2023, and Phase 2 project activities were commenced as outlined with analysis and results collected through 2024-2025.

3.8 Other information

If you have a specific information request regarding this project which may assist you in understanding, evaluating or reproducing this project please contact demandmanagement@ausgrid.com.au.

General information can be accessed from Ausgrid's Demand Management web page from the Innovation Research and Trials link: www.ausgrid.com.au/dm

¹ <https://racefor2030.com.au/project/solarshift-turning-electric-water-heaters-into-megawatt-batteries/>

4 Peak Time Rebate

This eligible project is a continuation Demand Management Innovation Allowance (DMIA) project from Ausgrid's last regulatory control period 2014-2019 into the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. The project concluded at the end of August 2023.

4.1 Project nature and scope

Ausgrid assessed the effectiveness of a peak time rebate (PTR) offer in localised areas of the Ausgrid network area on peak demand days. In partnership with energy retailers, the program involved inviting customers to reduce their energy usage during PTR event times. The project aimed to test whether this option can be used to alleviate location specific short-term network constraints, to defer or reduce the need for longer term network infrastructure upgrades.

4.2 Project aims and expectations

The primary purpose of this project was to determine the viability of PTR as a demand management solution through building retail partnerships and conducting customer trials. As such the objectives were to gain an understanding of the:

- Scale and density of peak demand reduction offered by PTR under various modelled scenarios for constrained network assets;
- Various customer acquisition strategies and the resulting measure of localised PTR customer take-up;
- Effectiveness of various customer incentives;
- Customer experience;
- Reliability and availability of retailer PTR platforms; and
- DNSP costs associated with PTR events and payments to PTR providers.

4.3 How and why project complies with the project criteria

This project was designed to research, develop, and implement DM capability and capacity in the form of peak time rebates as a non-network alternative. It is considered innovative in that the proposed PTR trials utilised technologies, techniques and processes that differed from those previously used in the market.

Collaboration with retailers across targeted geographic areas as nominated by Ausgrid was an expansion and modification on past retailer trials and will explore PTR customer density and peak event duration and provide insight into network support impacts.

If viable, the approach being trialled in this project has the potential to offer a cost-efficient alternative to network infrastructure upgrades in residential parts of the network. Collaboration on PTR trials is not eligible for recovery under the classifications specified under any other jurisdictional incentive scheme, state/Australian government scheme or included in forecast capital or opex approved in Ausgrid's distribution determination.

4.4 Implementation approach

Ausgrid agreed to partner with AGL and EnergyAustralia to conduct PTR trials. Since 2017, AGL and EnergyAustralia have been developing their PTR capabilities². AGL and EnergyAustralia are two of the largest retailers in Australia and serve a significant share of Ausgrid's customers. By incorporating AGL Peak Energy Rewards³ and EnergyAustralia's PowerResponse⁴ programs in a single DMIA trial, Ausgrid can expand the project learnings and maximise PTR penetration in nominated locations.

² <https://arena.gov.au/renewable-energy/demand-response/>

³ <https://www.agl.com.au/newcampaigns/peakenergyrewards>

⁴ <https://www.energyaustralia.com.au/home/electricity-and-gas/power-response>

Scheduling a PTR event with the retail partners generally involved providing them with a date, time, and target locations one day before or on the day of the event. The retailers then invite their enrolled customers to participate in the PTR event.

The PTR project took place across 2 phases. The first phase of this project included the implementation of collaborative PTR trials with retailers. The PTR events in 2020-2021 confirmed the functionality of the basic retailer PTR process, provided insight into the Retailer customer recruitment strategy and customer demand response and satisfaction.

Phase 1 of the trial included suburbs in the Lower Hunter, Newcastle West, and Northwest Sydney areas of Ausgrid’s service area. These areas were selected as they are representative of the residential areas where local, residential network needs are forecast to occur in the near to mid-term.

Phase 2 of the DMIA project focused on exploring how we can increase the density of customer adoption for this solution in the trial areas and to better understand the viability of this solution for network support purposes. Throughout Phase 2, Phase 1 partnerships with the retailers continued with an increased number of customers.

4.5 Outcome measurement and evaluation approach

The project outcomes were 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.

Measurement and analysis of program results completed collaboratively with our retailer partners and included quantitative and qualitative measures such as:

- Assessment of energy and demand reductions from participating customers;
- Identification of customer experiences and preferences;
- Assessment of dispatch platform suitability and reliability;
- Assessment of tested customer incentive and acquisition strategies; and
- Identification of demand reduction density and potential effectiveness for deferral of typical network constraints.

4.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-20234, total project expenditure to date and the total expected project costs by the completion of the project.

Table 2 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$73,912	\$1,050,790	Completed

4.7 Project Activity and Results

PTR trial concluded in August 2023 with only one PTR event scheduled in 2023-2024, with collected results reported in the FY23 DMIA compliance report. Most of the project activities in 2023-2024 involved closing out the project with the retailer partners, writing the final report and setting up data sharing arrangements so that Ausgrid and the retailer partners can continue to collaborate in the future with the aim of finding solutions to address network constraints.

4.7.1 Baselines

The energy reduction for each event was determined by comparing the participant’s actual energy consumption with a prediction of what would have been consumed (baseline) if the PTR event had not occurred. EnergyAustralia adopted the CAISO10 methodology⁵. AGL applied their own process based

⁵ https://www.energyaustralia.com.au/sites/default/files/2020-11/201120_PR_Baseline_Calculation_Doc.pdf

on historical weather data and loads. The customer rewards and the PTR results presented in the figures below were calculated using each respective Retailer’s baseline methodology.

Implementing an appropriate baseline for residential customers, particularly at an individual customer level, can be challenging due to highly variable factors such as weather, customer behaviour and solar output. The need for a robust and standardised baseline methodology which is effective for residential customers will be important in ensuring that the PTR initiatives continue to develop as a valued solution for customers, networks, and retailers.

4.7.2 AGL PTR Events

There were 24 PTR event days throughout the trial with AGL. Figure 1 illustrates the number of invited customers for each event in comparison to the customers that opted in. The increase in invited customers in 2022 and 2023, compared to 2021, can be attributed to the trial’s expansion from 24 to 44 suburbs and the recruitment campaign launched in late 2021.

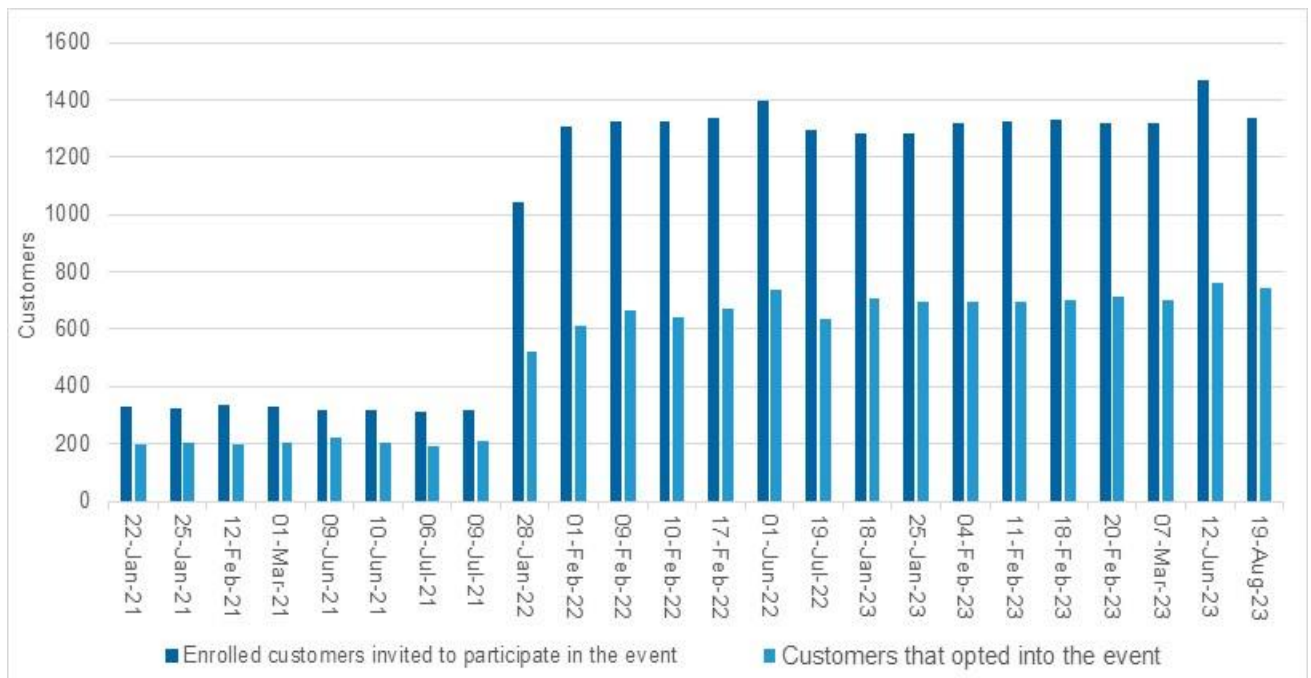


Figure 1 - Invited customers vs the customers that opted into the event for AGL events

The participation rate remained relatively constant throughout the trial, particularly for 2022 and 2023 when the number of invited customers were relatively consistent (see Figure 2).

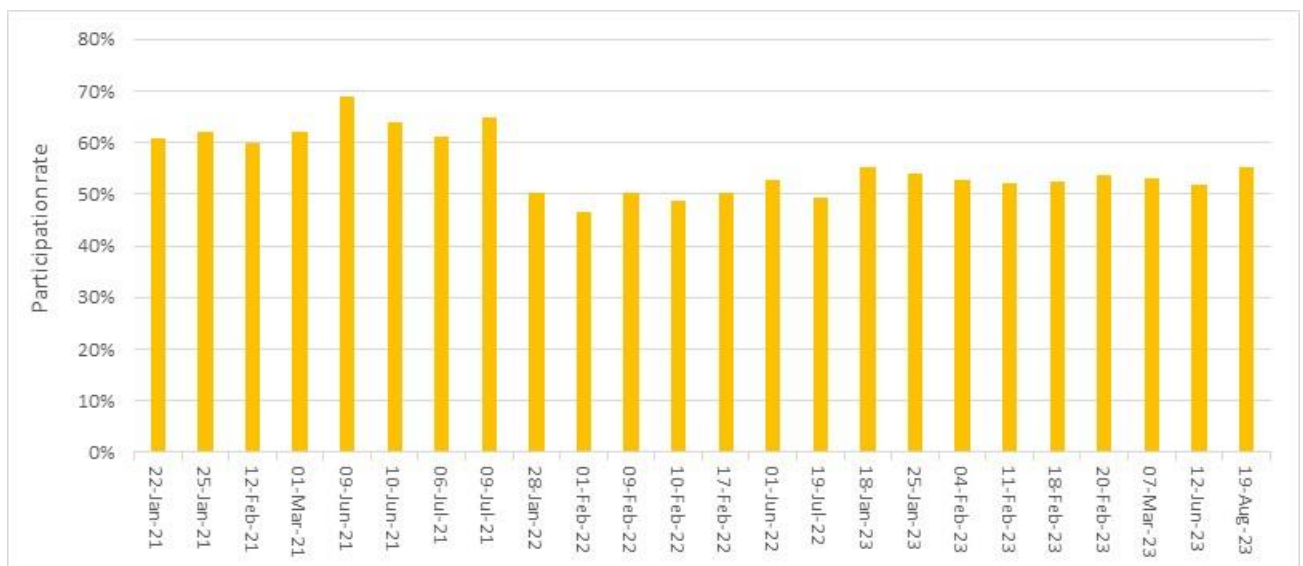


Figure 2 - Percentage of AGL customers that participated (opted in to the event)

Figure 3 shows that the average reduction from the participants fluctuated throughout the trial. The average opt-in customer reduction achieved throughout the trial was approximately 0.85kW according to AGL's baseline figures.

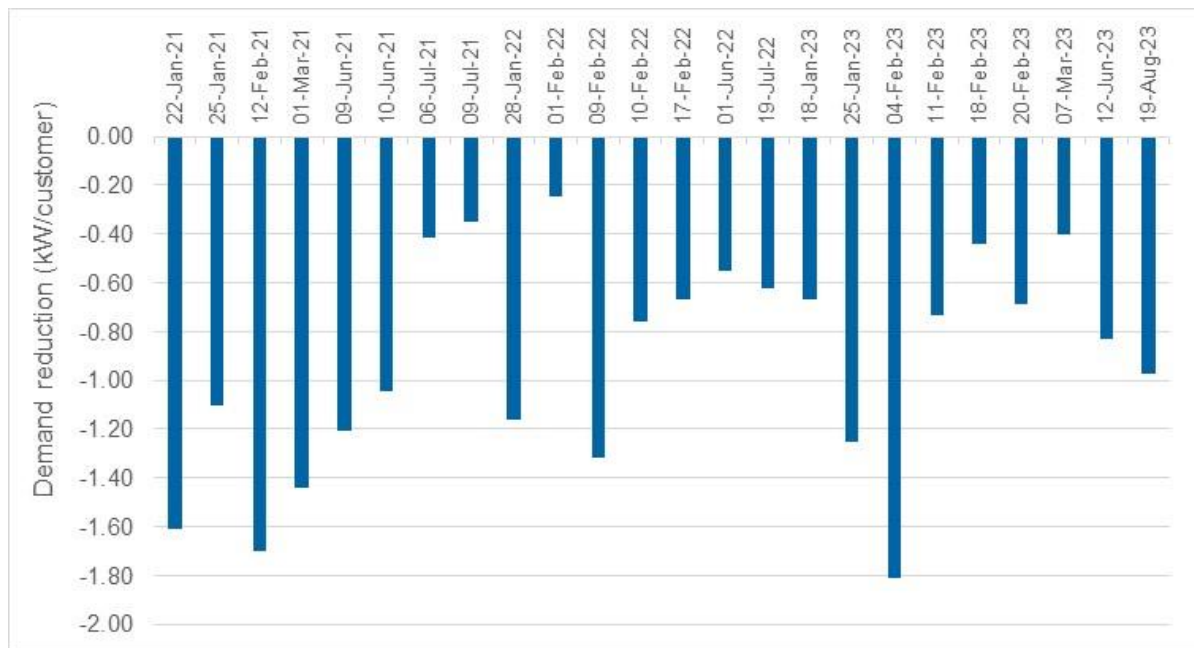


Figure 3 – Average customer reduction for the AGL events throughout the trial

The majority of the participants that opted in achieved a credit offered by AGL PTR program (see Figure 4 below). AGL offered \$5 for achieving target 1 reduction and \$10 for achieving target 2 reduction. These targets were calculated for each participant based on a percentage (typically in the range of 10-30%) reduction of their baseline usage.

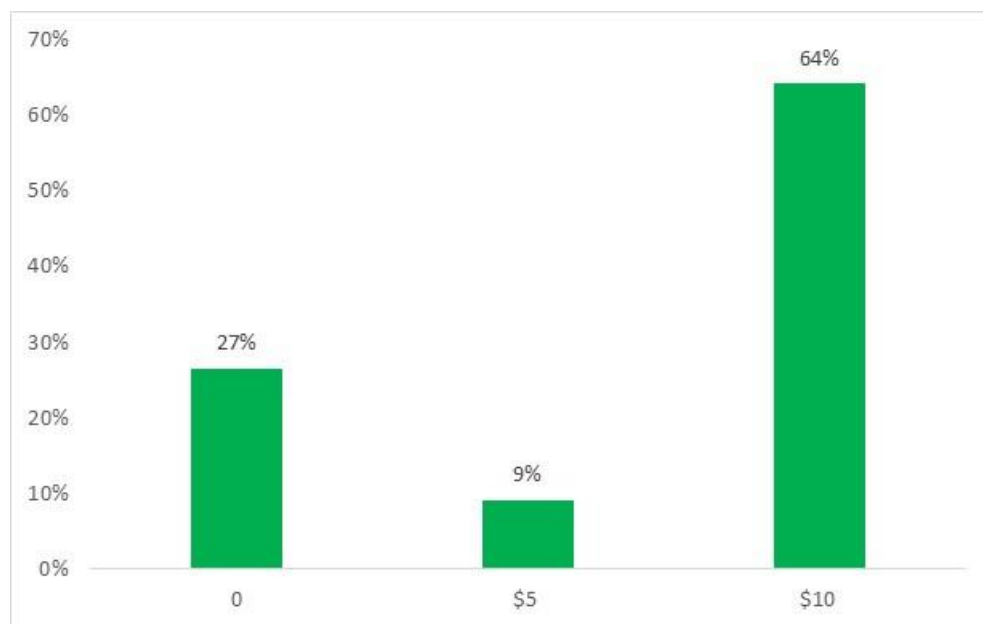


Figure 4 - Breakdown of credits earned for the AGL events during the trial

4.7.3 EnergyAustralia PTR Events

There were 16 PTR event days throughout the trial with EnergyAustralia. As shown in Figure 5, most of the invited customers didn't opt out of the event. The high participation rate can most likely be attributed to the opt-out (auto inclusion) method of recruitment employed by EnergyAustralia. The participation rate remained relatively constant throughout the trial (Figure 6).

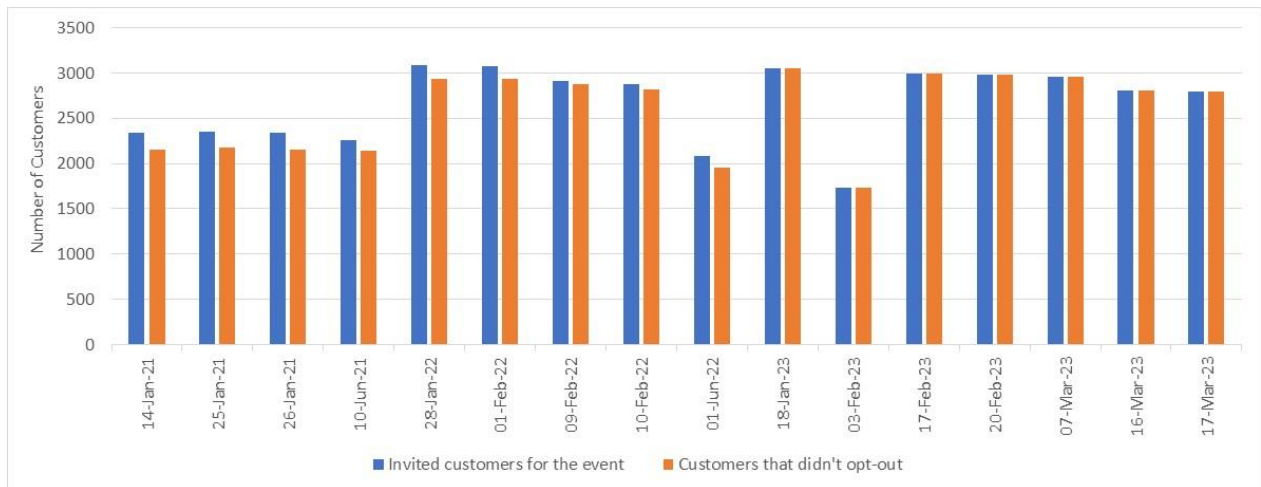


Figure 5 - Invited customers vs the customers that didn't opt-out for EnergyAustralia events



Figure 6 - Percentage of EnergyAustralia customers that participated (didn't opt out)

The results in Figure 7 suggest that there were a significant number of performing and non-performing customers in the group. This is likely due to the opt-out method of recruitment that was employed.

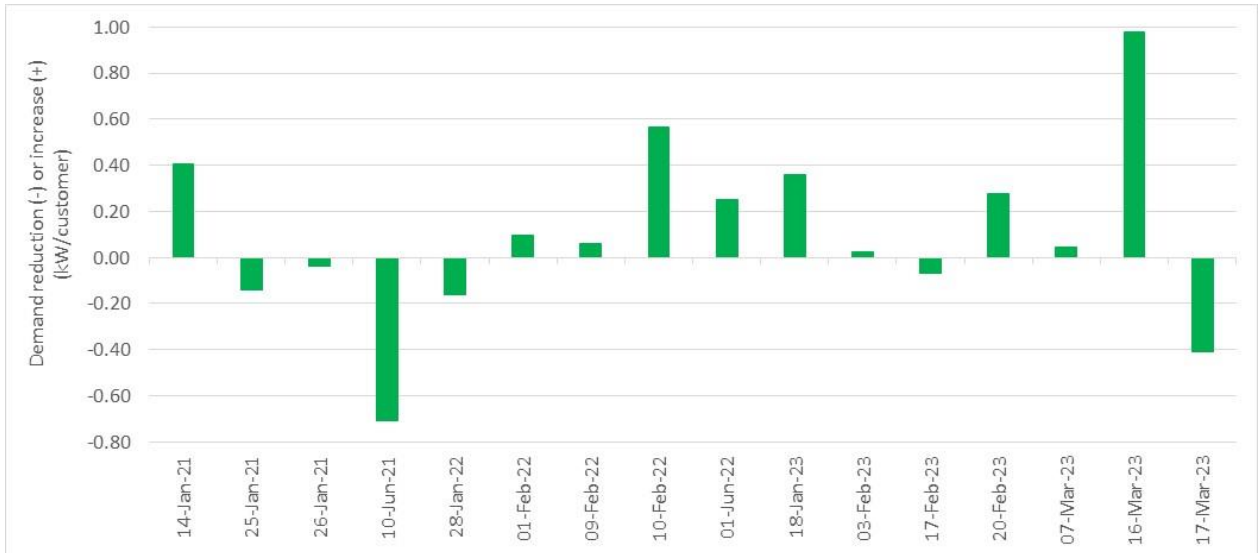


Figure 7 - Average customer response for the EnergyAustralia events throughout the trial

Figure 8 illustrates that almost half the customers did not earn a credit, indicating that many of the customers recruited via the opt-out method were inactive customers.

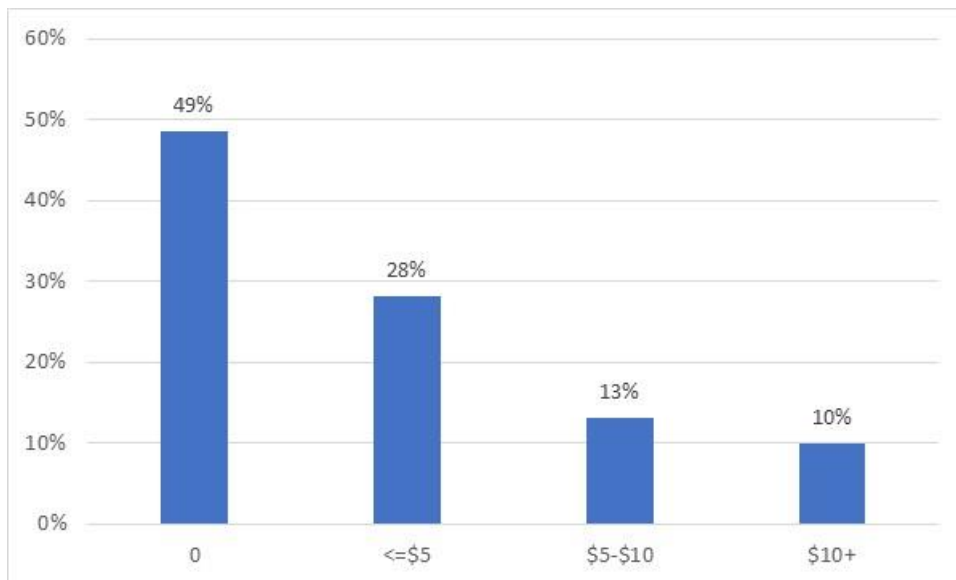


Figure 8 - Breakdown of credits earned for the EnergyAustralia events during the trial

Due to the blending of active and inactive customers, the results in Figure 7 provide limited insights on the response from those customers who were actively engaged in the program. To address this, we have attempted to isolate active customers by defining active customers as those who reduce their consumption by at least 5%.

Figure 9 presents an estimate of the energy reduction for actively participating customers. This analysis shows that when non-performing customers are excluded, the identified energy reduction is significant. The average response from customers who achieved a minimum of 5% reduction was approximately 1.05kW.

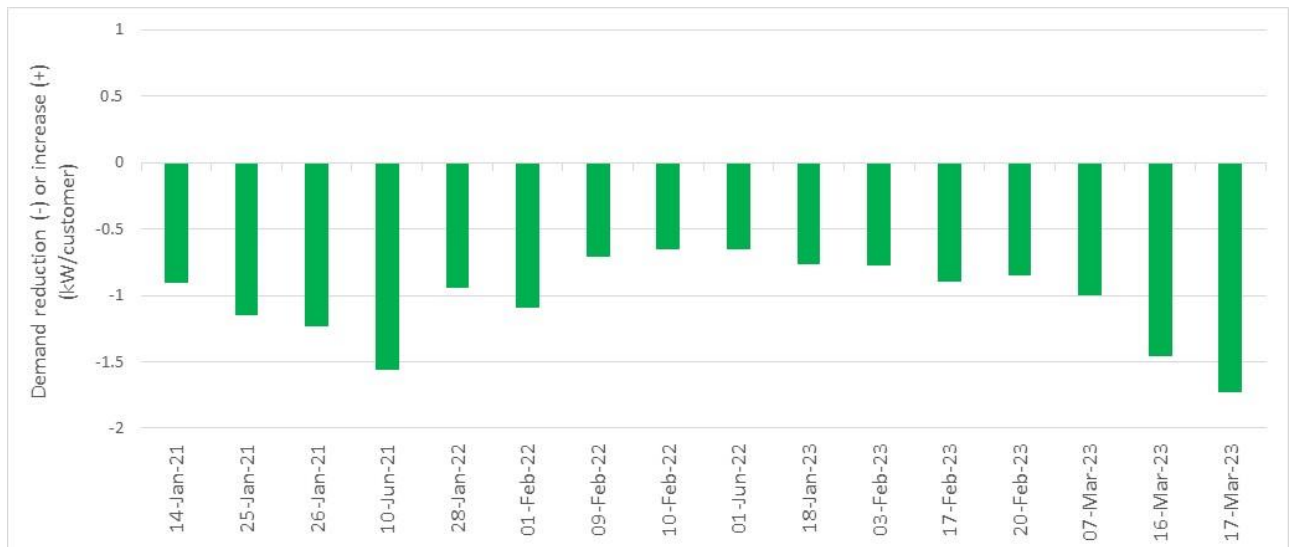


Figure 9 - Average customer reduction for EnergyAustralia customers that participated (didn't opt out) and achieved a minimum of 5% reduction

4.7.4 Key results from the trial:

- There were 30 event days scheduled during the trial with over 6,000 participants across 44 suburbs.
- The participation rate for opt-in recruitment averaged 53% while opt-out (auto inclusion) recruitment averaged 97%. The participation rates were relatively consistent throughout the trial, especially for events in the same season.
- While opt-out recruitment led to higher apparent participation rates, it didn't result in higher energy reductions or active participation. Approximately half of the participants recruited via the opt-out method received zero credit, which indicates that a significant portion of them were non-active participants.
- Approximately 45% of the participants recruited via opt-out method achieved a minimum of 5% reduction, averaging around 1.05kW reduction based on the retailer's baseline.
- On average, opt-in participants achieved an average demand reduction of approximately 0.85kW based on the retailer's baseline.
- An email recruitment campaign to register new customers resulted in an opt-in rate of 7%, which was higher than other demand management recruitment trials. An offer of a sign-up bonus resulted in an additional 2% of customers opting into the PTR program.
- During the summer of 2022/23 when an automatic air-conditioner controller was offered to the participants, the device was either never connected or previously connected but disconnected at the time of the event for 45% of the customers that collected the device. There were limited cases where the controller operated the air conditioner as the air-conditioner was manually switched off or the device was not connected.
- As of June 2023 (near the end of the trial), approximately 54% of the customers in the target trial suburbs did not have a smart meter which indicates that there is a potential to significantly increase the PTR participation rate with a higher uptake in smart meters.
- According to an end of trial survey, approximately 85% of the survey respondents are somewhat or extremely likely to participate in future PTR events.

4.7.5 Next Steps

Ausgrid will continue to work with the retail partners to investigate how PTR initiatives can help alleviate network constraints. Improvements to the PTR program such as the option to schedule weekend/public holiday events and the ability to invite customers based on specific location list rather than postcode will be explored. Internal processes are also being reviewed to further improve identification of PTR solutions for addressing network constraints.

With the Australian Energy Market Commission (AEMC) recommendation for 100% smart meter uptake by 2030⁶, there'll be greater opportunities to expand PTR participation. The development of cost-effective and mature PTR products that leverage multiple benefits for market participants will be important for the industry as it transitions to a Net-Zero future.

4.8 Other Information

General information can be accessed from Ausgrid's Demand Management web page from the Innovation Research and Trials link: www.ausgrid.com.au/dm

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

⁶ <https://www.aemc.gov.au/market-reviews-advice/review-regulatory-framework-metering-services>

5 Community Battery Feasibility Study and Research

This project is a continuing Demand Management Innovation Allowance (DMIA) project from Ausgrid's last regulatory control period 2014-2019 into the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. The project concluded in 2023-2024 regulatory year.

5.1 Project nature and scope

This project scope was to investigate the potential for locally based community batteries paired with an innovative business model to offer a competitive alternative to traditional local network investment, energy storage capability for market participants and introduce a novel way to markedly improve equitable access to energy storage for customers.

Following the feasibility study, a customer trial was undertaken in three locations across the region of Sydney and the Hunter - Beacon Hill, Bankstown and Cameron Park.

Battery sharing amongst networks, market participants and customers would offer both greater economies of scale and the diversity benefit of a shared asset. Shared storage services can lower costs for networks and the market which lowers costs for all consumers and saves participating customers more than they would if they invested individually. Additional storage capacity also enables increased renewable energy generation and resultant lower emissions.

The scope of this project under the DMIA includes a feasibility study into the concept by investigating the engineering, regulatory and commercial considerations, a customer survey to gauge customer response and attitudes towards the concept and the customer engagement components of the Phase 3 community battery trial.

5.2 Project aims and expectations

The first phase of the project aimed to assess engineering, regulatory and commercial aspects of the community battery concept within the National Electricity Market context via a feasibility study in the concept.

The second phase of the project aimed to assess the customer response to the concept of a community battery and to better understand customers perceptions, motivations to participate and attitudes towards the concept.

The outcomes of the feasibility study and customer research has now informed the development of a practical trial for the concept in phase three.

As part of Phase 3, the DMIA project continues to explore customer response, perceptions and behaviours as part of the community battery trial. The main objective of the trial is to test the benefits of stored solar energy to ease network constraints and raise community awareness about the benefits of community batteries.

5.3 How and why project complies with the project criteria

This project aims to explore the viability of an innovative approach to meeting network needs using a blended network / non-network community storage solution. By aligning the interests of networks, markets and customers, a lower cost alternative storage solution could extend the life of local network assets and improve network reliability and power quality.

The project is considered innovative in that this concept is testing how an in-front of the meter battery can be integrated into the electricity market; which has not been explored in detail by Ausgrid or within the National Electricity Market to the best of our knowledge. The engineering, regulatory, commercial and customer considerations are complex, particularly within the framework of the National Electricity Market and the National Electricity Rules and this project seeks to progress the study of this innovative concept for all aspects.

For customers, this research explores a solution which both offers a possible lower-cost alternative to traditional behind the meter storage and a more equitable access to storage technology for customers unable to invest in storage at their homes.

5.4 Implementation approach

The implementation approach for this project was envisioned as 3 possible phases:

Phase 1 – Feasibility study and model business case

The first phase of the project, delivered together with specialist consultants, was to complete a feasibility study and develop a model business case for community batteries as a solution for local network constraints. The scope of work included investigation of the following aspects;

- an **engineering** assessment of the network need and conditions in which a community scale battery would be beneficial, including identifying various battery configurations that could be potentially viable and a short list of suppliers that could provide these options;
- an assessment of the current **regulatory** framework and identification of any exceptions or waivers that would be required to operate a practical trial of the concept; and
- a **commercial** analysis to assess the business case from a project, customer and Ausgrid perspective, determine the key drivers and benefits, and identify uncertainties and risks.

Phase 2 – Customer Research – quantitative survey

The second phase of the project included a quantitative survey of Ausgrid customers. The survey included the following aspects:

- measure consumer needs, motivations and perceptions to store excess solar power in a community battery among solar and non-solar customers;
- measure factors contributing towards purchase of batteries, among current owners and those considering a purchase;
- assess factors impacting consumer experience and performance of current batteries;
- measure profile characteristics of solar, system owners in terms of demographics, household composition and socio-economic factors; and
- ascertain interest levels in future community battery storage solutions (shared assets, subscription models).

Phase 3 – Community Battery trial

The details and funding of a Phase 3 trial program was contingent upon the outcomes from Phase 1 and 2 and internal and external review of these outcomes. During 2020-2021, following completion of the phase one feasibility study, a decision was made to progress with a community battery trial under Ausgrid's Network Innovation program. The community battery trial has been developed in collaboration with Ausgrid's Network Innovation Advisory Committee (NIAC)⁷. This committee helps guide Ausgrid's network innovation activities and includes customer advocates, research bodies and environmental organisations. The NIAC were presented with the results of the phase one feasibility study and phase two customer research and were supportive of Ausgrid progressing with a community battery trial.

This DMIA project will continue to fund the customer research and the ongoing customer engagement components of the 2-year customer trial which is part of the community battery trial.

5.5 Outcome measurement and evaluation approach

The outcomes from phase one are a report that investigated and made recommendations about the community battery concept from the perspective of the engineering, regulatory and commercial issues.

To better understand the techno-economic considerations for a community battery as an alternative to network investment, outcomes from the phase one feasibility study considered the following key questions:

1. What are the technical options and costs for a community battery?
2. How do we expect the network conditions/issues to change over time?
3. What network conditions would be suitable for a community battery solution?

⁷ <https://www.ausgrid.com.au/About-Us/Future-Grid/Innovation-Portfolio/NIAC>

4. What is the potential contribution and benefits from Solar PV customer use of the community battery?
5. What are the market and system security benefits from a community battery?
6. What regulatory changes would be required to support the use of community batteries as an alternative network solution?

The outcomes from the phase 2 quantitative customer survey results included a report that provides a summary of customer survey results and insights to better understand customers perceptions and awareness of the community battery concept and potential motivations for participating in a potential community battery trial.

The learnings from both Phase 1 and 2 have been used to inform the progression of the project to a Phase 3 community battery trial funded under the Ausgrid Network Innovation program.

5.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-2024, total project expenditure to date and the total expected project costs by the completion of the project.

Table 3 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$13,900	\$522,037	Completed

5.7 Project Activity and Results

5.7.1 Material changes on the project

The delivery of the Phase 3 community battery trial was largely transferred to the Network Innovation program, in collaboration with Ausgrid’s Network Innovation Advisory Committee (NIAC). The NIAC was put in place to give customers a role in driving our innovation investment program, guided by an underlying set of innovation principles and their terms of reference⁸.

The DMIA funded component of Phase 3 of the trial is associated with the customer engagement elements of the trial including activities such as customer engagement communication activities and payment services to customers.

5.7.2 Summary of Project Activity to Date

Phase 1 – Feasibility study and model business case

The project activity for phase one commenced in 2018-2019 with the release of an expression of interest for consulting services, selection of a consultant consortium and commencement of research activities. As part of the research, Ausgrid provided access to detailed network and customer data and access to a wide range of internal subject matter experts (SMEs) to inform and guide the work by the consultants.

During 2019-2020, the feasibility study was completed in February 2020. The study assessed a range of technical, commercial, and regulatory issues and concluded the community battery project initiative could be feasible within as little as 3-5 years.

The findings from the Feasibility study confirmed that the community battery concept was likely to be viable under a set of assumptions, constraints and parameters that were supported by analysis of existing network and customer data. For reported results from the feasibility study, refer to Ausgrid’s DMIA Annual

⁸ <https://www.ausgrid.com.au/About-Us/Innovation/NIAC>

Report 2019-2020⁹. Ausgrid's Community battery feasibility report can be downloaded from the project research page on Ausgrid's website¹⁰.

Phase 2 – Customer Research – quantitative survey

During 2019-2020, the scope of the customer research was formulated, the procurement exercise completed, and a market research provider selected. In the third and fourth quarter of 2019-2020, the online survey was designed and developed in collaboration with a market research company and input from stakeholders. The survey was completed at the end of July 2020 and analysis of the results and reporting was completed by the market research company commissioned to conduct the survey by November 2020.

The survey design resulted in a targeted letter and email campaign to more than 11,000 Ausgrid customers. The survey design included:

- Existing solar PV customers segmented by annual export volume;
- Existing solar and battery customers;
- Non-solar customers; and
- Solar and non-solar customers in areas identified as representative of Distribution Centres where the community battery solution was potentially viable.

The survey was conducted in July 2020 with just over 900 Ausgrid customers who had solar PV systems or home batteries connected to Ausgrid's network or who were considering installing a solar system within the next two years. The questions in the survey focused on measuring customers' existing level of knowledge about community batteries and their sentiment, motivation, and barriers towards the concept of taking part in a community battery trial if presented with the opportunity. In addition, profiles of both solar customers and home battery owners were undertaken and presented in the report.

A detailed analysis of the results was completed and finalised by November 2020. The key findings of the online customer survey are discussed in Ausgrid's 2020-2021 DMIA Annual Report¹¹[Error! Bookmark not defined.](#) and the detailed public report containing the results from the survey is available on the project research page on Ausgrid's website¹².

Phase 3 – Community Battery Trial

More than 60 customers participated in the Community Battery Trial involving virtual storage across three sites. The Community Battery Trial involving customer virtual storage concluded in 2023-2024.

The participants in the trial could virtually store up to 10 kilowatt hours (kWh) per day. The excess energy is credited against their electricity use for that day. The credit was calculated at the end of each day and paid to the participant each quarter via bank transfer. There were no costs to participate, and customers didn't need to change their electricity retailer.

Figure 10 shows payments to customers were significant, with customers saving \$17 per month on average, and one customer saving as much as \$105 in a single month. Over the 39 months of the program, customers saved \$657 on average, with one customer saving as much as \$2,064.

⁹ <https://www.aer.gov.au/system/files/Ausgrid%20-%20DMIAM%20annual%20compliance%20report%20-%202019-20.pdf>

¹⁰ <https://www.ausgrid.com.au/In-your-community/Community-Batteries/Community-Battery-research>

¹¹ <https://www.aer.gov.au/system/files/Ausgrid%20-%20DMIAM%20annual%20compliance%20report%20-%202020-21.pdf>

¹² <https://www.ausgrid.com.au/In-your-community/Community-Batteries/Community-Battery-research>

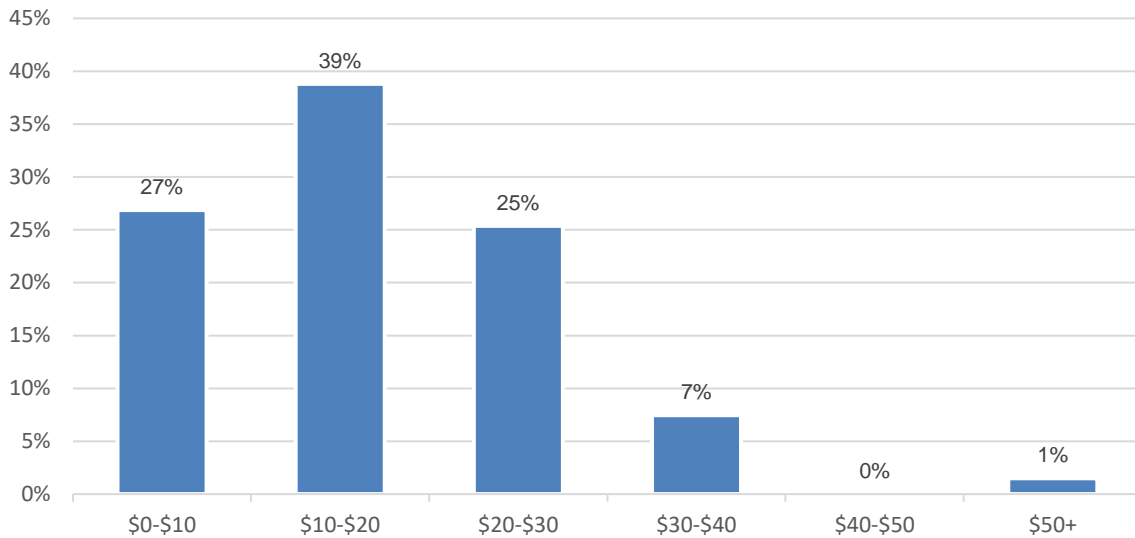


Figure 10 - Average monthly credit for customers

Participating households already had solar, meaning they faced lower bills than other customers in Ausgrid’s network. The average monthly retail electricity bill over the trial period, without the benefits of the community battery, is estimated to be \$97. Future programs could also focus on including non-solar users.

Collectively customers have stored more than 540MWh of solar energy in the community batteries across the three sites. Figure 11 shows the daily average for use of the virtual storage by participants.

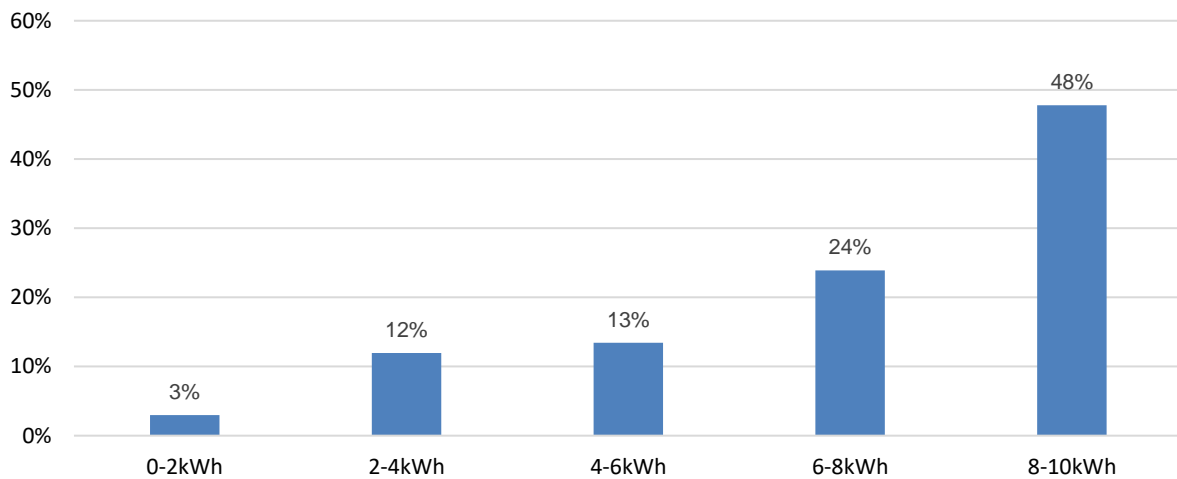


Figure 11 - Daily average virtual storage

Considering there was no cost-of-entry, participants’ savings were significant. Customers’ bills are estimated to have been reduced by 18% with minimal negative feedback regarding value of the payments. It should be noted payments were not based on costs, meaning these savings cannot be commercialised.

Throughout the Community Battery trial, participants had access to a mobile app and an online portal that showed real-time information about how much solar energy they are exporting to the grid, and how much energy they are using. Ausgrid conducted a few participants surveys throughout the trial with generally positive feedback with the NPS ranging from 19-33. More details of the survey results can be found in the previous DMIA reports¹³. Overall customers were generally positive about their experience participating in the Community Battery Trial.

¹³<https://www.aer.gov.au/publications/reports/compliance/demand-management-innovation-allowance-mechanism-assessment-2019-20-2020-21-and-2021-22>

Some of the key challenges and learnings that were identified in the trial included:

- Hardware installation – this tended to be expensive and there was little control over contractors with competing priorities within the trial timeline.
- Application experience – customers who regularly used the app generally also provided a positive overall experience through the trial. However the app was costly for Ausgrid to design, build and implement and future trials or programs could seek to leverage pre-built, third party applications or integration into retailer applications.
- Understanding the offer – As the credit offer was not connected with their retail bill on occasions this made it more complicated to understand or challenging for engagement. In future, more integrated offerings could be more appealing to consumers.

Monthly payments to participating customers often exhibited significant seasonality owing to varied power demand, solar generation and the structure of the tariffs. This successfully mimics the seasonal changing value of a home battery. It was observed that aggregate power demand slightly rose over the trial period, which resulted in increased payments.

The operation of the virtual batteries showed on average that they charged 7kW per day, and a median charge of 10kW per day. This indicated that the virtual batteries were being utilised efficiently. While some households could have used access to larger batteries, and others smaller batteries, the cost and benefit of this was unclear from the trial and could be explored further in future.

Next Steps

The customer research conducted throughout this DMIA trial has indicated that there's significant customer interest in community batteries. While most customers viewed financial incentives as the primary benefit associated with community batteries, environmental and social factors were also regarded as important benefits. Some of the key learnings and next steps have been summarised below:

- Simplify customer offer – It would be valuable to explore and trial more straightforward tariff approaches to make it easier for customers to understand.
- More efficient onboarding of customers – some customers had challenges enrolling into the trial and missed some benefits at the start of the trial. Often this was due to challenges with hardware installation. In future, it would be important to consider less onerous participation conditions.
- Reduce number of involved parties – the number of providers involved in the trial caused confusion with trial participants on occasions, including uncertainty about who to contact if issues arose. This could potentially be addressed through options to trial alternative approaches to simplify the customer experience.
- Substantive customer payments – generally, bill savings satisfied most customers and exhibited seasonal variations. Future programs could seek to monitor and test saving ranges following the findings of the trial, of around 18-20% per customer.

Following the completion of the Community Battery Trial, Ausgrid is continuing to rollout additional community batteries across the network¹⁴ and explore ways that community batteries can provide value to our customers, communities and the grid.

5.8 Other Information

For further general information about the Ausgrid Community Battery project can be accessed on Ausgrid's website at <https://www.ausgrid.com.au/In-your-community/Community-Batteries>.

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

¹⁴ <https://www.ausgrid.com.au/In-your-community/Community-Batteries>

6 Project Edith Customer Payments

This project was a new Demand Management Innovation Allowance (DMIA) project in the 2019-2024 regulatory control period. The following project report details the project activities until the end of the 2023-2024 regulatory year. The project will continue into the 2024-2025 regulatory year.

6.1 Project nature and scope

Project Edith is exploring how distribution networks can unlock more value for and from customer energy resources enrolled in VPP arrangements through dynamic network prices.

The project takes a collaborative approach, co-designing the solution with project partners and engaging with stakeholders from across the industry.

The project's first phase was a rapid demonstration of whether we could adapt existing systems to provide dynamic network pricing to unlock this additional value with only modest systems investments. A tariff solution that was sufficiently flexible to allow multiple changes within the year through a lean and iterative build-test-learn development cycle was required.

Customers enrolled in the trial remain on their listed network tariff, and we use an off-market approach to calculate their project tariff in parallel. The customer agents optimise customer energy resources around the project tariff – and when the project tariff charges are lower than the listed tariff, Ausgrid pays the customer agent the difference. Ausgrid funds these payments from the DMIA.

The second phase is expanding the program to additional agents and analysing customer response. In 2023-2024, Ausgrid recruited three additional customer agents to participate. The trial ran several experiments on how customers respond to price changes based on network and weather conditions.

The regulatory year of 2024-2025 will focus on onboarding more customers, analysing network constraints and aggregated response levels.

6.2 Project aims and expectations

Project Edith has three primary objectives:

1. Remove barriers to the participation of customers' energy resources in energy markets through efficient and fair pricing.
2. Allocate distribution network capacity in a decentralised manner and incentivise network support from customers' energy resources.
3. Identify and inform key areas for implementing this model, share insights and engage with the industry.

The project set to meet these by developing an end-to-end dynamic pricing system that published 5-minute network pricing and operating envelope data to customer agents on a day-ahead basis.

In Phase One, Ausgrid created a proof-of-concept to demonstrate dynamic pricing to stakeholders and help determine how to scale the solution. The Phase Two expansion tests the concept with a broader range of customer agents and their customers. The DMIA project for customer payments supports our objectives by enabling an off-market trial, allowing for a lean and iterative approach that is not possible with an on-market trial.

6.3 How and why the project complies with the project criteria

The project was initially funded from Ausgrid's Network Innovation allowance. The DMIA component of the project funds customer savings achieved by optimising the off-market project tariff instead of the listed tariff, as no NSW or national schemes are available to cover this gap.

This project is specific to Ausgrid's distribution network and is not covered by our forecasted capital and operating expenditure. Project Edith is demonstrating the effectiveness of dynamic network pricing in enhancing the utilisation of distribution networks. By influencing customer energy resources, dynamic pricing aims to reduce network costs associated with managing minimum and maximum demand, minimise solar export curtailment, and avoid unnecessary network upgrades. The project is critical for Ausgrid, other DNSPs, and AEMO to understand how well dynamic pricing signals can influence customer energy resources and shape the future National Electricity Market.

As the first trial of its kind in Australia, Project Edith targets key risks in transitioning to a net zero distributed energy system. Long-term network costs can be reduced if the aggregator/customer relationship changes customer energy profiles and leads to more efficient network utilisation. These reductions can benefit low-voltage (LV) and high-voltage (HV) networks, addressing minimum and maximum demand constraints. More broadly, dynamic network pricing can encourage greater customer energy resource participation in energy markets, accelerating the clean energy transition.

6.4 Implementation approach

This section outlines the different components that make up Project Edith.

6.4.1 The Edith tariff

We based the development of a dynamic tariff on Ausgrid's 2024-2029 Tariff Structure Statement and the national electricity rules pricing principles. The initial tariff included a capacity subscription price, but we removed it due to the implementation complexity and lack of customer response. The current tariff includes:

- Weather-based rules determine whether default tariffs or peak/solar soak prices are applied.
- A dynamic, two-way, energy-based price reflects the cost of network use at different times and locations.
- A fixed charge will be charged to recover the remaining residual costs.

We will continue working with Edith participants and stakeholders to develop the tariff.

6.4.2 Network model and forecasting

We require a complete representation of the network to understand power flows and network constraints and the potential of CER to alleviate them. We utilise existing databases, ratings, and switch state registers to generate a model suitable for power flow modelling. We use the network model, customer profiles, and weather inputs to develop generation and load forecasts.

6.4.3 Optimum Power Flow (OPF)

The OPF solver models forecast power system flows across network sections daily. It assesses when and where local network constraints are predicted to occur and then calculates the response required from Edith customers to prevent the constraint from occurring. The OPF can also generate operating envelopes to keep customer energy resources within network limits.

6.4.4 Pricing Function

The pricing function uses dynamic pricing to keep the network within limits, allowing it to be used most effectively. It uses the marginal cost and outputs from the optimum power flow to generate a dynamic network price and harness the customer's energy resources. The pricing function builds on the Evolve platform developed by the Australian National University and Zepben.

6.4.5 Utility Server

Ausgrid transitioned from the Evolve platform to our utility server application. The utility server hosts most of the Edith platform's data, applications, and services. We register customer agents on the utility server so they can retrieve the dynamic network prices and register their customers on Edith. Communication between Ausgrid and the customer agents is via the Common Smart Inverter Profile Australia Application Programming Interface to ensure a standardised and recognised approach.

6.4.6 Billing Engine

A method to calculate network charges for participating customers based on the project tariff and the customers' listed tariff. The billing engine calculates payments due to Customer Agents by determining the difference between these costs.

6.4.7 Customer offer and recruitment

Initially, Project Edith recruited five existing customers that had strong relationships with their Customer Agent for early testing using full SRMC-based dynamic prices. Subsequently, an additional 60 customers were recruited, who were subjected to a more straightforward weather-based dynamic tariff. This tariff

involved shifting from low default prices to predefined high prices (and high rewards) during specific weather conditions corresponding to times of network constraints.

During 2023-2024, Ausgrid recruited 351 customers to the program across two additional Customer Agents. The Customer Agent is responsible for determining how the value from dynamic pricing is shared with their customers and ensuring that value is shared separately from the customer's retail plan if the Customer Agent is not an energy retailer.

6.5 Outcome measurement and evaluation approach

To test the effectiveness of dynamic pricing, Project Edith assigns participating customers to a sandbox feeder configured to be near its technical limits for both peak load and peak exports. This setup allows the project to observe customer responses to dynamic price signals within a reasonable timeframe.

Initial approach

The billing engine described in Section 7 compares energy flows for each connection point with the network prices applied during each metered period (ranging from 5 to 30 minutes). This allows for assessing customer response to dynamic pricing, which the virtual power plant optimiser requests. The customers do not have visibility of the project tariff, so behavioural responses have not been tested.

The evaluation was qualitative, with few customers in the initial phase. It observed correlations between energy flows and prices during rapid changes. The evaluation also assessed tariff settings, aiming for dynamic pricing to produce similar costs to static pricing. Cost outcomes over several months were analysed to refine the pricing.

Phase two approach

For phase two, we were able to be much more deliberate in setting up and running our experiments. This methodology enables the systematic evaluation of dynamic pricing signals, providing insights into optimising pricing strategies for improved network management and customer outcomes.

Customer selection and cohort assignment:

- Randomly select a representative sample of customers for participation.
- Divide the customers into multiple cohorts to allow for comparison and control groups.

System Calibration:

- Configure the system to simulate high-constraint conditions that mimic real-world scenarios the project aims to address. This ensures that the experiments are conducted under realistic conditions relevant to the research goals.

Experiment Design:

- Identify and vary key characteristics of the pricing signals to be tested. These characteristics can include:
 - Size of the signal
 - Duration of the price
 - Time of day
 - Weather conditions
 - Pricing symmetry

Data Collection and Analysis:

- Monitor energy flows and customer responses during the experiments.
- Collect data on how pricing signal characteristics influence customer behaviour and energy usage patterns.
- Analyse the collected data to assess the effectiveness of each pricing signal characteristic.
- Adjust the pricing strategies based on the findings to enhance efficiency and customer participation.

Outcome Measurement:

- Ensure an ex-post reconciliation process to verify that customers are not adversely affected by their participation.
- Measure the long-term impact on network utilisation, cost reductions, and customer satisfaction.

6.6 Costs of the project

The table below shows Ausgrid's actual project costs for 2023-2024 and the total project expenditure to date. Total expected project costs by the completion of the project are unknown at this stage and will become available as the project progresses.

Table 4 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$404,888	\$409,925	\$1,315,000

6.7 Project Activity and Results

6.7.1 Summary of project activity and collected results in Phase One

Phase one of the project achieved its objectives by:

- Validating the technical feasibility of an end-to-end solution for dynamic pricing, including a network model, pricing engine, and API integration. The project partner optimised their customers' solar and home battery systems around the dynamic network prices, showing that sophisticated tariffs for price-responsive devices can be implemented and add value for market-active customers.
- Demonstrating that dynamic network pricing can be implemented by evolving existing systems, providing confidence in a cost-efficient implementation at scale.
- Gaining support from stakeholders, including customer advocates, regulatory bodies, energy networks, energy retailers and aggregators, building confidence in dynamic network pricing to generate value for networks and virtual power plants and their customers.

6.7.2 Summary of project activity and collected results in Phase Two

The following trial activities were undertaken in phase two:

- **Customer responsiveness:** Customers are highly responsive to dynamic price signals within certain boundaries, influenced by available technology and their electricity consumption needs. These boundaries will inform the design of dynamic tariffs.
- **Identifying inflection points:** Recognising the price points beyond which customer response plateaus is a significant step in optimising dynamic pricing strategies.
- **Prevailing conditions:** Price responsiveness varies depending on weather conditions and other factors like the time and type of day (public or school holidays), requiring a more comprehensive analysis.
- **Local variations:** The granularity of locational price signals and weather sensitivity analyses for different network zones are essential for tailored tariff designs.
- **Other price signals:** Comprehensive pricing strategies require integrating dynamic prices with other signals that customers face, including dynamic export-only tariffs.

The first half of 2023-2024 focused on building the Edith platform and contracting new customer agents. During this time, we continued to run experiments to assess whether customer agents could optimise around the dynamic pricing signals.

Figure 1 below shows a sample from a cloudy day with an evening peak. Prices were flat during the day, with a significant price spike in the evening to meet network requirements.



Figure 12 - Typical cloudy day on Edith Tariff

In practice, Edith prices have typically been virtually nothing from midnight to 6 am, with a minor morning peak and a depression during the day – which swings to a negative price signal if it's a mild sunny day – and then a peak period, with the highest prices at around 6 pm.

By the second half of the year, we were able to run a series of structured experiments with 203 customers. For each experiment, we split the customers into different randomly allocated cohorts. We calibrated the feeder to be highly constrained for the duration of the experiments, which ensures that the experiments mirror the types of events and conditions that we are trying to solve through Project Edith.

The experiments varied the following characteristics of the pricing signals:

Table 5 - List of some of the key characteristics for the pricing signal

Variable	Details
Size of the signal	To determine the price size required to get a response from customers. We aim to find the right balance between fairness and efficiency and compensate customers for providing flexible services.
The duration of the price	How long does the pricing signal last? If it goes on too long, customers will be unable to respond due to capacity limits with their batteries.
The time of day	Do we get different responses at different times of the day?
The weather	The weather significantly impacts customers' energy use – we use weather-based heuristics to trigger pricing events. For example, it is above 30 degrees on a sunny day.
Symmetrical pricing	Does pricing need to be symmetrical to elicit the right size of response?

Figure 2 below, shows that significant price changes correlate with a large shift in demand. We also observed that customer responses plateau once the price signal exceeds a certain level of approximately 17 cents; beyond this, we do not get a more significant response.

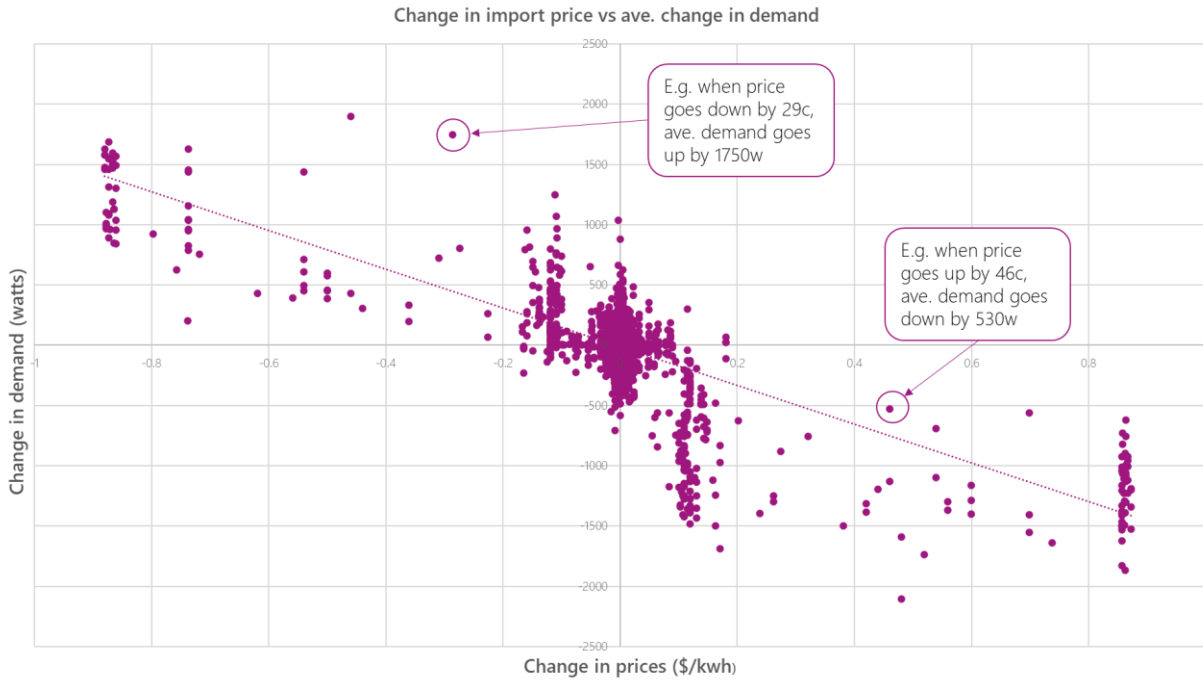


Figure 13 - Change in average demand (Watts) against the change in import price (\$/kWh)

Customer responses to positive and negative price changes appear to be broadly symmetrical. The aim is to define a pricing function, that provides just the right level of incentive for customers to participate.

Figure 14 below, shows the duration of the dynamic price signal. The dynamic price typically remains relatively low and ramps up and down mainly around solar soak or peak demand events. During these periods, we see the prices change significantly.

We have observed that the typical battery response lasts for a couple of hours before reverting to its typical profile. Ideally, we want a greater diversity of supply, so we work with customer agents to determine how best to achieve this. In the second graph in Figure 14 below, you can see that customers imported as much as they could, before reverting to exporting – despite the export charge of 51 cents.

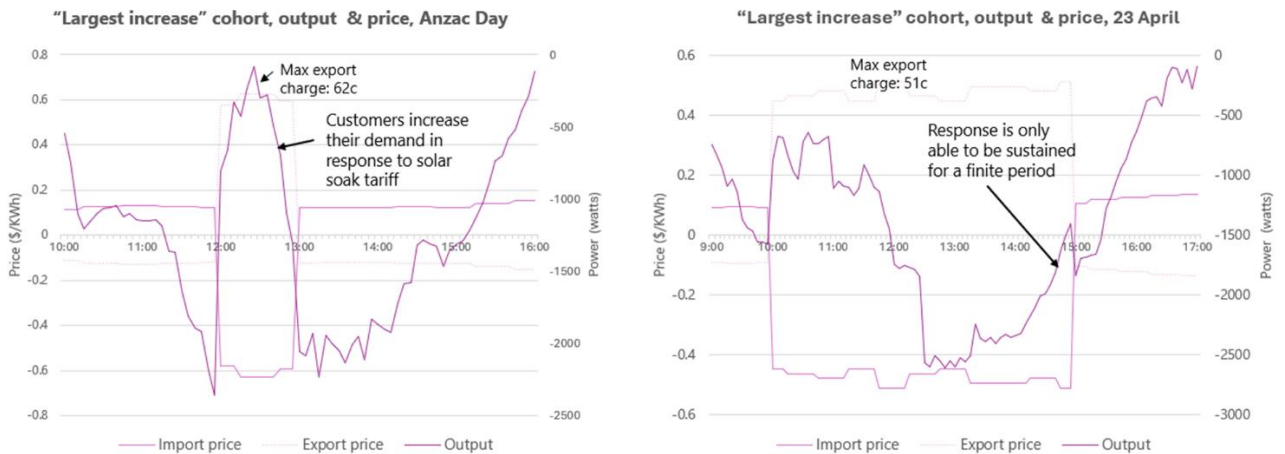


Figure 14 - Duration of the pricing signal

In the experiment highlighted in Figure 15, we split the customers into two cohorts, one receiving symmetric pricing and the other getting asymmetric pricing.

Through this experiment, we found that the symmetric cohort responded more strongly than the asymmetric cohort. The symmetric cohort increased their demand more during solar soak and reduced their demand more than during the peak. Although symmetrical pricing looks better, we need to undertake further research into whether it can introduce unintended outcomes if customers cannot respond.

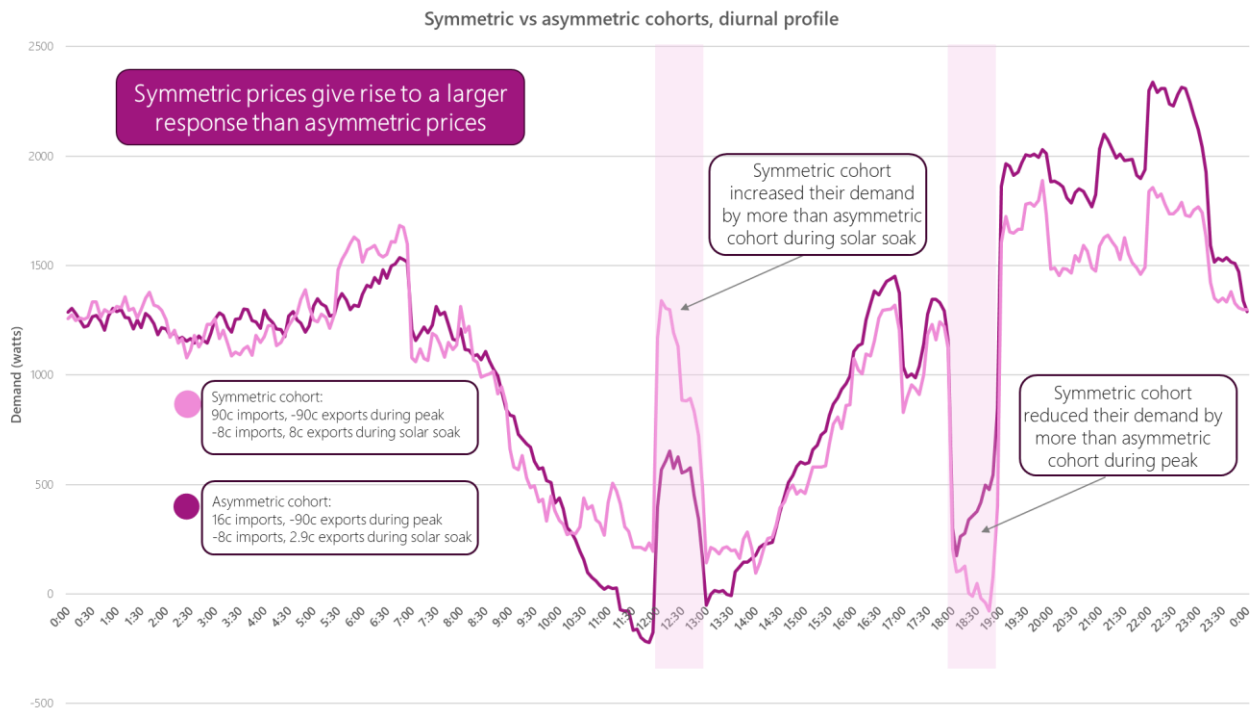


Figure 15 - Symmetrical vs asymmetrical pricing signals

Further work is needed to validate the hypothesis that dynamic network pricing can effectively manage network capacity in a growing two-sided market. This includes increasing the number of participating customers and Customer Agents to assess cost recovery mechanisms effectively. Following an Expression of Interest process, we added three Customer Agents to Project Edith.

At the end of 2023-2024, we have 417 customers participating in the program and we plan to grow this to between 1,000 and 2,000 customers by June 2025 in the next regulatory year. In addition to onboarding agents and customers, we are working on analysing network constraints and the level of aggregated response required to alleviate these constraints. This work will support removing barriers to customer energy resources participating in energy markets.

We also plan to work with customer agents to design and implement our project tariff. Through the next regulatory year, we will continue to test and refine the tariff, and in FY26, we propose to begin testing safeguards for dynamic network pricing before launching an on-market sub-threshold tariff. The ultimate aim is for a formally listed Tariff Structure Statement to ensure comprehensive cost recovery and network efficiency.

6.7.3 Update on material changes to the project

There were no material changes to the planned activities during 2023-2024. Planned activities are continuing as outlined with further analysis and results collected through 2024-2025.

6.8 Other Information

Further information about Project Edith can be accessed on Ausgrid's website at <https://www.ausgrid.com.au/About-Us/Future-Grid/Project-Edith>

7 Barriers to Electrification Study

This project is a continuing Demand Management Innovation Allowance (DMIA) project in the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. This project concluded in the 2023-2024 regulatory year.

7.1 Project nature and scope

As traditional technologies that use fossil fuels are replaced with technologies that use electricity as a source of energy, a key uncertainty is the degree and pace of electrification that will take place.

Greater electrification is expected to unlock more benefits, including greater load flexibility, better network utilisation and lower network costs for all customers. It also supports customers to unlock more value from CER investments and reduce their overall fuel costs and impact on greenhouse gas emissions.

Demand-side tariff and non-tariff solutions can play a role to manage both minimum demand and maximum demand conditions as customers make the transition.

The study will explore how demand management solutions can support efficient integration of new electricity load to the grid and develop an understanding of potential barriers to electrification customers may experience.

The project will also help to build further understanding of the pace and scale of electrification of homes, businesses, industry, and transport, that is likely to occur across Ausgrid's network and will be informed by market and industry research and stakeholder engagement to provide effective recommendations.

7.2 Project aims and expectations

The aim of the Barriers to Electrification Study is to better understand the current state of electrification across decarbonisation pathways and customer segments and identify what capabilities will be needed to support customer electrification and integration of new flexible loads.

The objectives of the research are to:

- Develop a prioritised list of customer barriers, based on external expert advice, rapid literature review and primary research including external stakeholder engagement.
- Develop a better understanding for how the pace and scale of electrification might be influenced by a range of policy, social, economic and technical customer barriers.
- Identify opportunities or challenges for electricity networks, that guide priorities towards enabling efficient electrification and prioritise novel demand management opportunities.
- Develop a better understanding of the potential for demand management tariff and non-tariff interventions that could be explored to integrate new load efficiently and support increased CER hosting capacity.

7.3 How and why project complies with the project criteria

This project will build Ausgrid's understanding of how the impact of decarbonisation, through rapid electrification will impact the changing role of electricity networks and inform how we can leverage the addition of millions of new potentially flexible loads to the grid.

The project is critical foundational research into electrification to understand how we can:

- Prioritise initiatives to implement or trial demand side management and price incentives to address barriers to electrification and reduce long term costs to customers through a pathway for DNSPs to guide efficient investment decisions.
- Improve network utilisation, leading to lower average costs per customer over time.
- Identify network expenditure savings, leading to lower average network charges per customer, compared to BAU, benefitting all network users, resulting from demand management, flexible CER and cost-reflective pricing.

7.4 Implementation approach

This project will be delivered in 2 phases including:

7.4.1 Barriers to Electrification market engagement (Phase 1)

This project will develop a prioritised list of the expected customer barriers and electricity network opportunities and challenges towards electrification. The project outcomes are expected to be organised into a report spanning the following topics:

- A current state landscape for decarbonisation relevant to Ausgrid's operating environment, including analysis on scale and pace of change and identify risks or uncertainties to likely electrification pathways.
- A list of customer barriers to electrification, including the nature and materiality of barriers to unlock customer and whole of system benefits and/or outcomes.
- A prioritised set of opportunities or challenges for Ausgrid and/or electricity networks to reduce the barriers identified or facilitate more efficient or accelerated electrification.
- A prioritisation framework to guides investment timing and priorities in electrification research, and innovation.

7.4.2 Customer demand management trials (Phase 2)

The Phase 2 will be informed by the findings of Phase 1, including project development to develop customer research and demand management trials to explore non-network tariff and non-tariff solutions identified through phase 1 to facilitate efficient customer electrification. Some of the possible customer trial activities might include:

- Demand side solutions to support efficient least cost electrification for customers e.g. apartment buildings, including identification and assessment of network and non-network solutions (e.g. retrofitting for EV-ready buildings, gas to electric hot water systems)
- Explore how electrification could be managed through development or trial of new network tariff structures or controlled loads.
- Explore how electrification could be incentivised to increase network CER hosting capacity.
- Explore demand side solutions to support efficient least cost electrification of social housing and potential barriers to lower costs for low-income housing customers.
- Undertake longitudinal customer research on priorities and preferences relating to electrification and improved understanding of customer attitudes towards electrification of residential energy use and incentives.
- Customer research and innovation into commercial or technical solutions that enable electrification for industrial or commercial loads and demand-side solutions for efficient integration of these loads to the network.

7.5 Outcome measurement and evaluation approach

The project will be assessed by evaluating the extent to which the project objectives are met as well as meeting the project delivery milestones as outlined in the implementation approach.

Findings from Phase 1 of this study will inform the development of model business cases for select projects prioritised to their impact in addressing customer barriers to electrification and opportunities for demand management to provide pathways to efficient electrification and meeting future geospatial capacity needs.

Benefits of this research and future scoping of trials are expected to include:

- Prioritised initiatives to implement or trial demand management solutions across Ausgrid's network to address barriers to electrification and reduce long term costs to customers.
- Greater network utilisation, leading to lower average costs per customer over time (including reduced cost of CER integration due to improved offsetting of new customer load and generation)
- Network expenditure savings, leading to lower average network charges per customer, compared to BAU, benefitting all network users, resulting from demand management, flexible CER and cost-reflective pricing.

7.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-2024, total project expenditure to date and the total expected project costs by the completion of Phase 1 of the project.

Table 6 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$218,007	\$380,229	Completed

7.7 Project Activity and Results

7.7.1 Summary of project activity and collected results to date

Through 2022-2024, Ausgrid engaged an external consultant to support the delivery of Phase 1 of the Barriers to Electrification study. Activities completed include development of the current state assessment of electrification pathways through primary and secondary research, which included the development of customer barriers to electrification. The barriers were tested with external stakeholder groups.

The external stakeholder interviews were undertaken with a range of customer representative groups and industry to understand and evaluate needs of customers they represent including views and preferences relating to electrification in place of gas or fossil fuels.

Table 7 outlines the stakeholder groups and timeframes of the engagement phase. Due to timing and availability of stakeholders, some research and engagement activities were undertaken in 2022-2023 and final external engagement interviews were undertaken in the 2023-2024 regulatory year.

Table 7 - Barriers to Electrification Stakeholder Engagement

Stakeholder group	Period	Summary of research themes discussed
Residential customers	May-July 2023	<ul style="list-style-type: none"> Understand and confirm key residential electrification barriers. Understand implications of residential electrification as flexible loads through new technologies Understand levels of customer awareness, preferences and motivations for electrifying their home Understand the customer expectations of electricity distribution networks to enable efficient electrification
Commercial & Industrial customers	May-July 2023	<ul style="list-style-type: none"> Understand and confirm key commercial and industrial barriers to electrification for large energy users. Understand opportunities, challenges and risks for high-energy users, including technology availability. Existing load flexibility opportunities and technologies Current approaches and challenges to achieving electrification and decarbonisation. Understand customer expectations of electricity distribution networks to enable efficient electrification.
Electrification industry (including retailers, Original Equipment Manufacturers (OEMs) and representative bodies)	May-July 2023	<ul style="list-style-type: none"> Understand industry perspectives on barriers and opportunities of electrification via innovative technology and customer outcomes Understanding customer sentiments and motivations to pursue electrification in the near-term Understand the industry expectations of electricity distribution networks to enable efficient electrification.

Outcomes of the stakeholder engagement and Phase 1 activities were finalised through 2023-2024. The findings from the consultant research and external stakeholder engagement have been summarised in this report.

7.7.1.1 Phase 1 Project activities and collected results

Ausgrid has a key role to support customer’s journey to electrification as Australia’s largest electricity distribution network with a mandate to deliver safe, reliable and affordable electricity to all customers. All customers will benefit directly or indirectly from decarbonisation through investments in CER such as rooftop solar, smart appliances, batteries and electric vehicles, which help lower bills and provides new levels of control over household and business energy usage.

Scaling demand flexibility plays an important role in supporting greater usage of existing infrastructure, which helps lower system costs for all customers. Innovation plays an important role in demonstrating non-network solutions that support integration of smart and efficient electric technologies, complementing existing demand management approaches, network tariff reform and increasing smart meter penetration.

Current state of electrification

NSW energy consumption has trended consistently downward from 1,169 petajoules (PJ) in 2009–10 to 1,142 PJ in 2018–19. However, sectoral trends in energy consumption within the NSW economy have stabilised, with less significant variation in sectoral demand more recently (Figure 16).

Figure 16 - Energy consumption across customer segments – New South Wales¹⁵

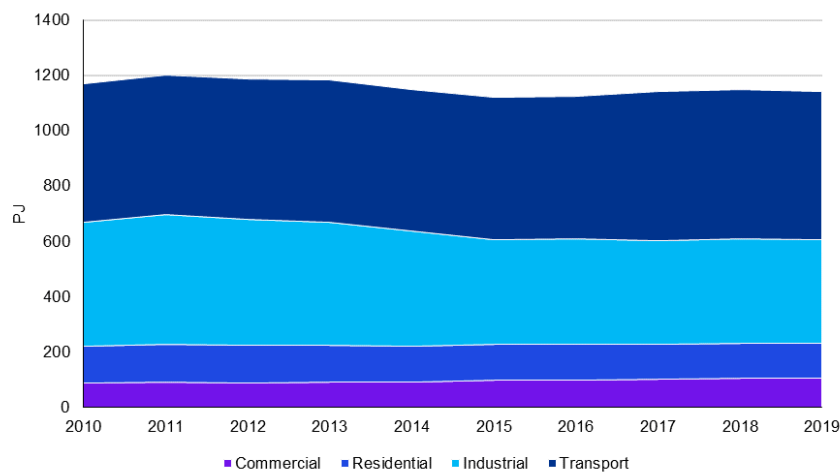
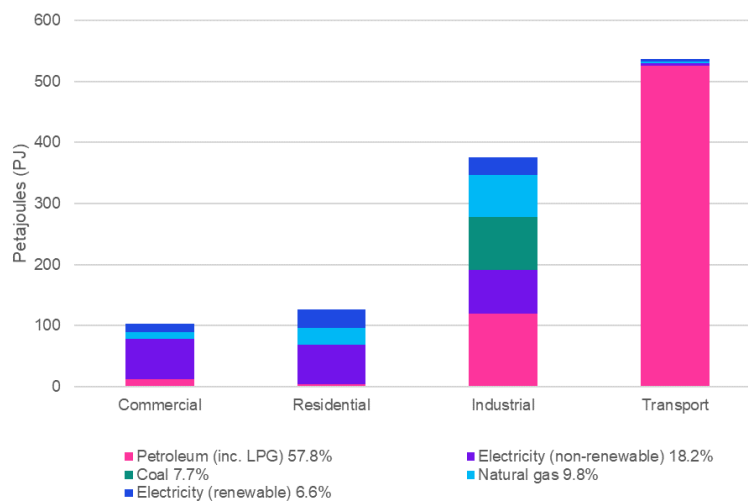


Figure 17 highlights the key decarbonisation opportunities where electrification of end-use consumption will play a role for petroleum (58.9%) and natural gas (9.8%), with electrification of buildings, industry and transport as key levers to deliver decarbonisation goals.

Figure 17 - Final energy consumption for each sector by fuel type, NSW 2018–19¹⁶

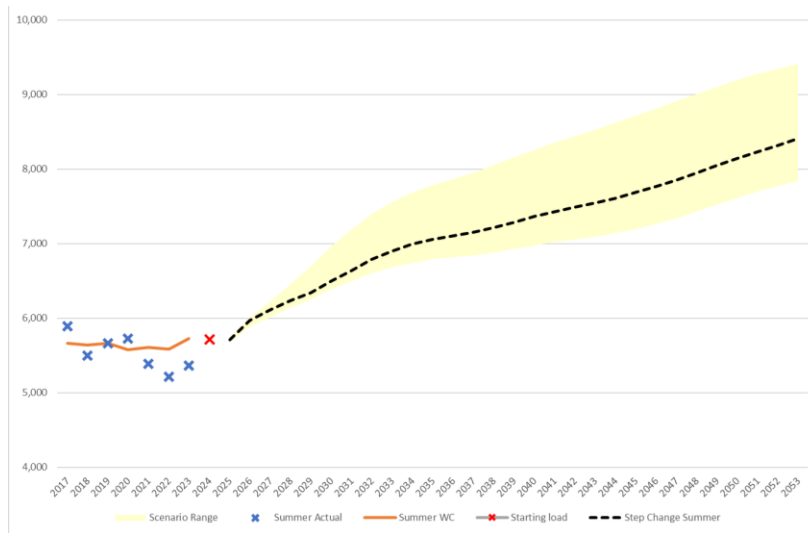


¹⁵ <https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/energy-consumption#energy-use-by-fuel-type-and-sector-status-and-trends>

¹⁶ <https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/energy-consumption#energy-use-by-fuel-type-and-sector-status-and-trends>

Ausgrid forecasts approx. 47% increase in Summer Maximum Demand by 2050 under the AEMO Step Change scenario, including 75% of the network with forecast load growth in the next 10 years. Figure 18 highlights the uncertainty between forecast scenarios.

Figure 18 - Ausgrid Summer Maximum Demand Forecast Scenarios (MW)



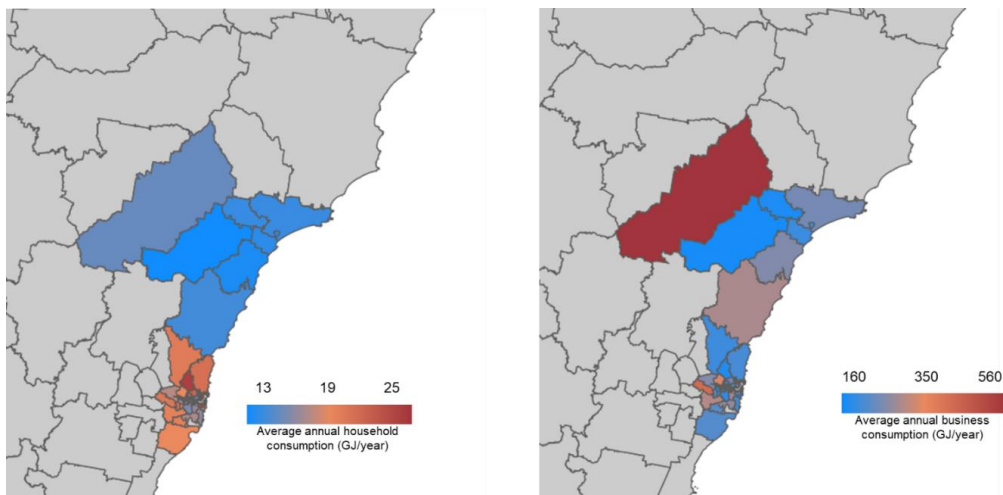
Peak demand is expected to shift later in the evening as increasing solar penetration and electrification affect typical load profiles over time, however the spatial impacts of these trends will remain unpredictable.

Ausgrid energy usage approximately equates to 89% residential and 11% non-residential usage. Non-residential usage remains a significant portion (approx. 60%) of total energy usage across Ausgrid’s network. Several factors account for spatial variation in electricity demand including use of natural gas, type of housing (e.g. density), type of business (e.g. commercial or industrial), and varying socio-demographics or commercial sectors.

Local government areas with a higher proportion of residential areas tend to have lower average electricity consumption compared to local government areas with a greater concentration of commercial and industrial zones due to larger usage energy requirements.

Residential and business customers are actively considering electrification of energy use, with notable scale observed from residential solar customers (e.g. seeking to remove gas/purchase EVs). The commercial and industrial sector also shows increasing electrification appetite demonstrated through ambitious scope 1-3 emissions commitments. Figure 19 highlights differences in spatial variation of natural gas between residential and businesses and industry consumers across Ausgrid’s network.

Figure 19: Average annual gas consumption across Jemena networks (household and business)¹⁷



Note: No data available for Muswellbrook or Upper Hunter






¹⁷ Ibid.,

Understanding the electrification pathways

A rapid literature review was undertaken to develop a prioritised set of electrification pathways that are likely to emerge across the Ausgrid network area through the adoption of specific assets with a range of applications across Ausgrid's customer base. Pathways were prioritised due to the greatest potential for fuel switching and where technology is commercially viable and available today, highlighted in Table 9.

For each pathway a profile was developed including an assessment of end users, key stakeholders supporting uptake, projections for asset uptake, key drivers and uncertainties of the pathway and commercial, technical, social, and policy and regulation considerations as they relate to the pathway.

Table 8 – Summary of electrification pathways and demand implications

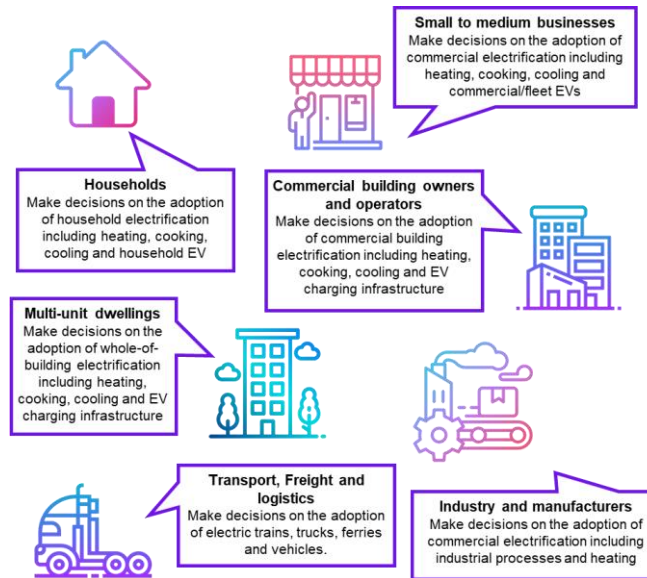
Pathway	Description	NSW Electrification potential	Relevance to this study
 Home appliances	Electrification of residential cooking, space cooling/heating and hot water.	Non-electric end-use residential consumptions is approximately 25% of total energy usage.	Residential hot water is the largest opportunity for demand flexibility, but uptake of emerging technology brings potential opportunities and uncertainties. Social research is needed to understand emerging demand trends, priorities and opportunities for scaling demand flexibility potential.
 Residential and fleet EVs	Electrification of residential and commercial vehicles (68% of weekday transport in Sydney) ¹⁸	Non-electric end-use consumption is approximately 85% for EV and fleet vehicles.	Early residential trials indicate strong flexible demand potential, but further longitudinal research is required to test emerging grid and market services at greater scale across more diverse segments of car owners. There is little information available on corporate fleet electrification and demand flexibility across sectors and duty cycles.
 Commercial building electrification	Electrification of buildings that draw on natural gas or diesel including space heating, hot water, cooking and backup power.	Non-electric end-use consumption is approximately 23% for commercial consumers. ¹⁹	Demand flexibility potential remains relatively unknown, with a historic focus on energy efficiency measures. Some small-scale research and trials including cold storage, supermarkets and shopping centres exist, but there remains a relatively low participation in demand flexibility overall, but an increasing opportunity in the near-term as greater electrification takes hold.
 Transport	Electrification of transport busses, ferries and heavy fleet vehicles.	Non-electric end-use consumption is approximately 74% for transport consumers.	Large electrification and emissions reduction opportunity, but more time needed to address barriers to electrification and commercial viability of the available technology solutions, which are increasing rapidly globally and in Australia.
 Industrial processes	Electrification of large commercial appliances and industrial processes that require heat.	Non-electric end-use consumption is approximately 98% for industrial consumers.	

¹⁸ <https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/transport#freight-status-and-trends>

¹⁹ <https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/energy-consumption#energy-use-by-fuel-type-and-sector-status-and-trends>

Across each of the electrification pathways, there are numerous stakeholders that play influential roles in driving and realising an electrified future across Ausgrid’s network. Figure 20 outlines the key decision makers that will embark on an electrification journey over the coming years.

Figure 20 - Key users and customer segments of electrified assets

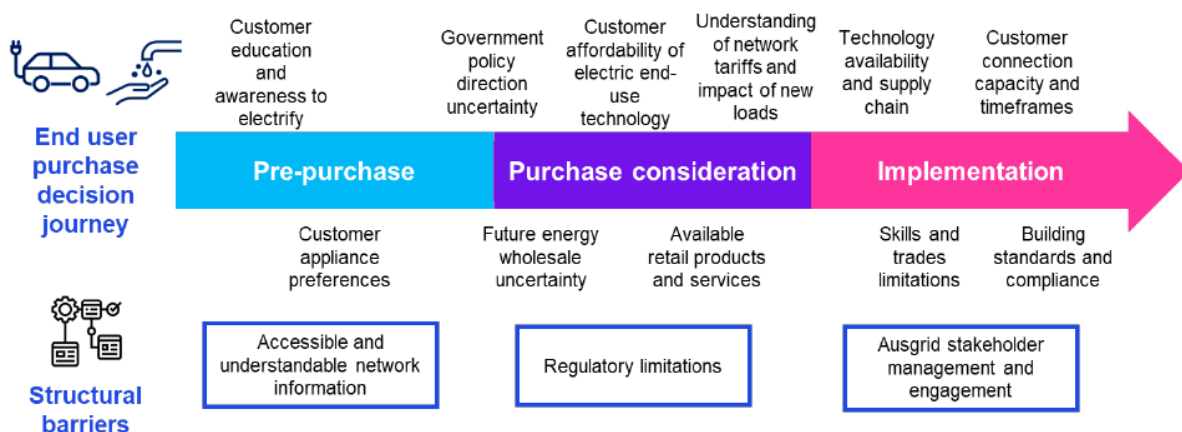


The external engagement process undertaken to interview stakeholders and identify barriers to electrification across customer segments in Ausgrid’s network (as identified earlier in Table 8) was a critical element of this study to ensure barriers identified in the study were grounded in the practical experience of those supporting or undertaking decisions to electrify.

Assessment of barriers to electrification

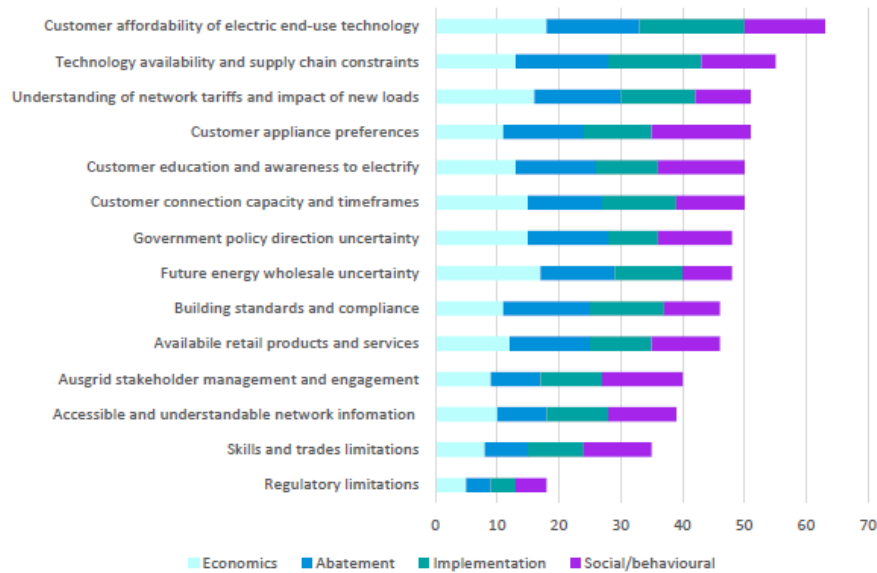
23 hours of external interviews with subject matter experts across the energy supply chain identified over 110 unique barriers across electrification pathways and customer segments. These were consolidated and prioritised into high-level categories. Figure 21 shows the barrier categories across a typical household electrification journey.

Figure 21 – Typical electrification journey



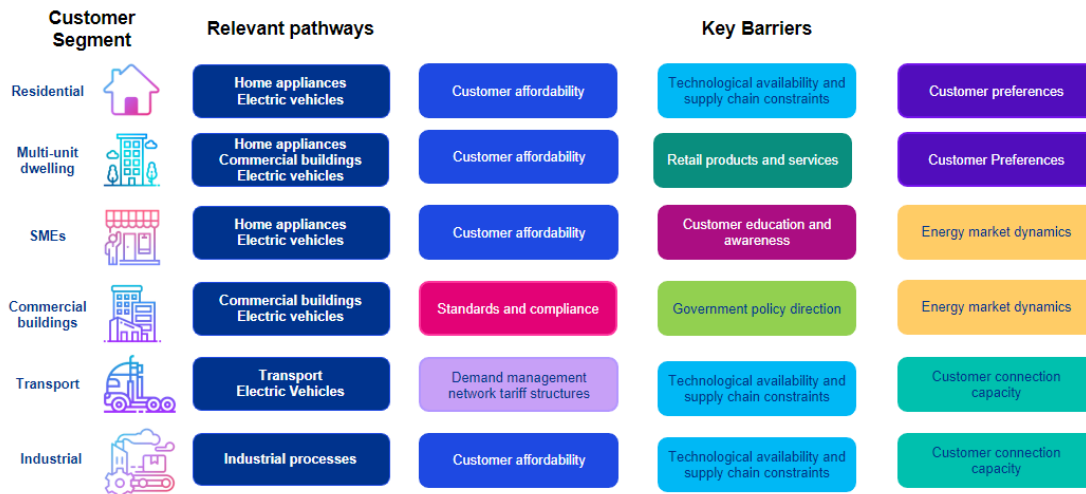
Assessment of the barriers across customer segments and relevant pathways showed the top five barriers identified related to customer affordability, technological availability and/or supply chain constraints, customer preferences, connection capacity and timeframes and energy market dynamics due to uncertainty around future wholesale electricity and gas prices. A summary of the assessed materiality of aggregate barrier categories is highlighted in Figure 22 below.

Figure 22 – Aggregate impact of barrier categories to electrification



While understanding aggregate barrier impacts was a useful way to draw out material barriers across all customer segments and pathways, specific barriers and differences between customer segments or pathways were also important to draw out in more detail, shown in Figure 23 below.

Figure 23 - Key barriers to electrification by customer segment and pathway



Stakeholder engagement and access to trusted and tailored information were highlighted as key enablers that Ausgrid can undertake to support unique or varied needs. The following stakeholder insights will guide the development and design of future demand management research, trials or knowledge development and sharing programs for differing barriers across these groups.

Residential customers

- **Costs to electrify** - upfront costs were the most immediate barrier largely due to the initial expenditure required for installing consumer energy resources (CER) and electric appliances.
- **Risk of new vulnerabilities** - stakeholders emphasised the risk of a two-tiered electrification journey, with an increasing disparity between financial means, awareness and agency to electrify.
- **Uncertainty about Ausgrid’s role** – uncertainty on Ausgrid's role can affects the ability to engage on demand management initiatives. More assistance with education would be valuable.
- **Skills and trades** – access to skills to install CER and electric appliances in homes, and the absence of solutions for complex cases such as older buildings or townhouses were reported.

Multi-unit developments

- **Availability of products and services to address complexity** – gaps in products and services that support complexity of building needs and coordination needed between strata and body corporates.
- **Lack of information on potential solutions** - there is an opportunity to increase awareness of demand management options (such as building load management systems) earlier in the process to avoid overly high max demand estimates.
- **Capital costs and recovery** – high costs and complexity of whole of building electrification initiatives can disincentivise starting the journey. Different factors can influence retrofitting costs and require a high level of knowledge to navigate decisions and cost recovery options.
- **Resident/owner preferences or engagement** – NSW strata rules require 50% of the strata committee to approve minor renovations, includes installing appliances and EV charging infrastructure. Preferences or lack of engagement on benefits in aggregate can be a barrier.
- **Access to trusted advice and information** – Working closely with state and local government stakeholders and Strata NSW was seen as a key opportunity to support the estimated 500k+ multi-occupancy units throughout Ausgrid's network. There were often misperceptions around a lack of network capacity available should buildings implement electrification initiatives.
- **Communal hot water** – gaps in switching communal gas hot water to communal electric hot water exist due to differences in metering arrangements under the National Electricity Rules. This leads to a need for strata levies, embedded networks or alternative arrangements to recover capital and operational costs. More research is needed to support stakeholders to identify the most appropriate replacement of communal gas hot water systems.
- **Owner-occupier split incentives** - a higher proportion of renters in multi-unit dwellings limits agency and makes cost recovery for building-wide capital works complex.

Small businesses

- **Awareness of electrification options and benefits** – stakeholders highlighted that many small businesses were not aware of the available options or benefits of electrification.
- **Balancing competing priorities and lack of time to engage** - many business owners need sufficient time and focus for investments that do not relate to core business. There are competing priorities for investment and unless energy is a major input cost, it may be overlooked.
- **Lack of trusted information** – stakeholders noted this segment can be particularly frustrated by conflicting reports and misinformation about the benefits to electrify (notably restaurants).
- **Owner-occupier split incentives** – many businesses do not own their premises. If the occupier has agency for capital works on the premises, the payback period for investment needs to be shorter than the lease period, without other incentives in place.
- **Incentives and access to finance** - incentives available to small businesses were insufficient in duration to justify investment. Long-term savings associated with electrification are generally understood but businesses are also managing other rising prices and labour shortages.

Commercial/large buildings

- **Building standards and benchmarking programs** – there are significant drivers for change in this sector. NABERS, commercial building disclosure programs and the green star building rating program have been effective at progressing change, historically focussed on energy efficiency. These programs may offer future opportunities for demand flexibility as they expand further.

Transport

- **Technology availability and supply chain constraints** – the availability of electric alternatives that can meet operator and customer requirements (or preferences) is a key consideration, with uptake ultimately impacting how quickly the electrification transition occurs.
- **Early-stage maturity for heavy vehicles, busses and ferries** – available electric alternatives are in early trial or commercialisation stages in Australia, with few manufacturers, maintenance or support providers widely available in the Australian market.

Industry

- **Commercial viability, complexity and scale required to electrify** - Industries are often aware of electrification options but must balance the need to remain competitive against local and international providers and meet operational requirements and costs.
- **Opportunity for storage and demand flexibility** - storage and dynamic access arrangements could offer electrification opportunities in this segment. Past barriers to scaling demand flexibility typically include 24/7 load requirements or the inflexible nature of various operational needs.

All sectors are actively considering how they will consume and source energy in the future and the potential for electrification is significant to meet ambitious decarbonisation targets. Investment in infrastructure to meet evolving needs will be needed to support emerging priorities for reliability and resilience. However, as the economy electrifies, there is also a largely untapped opportunity to scale demand flexibility opportunities, which support greater use of existing infrastructure.

As focus moves beyond early-stage awareness and adoption of electrification, further research might explore the level to which overcoming barriers translated to greater demand-side participation through informed decision making and successful demonstration of innovative energy management solutions. Customer engagement and awareness, especially where customers transition from 3 fuels to 1 will be a key factor in adoption of complementary strategies including network tariff reform and increasing smart metering penetration.

7.7.1.2 Project learnings and next steps

The study reinforced the need for greater coordination and engagement to address the key barriers identified in this study. Ausgrid can play an important role to support the electrification of homes and businesses through developing and sharing knowledge through further research and trials.

Ausgrid will continue to work with stakeholders engaged in Phase 1 research activities as key partners for supporting electrification outcomes, including state and local government, retailers, emerging-technology innovators and providers, research partnerships (Race for 2030) and CSIRO (including a potential first-in-Australia Living Labs initiative). Key themes from Phase 1 where Ausgrid has the greatest potential to enact change include:

- Supporting customer choice and provision of simple and understandable information to choose when and how they switch to electric appliances.
- Enabling customers to maximise the use of cheaper and more renewable electricity for the electrification of heating/cooling and EVs during the day.
- Trialling new demand-side technologies for harnessing greater flexibility provided by generation, storage and emerging technologies yet to reach significant scale in Australia.
- Continue to explore innovative solutions that help identify and address barriers to demand-side participation for larger commercial and industrial energy users as they electrify.

Demand management research and trials that are prioritised for further development in the next regulatory year (2024-2025) include:

- Longitudinal social research that continues to build understanding of emerging socio-technical trends and how they are shaping future household demand and electrification through everyday life priorities, values and routines across different customer segments and geographies to support demand management opportunities.
- Test capabilities of demand-side technologies with customers (including potential living labs), retailers and innovators/ manufacturers (with a focus on electric vehicles, electrification of hot water, energy management systems and interoperability as priorities identified in the study) to inform standards and the development and demonstration of flexible products and services.
- Support development of information, guidance and real-world case studies that showcase innovative solutions that limit barriers, including ongoing work with state and local governments on areas such as whole of building electrification for multi-occupancy buildings.
- Support the development of trusted information and evidence (informed by research and trials) to support policy development, settings for evolving incentive schemes (which play an important role in the uptake of new technologies and standards) and help maximise value of consumer investments that can make better usage of existing network infrastructure.

Key insights from priority initiatives will be integrated into the broader strategic approach focused on supporting households and businesses to electrify. These initiatives will also support Ausgrid to continue to proactively engage with customers and stakeholders as expectations, preferences and access to new technologies evolve.

7.7.1.3 Phase 2 Project activities

Phase 2 activities included internal and external stakeholder engagement with industry and research stakeholders following the outcomes of Phase 1 and knowledge sharing including a presentation of Phase 1 findings to the Network Innovation Advisory Committee (NIAC). Phase 2 concluded in the regulatory year of 2023-2024 as next steps will advance development of priority initiatives with detailed project development activities.

7.7.2 Update on material changes to the project

There were no material changes to the planned activities during 2023-2024. Planned Phase 1 and Phased 2 activities were completed as outlined.

7.8 Other Information

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

Further information on electrification at Ausgrid can be found at <https://www.ausgrid.com.au/Your-Energy-Use/Electrification>

8 C&I Thermal Load Flex

This project is a continuing Demand Management Innovation Allowance (DMIA) project in the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. This project is expected continue into the 2024-2025 regulatory year.

8.1 Project nature and scope

Ausgrid is seeking to assess the effectiveness of commercial and industrial customers' thermal load flexibility in providing network support during peak demand and minimum demand conditions. Flexible demand response for such loads is evolving as part of recent ARENA funded trials. For example, supermarkets, shopping centres and refrigerated distribution centres could offer load flexibility under both peak demand and minimum demand conditions achieved via "thermal flex", that is, through advanced control of refrigeration and HVAC loads. With the addition of on-site CER such as solar PV and batteries, a material quantum of load flexibility could be realised. As loads that are substantial in scale and commonplace in the community, thermal flex could potentially offer an attractive and reliable source of load flexibility across a wide range of network assets.

The project aims to test the performance of this option when used to manage location specific network constraints. The project involves partnerships with 3rd party organisations.

8.2 Project aims and expectations

The primary purpose of the project is to determine the viability of thermal flex as a demand management solution through building partnerships with 3rd party organisations and conducting customer trials. The objectives are to gain an understanding of:

- Quantum and reliability of response acknowledging that thermal flex participants may also be participating in other market schemes;
- Ability of provider to shape response to maximise network benefit;
- Customer acquisition strategies and subsequent take-up of thermal flex;
- Impacts from customer comfort/product requirements;
- Customer experience;
- Procurement and operating costs;
- Viability as a BAU solution.

8.3 How and why project complies with the project criteria

This project was designed to research, develop, and implement DM capability and capacity in the form of thermal flex as a non-network alternative. It is considered innovative in that the proposed thermal flex trials will utilise technologies, techniques and processes that differ from those previously used in the market.

If viable, the approach being trialled in this project has the potential to offer a cost-efficient alternative to network infrastructure upgrades in parts of the network that include customers with thermal flex capability. Collaboration on thermal flex trials is not eligible for recovery under the classifications specified under any other jurisdictional incentive scheme, state/Australian government scheme or included in forecast capital or opex approved in Ausgrid's distribution determination.

8.4 Implementation approach

The thermal flex project is expected to take place across 3 phases. The first phase commenced during 2022-2023 with negotiations progressing with one flex provider.

Phase 1 of this project includes the establishment of the collaborative thermal flex trial with 3rd party providers. Key activities will involve setting up partnerships, establishment of trial agreements, setting out the trial outcomes and site selection. Ausgrid has undertaken analysis of the low voltage and high voltage network leveraging existing planning models to shortlist candidate areas of the network where thermal flex might provide network benefits.

Phase 2 of the DMIA project will involve field trials of thermal flex consistent with the project aims and expectations and evaluated using the approaches outlined below.

Phase 3, as an optional phase and subject to the outcomes of Phases 1 and 2, could explore further activities to aid in development of the solution as a BAU process for managing network risk.

8.5 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.

Measurement and analysis of program results will be completed collaboratively with our project partners and are expected to include quantitative and qualitative measures such as:

- Assessment of energy and demand reductions customers during peak demand and minimum demand conditions;
- Assessment of equipment reliability and comparison of planned vs actual dispatch outcomes;
- Identification of customer experiences including impact to business operations;
- Assessment of any tested customer incentive and acquisition strategies;
- Identification of demand reduction density and potential effectiveness for deferral or reduction of network capital upgrades for typical network constraints; and
- Assessment of suitability of thermal flex solutions as a BAU tool in providing network support

8.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-2024 and total project expenditure to date. Total expected project costs by the completion of the project are unknown at this stage and will become available as the project progresses.

Table 9 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$5,413	\$10,198	N/A

8.7 Project Activity and Results

8.7.1 Summary of project activity and collected results to date

Project activity to-date includes initiation of discussions with market providers of thermal flex during 2022-2023. As this DMIA trial progress further project activity updates will be provided in subsequent DMIA Annual Reports.

Some preliminary investigations were undertaken to examine case study opportunities for establishing 1-2 demonstration sites. Further external progress on sites available for demonstrations is expected to take place in the next regulatory year.

8.7.2 Update on material changes to the project

There were no material changes to the planned activities during 2023-2024. Total expected project costs will be finalised upon successful completion of a detailed project assessment.

8.8 Other Information

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

9 Heat Pump Hot Water Systems

This project is a new Demand Management Innovation Allowance (DMIA) project in the current 2019-2024 regulatory control period. The following project report provides details of the project activities up until the end of the 2023-2024 regulatory year. The project will continue into the 2024-2025 regulatory year.

9.1 Project nature and scope

Domestic Hot Water (DHW) systems account for approximately 25% of energy consumption and 20% of carbon emissions in homes. Heat Pump Hot Water Systems (HPHWS) are anticipated to play a significant role in improving energy efficiency and electrification of DHW systems. A HPHW system uses around 30% of electricity that is required by a conventional electric hot water system. In recent times the number of heat pump installations have increased in NSW due to various incentive schemes such as Energy Saving Scheme.

Without an understanding of the impacts associated with HPHW systems and their optimal charging schedule, it is not possible to design effective demand management and electrification strategies to manage hot water systems.

This project will focus on understanding the DHW electrification process and HPHW installations to explore the compatibility and impact with traditional demand management techniques and control schedules for demand flexibility. The findings aim to inform appropriate demand management techniques and benefits for hot water electrification and integrating heat pump technologies.

This DMIA project is supported through RACE for 2030 project, in which Ausgrid is partnering with NSW Land and Housing Commission (LAHC), NSW Aboriginal Housing Office (AHO), UTS, NSW Office of Energy and Climate Change (OECC) and Essential Energy.

9.2 Project aims and expectations

The objectives of the project are to:

- Investigate opportunities and barriers associated with electrification and upgrades of hot water systems;
- Understand the demand impacts of heat pumps hot water systems on the network;
- Explore optimal hot water charging schedules to address minimum and maximum demand periods;
- Assess compatibility of HPHW systems with controlled load;
- Understand consumer and industry perspectives on energy efficiency, decarbonisation and electrification;
- Assess energy efficiency, performance, consumer experience and energy bill savings associated with HPHW systems; and
- Understand different HPHW system technologies and installer practices.

9.3 How and why project complies with the project criteria

The concept of charging HPHW systems at different times to address maximum and minimum demand constraints is a relatively new area that has not yet thoroughly been investigated. The project will also assess potential demand impacts associated with electrification of hot water systems, which is a recent development in the industry aimed at achieving Net Zero targets.

The successful completion of this research project will enable Ausgrid to:

- Understand the demand impacts of HPHW systems on the network;
- Develop optimal hot water charging schedules to address maximum and minimum demand periods;
- Develop effective strategies for electrification and upgrades of hot water systems;
- Guide policy development and advocacy in areas such as including NSW Energy Saving Scheme and Peak Demand Reduction Scheme, and supporting related programs as part of the national CER roadmap

9.4 Implementation approach

It is proposed that the project be split into two phases:

- Phase 1 – Install HPHW and assess different hot water charging schedules; and
- Phase 2 – Monitor HPHW system performance overtime.

9.4.1 Phase 1 – Install HPHW systems and test different hot water operating schedules

During phase 1, LAHC and AHO will replace old hot water systems with HPHW systems at approximately 100 social housing properties and test different hot water operating schedules. Sites will only be selected where the tenants have voluntarily opted into the trial.

Approximately one-third of these sites are expected to be in Ausgrid's network area. LAHC and AHO will manage the customer engagement and the installations through their own contractors. HPHW systems at different price points will be installed.

Sites with various characteristics will be targeted, including properties equipped with:

- An existing gas DHW system to evaluate the hot water electrification process;
- A rooftop solar installation to investigate optimisation of 'solar soaking' using a HPHW system; and
- A controlled load set up to assess its compatibility with a HPHW system.

Where a site doesn't have a smart meter or controlled load, a smart device will be installed at the switchboard to remotely measure energy usage data. For certain sites, hot water charging schedule will be adjusted via the smart device to investigate optimal hot water charging schedules.

The outcomes of the trial will be assessed via customer and installer surveys, and energy usage data. Key deliverables for this stage include:

- i) Pre and post installation customer survey results;
 - Installer feedback/surveys;
 - Assessment of the HPHW system performance including energy and bill reductions achieved for different customer types and site configurations;
 - Evaluation of the compatibility of HPHW system with controlled load;
 - Analysis of the optimal hot water charging schedule for minimum and maximum demand; and
 - Assessment of the electrification process for gas DHW systems.

9.4.2 Phase 2 – Monitor HPHW system performance over time

After the completion of phase 1 in May 2025, phase 2 will commence with the aim of continuing to monitor energy usage data for the installed HPHW systems over an additional 2 years to assess changes in HPHW performance over time as well as tenant hot water usage behaviour.

The additional data collected over the extended period will not only help verify lessons learnt from the first year of the HPHW installation but will also provide valuable insights for developing and refining demand management and electrification strategies.

Key deliverables for this phase include:

- Verification of the results from phase 1;
- Assessment of HPHW system performance over time including changes in customer usage behaviour;
- Modelling the potential impacts of HPHW system on the network based on different hot water charging cycles;
- Development of a methodology for detecting HPHW systems on the network via metering data; and
- Evaluation of the potential network impacts of converting gas DHW systems to HPHW systems.

9.5 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.

Measurement and analysis of program results will be completed collaboratively with our project partners and are expected to include quantitative and qualitative measures such as:

- Household energy consumption and bill impact associated with the installation of HPHWS;
- Potential demand impact of HPHWS on the network including how different operating schedules impact minimum and maximum demand;
- Percentage of load shifted to daytime solar soak window;
- Market benefits associated with shifting DHW operating schedule to include daytime solar soaking window;
- Compatibility of HPHWS with controlled load; and
- Customer and installer feedback.

9.6 Costs of the project

The table below shows Ausgrid’s actual project costs for 2023-2024, total project expenditure to date and the total expected project costs by the completion of the project.

Table 10 - Project Costs

Budget Item	Actual project costs 2023-2024	Total project costs as at end of June 2024	Total expected project costs
Total project costs (excl GST)	\$48,782	\$48,782	\$250,000

9.7 Project Activity and Results

Most of the project activities to date have been associated with development and approval of the project with the field trial expected to begin by the end of June 2024.

Project activities to-date includes:

- Development of the project in collaboration with project partners;
- Formal approval of the project proposal by RACE for 2030 and signing of the project agreement by the project partners;
- Site selection to maximise project learnings;
- Shortlisted different types of HPHWS models to be installed;
- Onboarded tenants to be part of the trial.

9.8 Other Information

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