

Ergon Energy Demand Management Innovation Allowance Report 2019-20

September 2020



Part of Energy Queensland

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1. Introduction

1.1 Purpose and compliance

Ergon Energy is pleased to present the Demand Management Innovation Allowance (DMIA) Report for the 2019-20 regulatory year. The purpose of this report is to allow the Australian Energy Regulator (AER) to:

- assess Ergon Energy's 2019-20 DMIA initiatives and Ergon Energy's entitlement to recover the expenditure under the AER's Demand Management Incentive Scheme (DMIS)
- confirm Ergon Energy's compliance with the annual reporting requirements of the AER's Regulatory Information Notice (RIN).

This report has been completed in accordance with Schedule 1, paragraph 6 of the AER's RIN (refer figure 1), which requires a DNSP to which the DMIS applies to submit an annual report to the AER on its expenditure under the DMIA. This report, and the information contained in the report, is suitable for publication by the AER.

DMIA reporting requirements Schedule 1: Item 6 – Demand Management Incentive Allowance

- 6.1 Identify each demand management project or program for which Ergon Energy seeks approval.
- 6.2 For each demand management project or program identified in the response to paragraph 6.1:
 - a) Explain:
 - (i) how it complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme;
 - (ii) its nature and scope;
 - (iii) its aims and expected outcomes;
 - (iv) the process by which it was selected, including its business case and consideration of any alternatives;
 - (v) how it was/is to be implemented;
 - (vi) its implementation costs; and
 - (vii) any identifiable benefits that have arisen from it, including any off peak demand reductions.
 - b) confirm that its associated costs are not:
 - (i) recoverable under any other jurisdictional incentive scheme;
 - (ii) recoverable under any other Commonwealth or State Government scheme; and
 - (iii) included in the forecast capital or operating expenditure approved in the 2015-20 Distribution Determination or recoverable under any other incentive scheme in that determination; and:
 - c) state the total amount of the Demand Management Innovation Allowance spent in the relevant regulatory year and how this amount has been calculated.
- 6.3 Provide an overview of developments in relation to projects or programs completed in previous years of the regulatory control period, and any results to date.

1.2 DMIA projects summary

In its Distribution Determination¹, the AER decided to apply Part A of the DMIS (i.e. the DMIA component) to Ergon Energy, approving an innovation allowance amount of \$5 million over the 2015-20 regulatory control period.

The DMIA is provided to investigate opportunities that are not yet commercial, in addition to any business-as-usual capital and operating expenditure allowances for demand management and embedded generation projects approved in Ergon Energy's Distribution Determination. This provides a direct incentive for DNSPs to assess emerging opportunities for potentially efficient non-network alternatives, to manage the expected demand for standard control services in some other way or to enable more efficient connection of embedded generation other than through network augmentation.

Ergon Energy's 2019-20 DMIA program comprised nine projects. The total cost incurred for the DMIA initiatives during 2019-20 was \$2,661,961. The table below summarises Ergon Energy's DMIA program expenditure recovery for the 2019-20 regulatory year.

Project	2019-20 expenditure (\$) direct cost only			Status
	Total project budget	Capital	Operating	
Centralised Energy Storage Stage 2	450,000		180,736	Closed
Lakeland Solar Storage	70,000		2,185	Closed
Alternate Supply Bustard Head	932,673		224,712	Continuing
Solar Analytics Cust Devices Enablement	232,912		109,836	Continuing
Western Grid Lab Testing & Prod Dev	382,500		233,452	Continuing
West Leichhardt SWER	3,131,525		1,743,762	Continuing
IPDRS Pilot	636,636		56,185	Continuing
Evolve	240,000		16,093	Continuing
Expanded Network Visibility Initiative	155,464		95,000	Continuing
Total	6,231,710		2,661,961	

Ergon Energy confirms that the costs of the projects specified in this report are:

- not recoverable under any jurisdictional incentive scheme;
- not recoverable under any other Commonwealth or State Government scheme;
- not included as part of:
- the forecast Capital Expenditure or the forecast Operating Expenditure; or
- any other incentive scheme applied by the 2015-20 Distribution Determination

¹ AER (2015), Final Decision, Ergon Energy determination 2016-17 to 2019-20, Attachment 12 – Demand management incentive scheme, October 2015.

2. DMIA Project development and selection process

Ergon Energy considers DMIA investments an important component of its commitment to delivering customer value over the longer term. The DMIA program complements our demand management program, which is geared toward providing a more efficient solution to network augmentation. The DMIA initiatives have enabled Ergon Energy to investigate and test innovative approaches to a range of network issues, customer behaviours, renewable integration and tariff enablement.

For the 2019-20 DMIA program, all nominated DMIA projects are subject to a screening and feasibility processes, consistent with the AER's DMIS. The general DMIA project development and assessment process applied in Ergon Energy involves:

- Promotion of DMIA funding and criteria to internal stakeholders to encourage project ideas to be submitted, as an EOI or more formal DMIA Project Scope;
- Review of EOI or DMIA Project Scope against DMIA criteria as a minimum, and against relevant internal strategy documents, including the Energy Queensland Future Grid Roadmap*, the Demand and Energy Management Strategy and Load Control Strategy;
- Project proponents are encouraged to discuss project ideas with other Ergon or Energex subject matter experts, which helps guide and refine the idea;
- Projects that are deemed to meet the DMIA criteria are then formally submitted to the DMIA Program Manager for approval, or endorsement to the appropriate financial delegate.

*The Future Grid Roadmap is a document that outlines a range of themes and supporting activities and no-regret investments necessary for the Energy and Ergon Energy to achieve a transition to the intelligent grid of the future over the next 10-20 years. It is not essential to meet criteria other than the stated DMIA criteria, however project proponents within EQL should, where possible, ensure their project aligns with these existing EQL strategic network direction and priorities.

Budgets are prepared in accordance with Ergon Energy's standard project methodology, detailing information including project goals, deliverables, milestones and resources required. Cost estimations were developed for the requirements identified, for each phase of the project. These cost estimations drew upon various sources including the cost of similar projects undertaken by Ergon Energy, current preferred contractor panel contracts and market research.

During this year, a DMIA case study template was developed to capture and promote learnings and project outcomes, when a project is completed (as appropriate) – these will be included as in the annual AER reports and we will also make these available publicly (subject to any confidentiality requirements where third parties are involved). We have also included a reference to the DMIA program on the Energex website, allowing potential project proponents to make contact with us to discuss potential project ideas.

Looking forward to the 2020-25 reg period, our intention is to develop a five-year strategic plan for Ergon DMIA funding, in early 2020/21. This will identify key focus areas for DMIA project development, aligning with DMIA criteria and internal priorities around the changing way customers are using the network, increased deployment of distributed energy resources, two-way flow of data and energy.

3. DMIA Project updates

This section of the report details the status of Ergon Energy's DMIA projects in 2019-20 by describing each project, its objectives, progress and findings to date. For applicable completed projects, a case study is included in Attachment 1.

3.1 Centralised Energy Storage System (CESS) – Stage 2

The project aims to investigate, develop and test advanced control of centralised energy storage with renewable energy and synchronous generation for distribution network applications.

3.1.1 Compliance with DMIA Criteria

Centralised energy storage combined with generation are a promising solution for reducing peak demand, improving reliability and power quality. As this technology develops, a key barrier for broader implementation will be the integration of the many control systems in a seamless manner.

3.1.2 Nature and Scope

Distributed storage could play a significant role on our electricity networks as energy storage technology improves and price continues to fall. Ergon Energy and Energex have a range of potential applications for larger-scale distributed energy storage, particularly for micro-grid applications for network support and also off-grid applications.

The Centralised Energy Storage System (CESS) project utilises an 83kVA/200kWh test and development platform to enable control systems development around energy storage integration. The system was tested, trialled and integrated in a controlled, test environment in our workshop to develop functionality and verify its effectiveness and reliability. It is anticipated that the CESS project will seed other projects to develop advanced control systems to manage network demand, enable higher penetrations of customer-owned renewable generation and also develop microgrid functionality.

3.1.3 Aims and expected outcomes

The project aimed to:

- develop integration strategies for traditional generation, energy storage and renewable energy,
- enable higher penetrations of renewable energy using centralised energy storage systems, and;
- understand the how to achieve seamless transitions between on-grid and off-grid, and the ability of centralised storage to support islanding (micro-grids).

3.1.4 The process by which it was selected, including its business case and consideration of any alternatives

All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers and adhere to the standard governance framework. The eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the

project proceeds to the feasibility assessment and approval stages, as per the governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.1.5 How it was/is to be implemented (i.e. general project update)

A key area of interest lies in enabling effective integration of diesel generation and renewable energy, alongside inverter/battery technologies. Stage 1 of the CESS project involved the procurement of an 83kVA/200kWh energy storage system as a flexible test and development platform. This was successfully completed and commissioned in May 2016, at the Cairns, 308 Hartley Street depot, alongside 60kW of solar PV. Stage 2 is currently in the final stages with the final report to be issued shortly. The key operational elements of this project included:

- Testing and development of seamless transition between on-grid and off-grid of an LV electrical installation (i.e. microgrid functionality), black start capability and disturbance ride through function (i.e. uninterruptible power system)
- Implementation of novel protection scheme for LV microgrid and development of white paper on the challenges and risks of electrical supply with solely inverter-based resources.
- Testing of grid forming inverter performance in LV microgrid application.

3.1.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The work in both stages of the project has increased our understanding of centralised energy storage and inverter technology to assist with network support, renewable integration and implementation of microgrids.

A case study was developed for this project – refer to Attachment 1.

3.2 Lakeland Solar & Storage

Study in conjunction with end of grid solar and storage project to understand how large-scale solar PV and battery storage can service fringe of grid regions.

3.2.1 Compliance with DMIA Criteria

Currently there is little knowledge sharing about how large-scale solar PV and battery storage can service fringe-of-grid regions, in particular around demand management. It is expected that the learnings of this project will present significant value to current and future potential issues faced by power network transmission and distribution operators, academic institutions, energy policy makers and regulators.

3.2.2 Nature and Scope

The Lakeland Solar & Storage (LSS) is a 10.8MW solar farm with 1.4MW/5.3MWh battery energy storage, located adjacent to 132/66/22kV Lakeland substation.

The project was developed with support from the Australian Renewable Energy Agency (ARENA), with \$17.41m of the total project value \$42.5m, funded by ARENA. As part of the ARENA funding

requirements, a Knowledge Sharing Program (KSP) was created to demonstrate additional network services through the combination of solar and battery, in fringe of grid areas.

This project was purely funding Ergon Energy's ability to assist the project owner (Conergy) in enabling them to achieve an effective series of tests and knowledge sharing around using the battery to support novel applications in fringe of grid.

EQL is a key member of the KSP. This project is to facilitate the proposed battery test plan and provide broader knowledge to the business and industry.

3.2.3 Aims and expected outcomes

This project aims to:

- Provide technical assistance for the Lakeland Solar & Storage project
- Facilitate the proposed battery test plan, in line with the KSP commitment by EQL

3.2.4 The process by which it was selected, including its business case and consideration of any alternatives

All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers, and adhere to the standard governance framework. Accordingly, once projects are identified and nominated through the Ergon innovation environment, the eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.2.5 How it was/is to be implemented (i.e. general project update)

Lakeland Solar & Storage was connected and exporting full power in early 2018. There has been some connection non-compliance issues, which has delayed the battery test plan. As a result of the issues, the active harmonic filter was implemented earlier than expected, which has been performing well. The proposed battery test plan was expected to start in Sep/Oct 2018, following pre-test simulations. As a result of the Conergy buyout and structural changes, the project was passed to a new company that have not fulfilled the broader battery test plans under the ARENA agreement. As a result, the Ergon Energy DMIA project has been ended prematurely without achieving the final planned testing and knowledge sharing.

3.2.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

Protection and connection studies have considered the challenges of implementing large scale solar and battery in micro-grid applications. Active harmonic filtering was implemented to better enable the system.

3.3 Alternative Supply Bustard Heads

Trial a stand-alone power system (SAPS) as a network support device, with the long term aim to reduce network costs.

3.3.1 Compliance with DMIA Criteria

The Bustard Head SAPS project complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme as the project will enable the substitution of costly network components with alternative supply arrangements that provide improved power quality and reliability whilst enabling improved value to all customers.

3.3.2 Nature and Scope

Trial a stand-alone power supply system as a network support, with the long term aim of using SAPS as a lower cost solution to network maintenance/replacement.

3.3.3 Aims and expected outcomes

Direct outcomes and benefits:

- The customer outcomes will be a more reliable power supply.
- The network outcome will be a reduced operating cost and reduced network losses on their distribution system
- Indirect outcomes and benefits:
 - Ergon has developed new approaches to working with customers towards more cost-effective supply solutions through the development of a SAPS Customer Engagement Strategy;
 - Ergon will develop new equivalent electricity supply standards for solar/battery hybrid systems;
 - Ergon will work with Standards Australia to update AS4509.2 SAPS design standard to improve the quality of SAPS design across Australia and provide design criteria comparable to existing network electricity supply for SAPS.

3.3.4 The process by which it was selected, including its business case and consideration of any alternatives

'All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers, and adhere to the standard governance framework. The eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.3.5 How it was/is to be implemented (i.e. general project update)

The project has already achieved customer engagement and approval, SAPS design fundamentals development and contractor aware for the design, install and maintenance of the system. Further work will be in installation of the SAPS and ongoing customer feedback, as well as finalisation of design philosophy and measures for equivalent supply.

This will lead into new work to enable appropriate life-time management of alternative supply dependent on the criteria set under the new AEMC rules for SAPS.

3.3.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The project has already developed some criteria for equivalency in design that now need to be tested. Customer engagement has been positive for the project. As a result of this project, a Stand-Alone Power Systems Customer and Community Engagement Strategy has been drafted.

3.4 Solar Analytics Customer Devices Enabling

Trailing HEMs device to test ability to deliver customer and network benefits (including outage notifications for load control, PV export limits, and increased LV visibility for the network).

3.4.1 Compliance with DMIA Criteria

The project is exploring the benefits and opportunities that smart customer side devices can deliver for both customers and the network. Focus areas for the project include; outage notifications for irrigators, development of renewable energy value streams for irrigator customers that reduce strain

on the network, PV and demand management in isolated communities and increasing LV visibility for the network using Solar Analytics customer data.

3.4.2 Nature and Scope

Project to work with Solar Analytics and explore the opportunities that additional product development of the Solar Analytics device can provide Energy Queensland's network and customers. Areas of opportunity that are to be examined include;

- Developing additional features to assist irrigators on trial QCA tariff structures
- Providing increased visibility and control of solar PV and customer block loads for the isolated communities
- Investigating how a limited deployment may provide greater accuracy for state estimation at a lower cost than some current data streams
- Explore general load and renewables control via a customer side device

3.4.3 Aims and Expectations

The Solar Analytics Customer Devices Enabling Renewables (SACDER) Project Scope has several aims:

- To drive development of additional capabilities within customer owned devices that provide network benefits for both niche and widespread uptake;
- To determine opportunities for Energy Queensland to improve LV visibility based on existing and growing Solar Analytics data sets that provide richer customer information without requiring network owned monitors;
- To participate actively in the development of customer side products that enable opportunities to improve network outcomes in enabling customer choice and increasing renewable energy;
- To trial new products and determine the value they can provide the community.

3.4.4 The process by which it was selected, including its business case and consideration of any alternatives

All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers, and adhere to the standard governance framework. The eligibility-screening process is performed on nominated projects as a high level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources. The Solar Analytics devices proved to be an effective method for the participating irrigation customers to be notified of load control switching and energy consumption. An unexpected benefit was obtained by Ergon Network in that the devices gave enhanced visibility of the

effectiveness of a dedicated audio frequency load channel used for irrigations customers in the trial, identifying some signalling errors to be rectified.

3.4.5 How it was/is to be implemented (i.e. general project update)

To date 10 trial devices have been installed at irrigation customer pumping sites to meet the requirements of Milestone 1. This phase of the project targeted customers participating in the existing Agricultural Tariff Trial (T33) and aimed to develop the Solar Analytics product so that it is capable of providing Agricultural Tariff Trial customers with notifications about power supply outages at their irrigation points of connection following load control events instigated through the tariff. This was a voluntary program that seeks to understand how customer owned energy monitoring devices can provide benefits for both customers and Ergon Energy's network. Existing Agricultural Tariff Trial (Tariff 33 Group) customers were invited to participate in order to help Ergon Energy Network and Energex Network understand the benefits of knowing when a customer's supply is switched off under the load control tariff conditions.

Next steps for the project include procuring, analysing and deriving value for the network, from Solar Analytics existing customer data. The final milestone for the project is to utilise the Solar Analytics project in conjunction with CRC project partners technology to deliver a demand management solution, which may include application in an Isolated Network.

3.4.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

An outcome of this trial was that it enabled fault identification and diagnosis in relation to the network audio frequency load control system, as part of the Agricultural Tariff 33 (load control) trial. This reduced customer angst and improved customer acceptance of load control tariffs for non-domestic purposes. As a result of the success of the overall Agricultural Tariff 33 Trail, of which the Solar Analytics devices as an important element, 3 new load control network tariffs were submitted and

approved as part of the Energex and Ergon Energy Tariff Structure Statements for 2020-25 regulatory period.

3.5 Western Grid Lab Testing & Product Development

Lab trials of a number of devices with the potential to enable increased capacity and improved to quality of supply for fringe of grid customers.

3.5.1 Compliance with DMIA Criteria

The project is developing and implementing demand management capability for SWER networks, by examining prototype technologies with the potential to reduce network costs through minimising SWER network augmentation.

3.5.2 Nature and Scope

The scope for the project has 3 key areas:

- SWER BESS:
 - BESS systems enabled specifically to provide benefit to both the SWER customer and the network enabling customer or DNSP owned RE and demand management
- Isolated transformer balancing:
 - Device for the SWER isolation transformer connection point to balance upstream issues from SWER network loads
- Customer side devices:
 - Enablement of customer generation and load management / control to the benefit of the customer without being to the detriment of the network

3.5.3 Aims and Expectations

The Western Grid – Laboratory Testing Project Scope has two aims:

- Trial some developing and early offering products that are available to assist in SWER capacity and power quality enhancement;
- Engage with industry in the development of products that meet the growing needs of Energy Queensland to seek alternatives for SWER customers in both on-grid and off-grid scenarios.

The desired outcomes are:

- Ability to improve SWER capacity
- Ability to improve customer power quality
- Ability to be utilised in SWER environments

3.5.4 The process by which it was selected, including its business case and consideration of any alternatives

Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers, and adhere to the standard governance framework. The eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.5.5 How it was/is to be implemented (i.e. general project update)

Testing of the four prototypes in the laboratory has been completed, with testing of the final prototype underway.

Tested so far:

- Empower Elektrobank Home BESS – performed well but will not be manufactured in great numbers
- Selectronic SP PRO Home BESS – performed well and is planned to feature in field trials
- LVR-30 Low Voltage Regulator – performed well and is planned to feature in field trials
- Ecojoule EcoStore BESS / Voltage Regulator Grid Support System – performed well and is planned to feature in field trials

Still to be tested:

- Mondo UBI 3.0 Home Energy Management System

3.5.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The trial is still in the testing phase but has shown capability that has potential for products to go into the field and assist in SWER network demand management and renewable energy management.

Three of the devices have performed well and are being considered to be used in a field-based trial to confirm their ability to perform well in actual real life settings. The UBI looks promising but is still to be laboratory tested.

3.6 West Leichhardt SWER

Trial two larger scale stand-alone power systems (SAPS) as network support devices as an alternative to grid supply.

3.6.1 Compliance with DMIA Criteria

The West Leichhardt SAPS project complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme as the project will

enable the substitution of costly network components with alternative supply arrangements that provide improved power quality and reliability whilst enabling improved value to all customers. Improved data and information that can be achieved by application of an estimator can be used to improve the benefits of demand management and coordination of Distributed Generation across the low voltage network.

3.6.2 Nature and Scope

Trial SAPS as network support and develop supporting policies, processes and systems that can more broadly enable DNSP led SAPS across Ergon Energy's and Energex's networks.

3.6.3 Aims and expected outcomes

- Improved reliability and power quality for the two customers involved in the trial
- Informing design rules and scenarios for SAPS
- Developing customer engagement strategies and plans to transition customers from grid to SAPS supply
- Identifying changes to Ergon Energy's connection policy and connection agreements to ensure a consistent approach for SWER customers and encouraging alternate solutions where appropriate rather than extending the SWER network;
- Acquiring the knowledge and experience to inform;
 - future business requirements for SAPS supply; and
 - future product solutions to enable a more flexible approach to connections in the future by the planning teams.

3.6.4 The process by which it was selected, including its business case and consideration of any alternatives

All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers, and adhere to the standard governance framework. The eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of the DMIA. Specifically, this tests whether each potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.6.5 How it was/is to be implemented (i.e. general project update)

The project has been approved and there is ongoing extensive customer and stakeholder engagement. The contract has been awarded for the design, install and maintenance of the SAPS.

Further work will be in installation of the SAPS and ongoing customer feedback, as well as finalisation of design philosophy and measures for equivalent supply.

This will lead into new work to enable appropriate life-time management of alternative supply dependent on the criteria set under the new AEMC rules for SAPS.

3.6.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The project has already developed some criteria for equivalency in design that now need to be tested. Customer engagement has been positive for the project.

3.7 IPDRS Pilot

The purpose of this project was to undertake market discovery to establish a complete end-to-end energy management system that enables the Internet Protocol Demand Response Device (IPDRED) functionality. Regulatory change regarding a DNSPs ability to own assets behind the customer meter has led to a Network strategic change as to the securing of demand management/response direct with customer. The movement away from direct firm load control has shifted to market procurement. This project is joint funded under Ergon and Ergon DMIA allowance.

3.7.1 Compliance with DMIA Criteria

The project aims to orchestrate improved energy management (peak lopping, valley filling, neutralise otherwise disruptive loads) to reduce network augmentation requirements. The purpose of an IPDRED is to increase the amount of load under management (more appliances, improved geographic coverage), improved the ability have more granular / targeted load control; and to complement existing load control based around audio frequency-based load control. As the project was initiated in 2019-20 but expected to carry forwarded into the 2020-25 regulatory period, it was assessed against the DMIA criteria applicable in both Regulatory periods. The project was deemed to be in compliance as it was a program for researching, developing or implementing demand management capability or capacity, that could be used broad based or in specific network demand constraint areas.

3.7.2 Nature and Scope

Undertake market discovery to establish a complete end-to-end market-delivered demand response (MDDR) process; from DNSP signalling a requirement to third parties reacting, and verifying their response, to satisfy that requirement. Market discovery will enable understanding for a broader market undertaking. This scope covers engagement of potential third-party solution providers delivering MDDR.

3.7.3 Aims and expected outcomes

The aim is to identify suitable service providers for a complete energy management platform (from platform serve to a demand response communications pathway). The outcome will be a detailed business case to move forward with market roll-out Internet Protocol Demand Response Enabling Device (IPDRED) requirements if the pilot is successful.

3.7.4 The process by which it was selected, including its business case and consideration of any alternatives

With regulatory requirements seeking DNSP movement away from any activity behind customer meters this program seeks to fulfil the stated D&EM strategic intent of managing two-way energy flows, being cost-efficient in encouraging other market players to deliver attractive demand management/response mechanisms that value add to them and their customers. With growth of residential DER, understanding how to support a pathway for this market will increase both the type and magnitude of loads under management and accessible for network support. With individual

customer addressability there will be greater granularity and flexibility in response to network constraints. With other market players encouraging take-up of their services to optimise energy use to tariffs and value from demand response the cost to procure these services from the market only as required should significantly reduce cost to serve, whilst augmenting the existing network value of the audio frequency load control / demand management platform.

3.7.5 How it was/is to be implemented (i.e. general project update)

The project was meant to operate through the engagement of service providers of technology solutions being sought for platform and communication pathways. Service providers were asked to secure new participants to their existing “home energy management systems” based on a set of DNSP requirements, including an incentive payment. Unfortunately, to date this customer acquisition model has not been successful. Alternatives to boost customer participation are in review.

3.7.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

Given the regulatory moves toward market procurement of load control, part of the original objective to have a better understanding of the cost to deliver an end to end control methodology has morphed to being that of formalising with the market, a DNSP's requirements of their vendor solutions to enact demand management/response on the DNSP's behalf.

3.8 Evolve

The evolve project will implement systems and capabilities that calculate and publish, (via a software API), the operating envelopes for individual and aggregate DER (specifically rooftop PV and batteries) in the distribution network that underpin increased network hosting capacity of distributed energy resources (DER), by ensuring high penetration DER are able to maximise their connection, operation and participation in markets for energy, ancillary and network services, whilst ensuring the secure technical limits of the electricity networks are not breached.

3.8.1 Compliance with DMIA Criteria

The project was viewed as meeting DMIA Criteria by investigating ways to shift or reduce demand for standard control services through non-network alternatives. The evolve project includes active management of DER to enable visibility and control of targeted network areas with constraints. The operating envelopes (outcome of the project) will provide an upper and lower limit for safe operation of the network for both DER import and export that potentially can be used to implement more granular and effective demand management programs to respond to local network constraints.

3.8.2 Nature and Scope

The scope is to calculate the operating envelopes for DER assets using a variety of low voltage (LV) and medium voltage (MV) network data sources and will include the as-switched network model, as well as the current and forecast operating state. The operating envelopes will be published to DER aggregators and other interested parties using a mutually agreed and developed API.

3.8.3 Aims and expected outcomes

The evolve project will include the augmentation and extension of software systems and installation of additional sensors targeting specific locations to calculate and publish normal-state and emergency operating envelopes and constraints that apply to individual or aggregated DER operating

within the electrical network. Outcomes of the project are to develop capability with calculating and projecting localised envelopes, reduce the costs of deployment as well as optimal network hosting capacity of DER, while ensuring the secure technical limits of the electricity distribution network are not breached.

3.8.4 The process by which it was selected, including its business case and consideration of any alternatives

The DMIA project approval process was followed for selecting this project (evolve). Potential DMIA projects are selected and scoped to respond to current and emerging network limitation drivers and adhere to the standard governance framework. Accordingly, once projects are identified and nominated, the eligibility-screening process is performed on nominated projects as a high-level assessment, to determine whether the projects meet the objectives of DMIA. Specifically, it tests whether any potential project is in accordance with paragraph 3.1.3 of the DMIS. Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per a gated governance framework and with internal subject matter expert review and feedback. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

3.8.5 How it was/is to be implemented (i.e. general project update)

The evolve project is implementing operating envelopes within an evolve framework, an open-source technology framework which is deployed into cloud infrastructure and integrated with both DNSP and aggregator systems. The evolve framework ingests the relevant network and DER data and then makes this available for analysis in a standards-based form. The calculation and publication of operating envelopes are to be implemented as a series of software modules and algorithms within the evolve framework. Testing and validation of operating envelopes are scheduled for the second half of 2020 and the results will be reported in future knowledge sharing outputs from the evolve project.

3.8.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The evolve project is still in the early testing phase but has shown capability that has potential for DER management and consequently network demand management.

There are several projected benefits of operating envelopes at the current maturity levels of DER deployed within the electricity system:

- 1) Operating envelopes can address multiple use cases including challenges currently being faced in both electricity distribution networks and at the whole of system level;
- 2) Operating envelopes promise to be simple to implement across a variety of different DER assets, and do not require the use of sophisticated local control and optimisation systems;

Operating envelopes can be deployed progressively into different segments of a distribution network as they are needed.

3.9 Expanded Network Visibility Initiative

The purpose of the Expanded Network Visibility Initiative (ENVI) is to build on the work of the Solar Enablement Initiative and LV State Estimation project, former DMIA projects, which successfully demonstrated a novel state estimation in operation on Energex's network. ENVI will develop the tools

and systems to enable the scale-up of Distribution System State Estimation (DSSE) across Energy and Ergon Energy Network medium and low voltage feeders.

3.9.1 Compliance with DMIA Criteria

The Expanded Network Visibility Initiative complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme. The visibility over historical and near real-time network performance that can be achieved by application of DSSE will improve the business' ability to identify areas of network which may benefit from additional demand management and facilitate better orchestration of Distributed Generation on the low voltage network.

3.9.2 Nature and Scope

Broadly, this project will focus on developing and deploying the capability to load and generate state estimation runs on medium and low voltage feeders in Energex and Ergon Energy with minimal manual intervention. In addition, the ability to automatically return or access the outputs of the state estimator within the business.

3.9.3 Aims and expected outcomes

The purpose of the Expanded Network Visibility Initiative (ENVI) is to expand on the work of the Solar Enablement Initiative (SEI), a former DMIA project, which successfully demonstrated a novel State Estimation Algorithm (SEA) in operation on Energex's network. ENVI has one primary objective and three secondary objectives:

1. Development of the tools and systems required for Ergon Energy and Energex to scale-up the SEA across their MV and LV networks to provide expanded network visibility as an intelligent foundation to enable distributed energy resources (DER) and facilitate demand management activities (Primary).
2. Refine the prototype semi-automated network analysis tool developed by the SEI to enable engineers to accurately predict the impacts of future Distribution Energy Resource connections – both generation and load (Secondary).
3. Further refine and maintain the SEA to facilitate Dynamic Operating Envelope trials which seek to dynamically signal customers or third parties, such as Virtual Power Plants (VPPs) or aggregators, to operate within an operating envelope based on near real time network operating conditions (Secondary).
4. Develop a tactical plan for the use of the SEA's companion Capacity Constraint Optimisation to inform and automate existing manual Load Control Schedules (LCS) (Secondary).

The work will be undertaken in a collaborative engagement with external company GridQube who has been granted the rights to commercialise the SEA from University of Queensland.

3.9.4 The process by which it was selected, including its business case and consideration of any alternatives

This project was selected based on the multiple benefits it can provide to many areas of the business, demand management being one. DSSE is seen to be an efficient approach to gaining

visibility over the network, without the need for extensive and costly network monitoring. It can achieve the same level of visibility using less data.

3.9.5 How it was/is to be implemented (i.e. general project update)

The project is progressing well with DSSE operational in EQL's Amazon Web Services tenancy. The next stage will involve developing the ability to transfer large amounts of network and monitoring data securely and efficiently between on-premises systems and the cloud. This is critical to scale-up operations and transition the capability into BAU processes.

3.9.6 Any identifiable benefits that have arisen from it, including any off peak or peak demand reductions

The project was not targeting a specific quantity of peak or off peak demand reduction but is targeted at establishing platforms and capability from which sound demand management decisions can be made based on the increased network visibility provided by DSSE.

4. Attachment 1: Case Study

Centralised Energy Storage System (CESS) Stage 2

4.1 Project Outline

The focus of CESS is understanding how centralised energy storage can be integrated into distribution networks and isolated system, to enable greater renewable penetration and reduce cost of electricity supply.

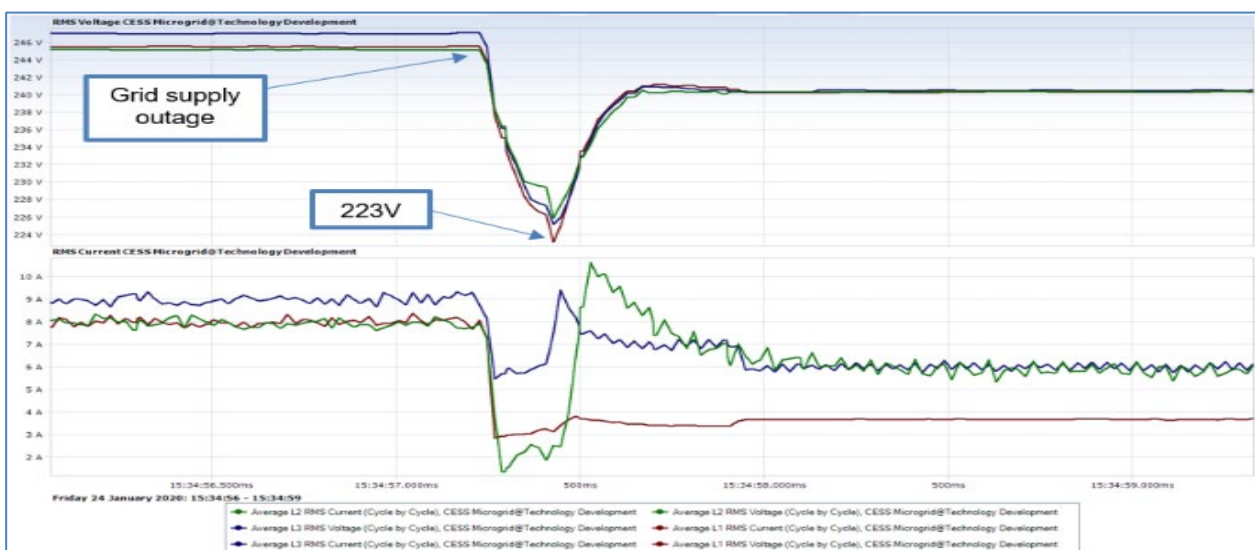


The CESS Stage 1 project was completed in 2017 and involved the development of a centralised inverter and energy storage test platform (83kVA/200kWh). The CESS Stage 2 is an application of the CESS platform using advanced control systems. The project investigated applications for the distribution network and isolated systems, considering the challenges and benefits of DER solution to power quality, capacity and renewable enablement.

The project targeted microgrid technology (i.e. grid-forming and virtual synchronous machine) using modern inverter systems, including the demonstration of the technology, the challenges with implementation and the potential benefits to the business and customers.

4.2 Project outcomes / findings

- Demonstration of a seamless microgrid of an LV installation, which includes seamless transition between off-grid and on-grid, black start capability and seamless disturbance ride through



- Implementation of virtual synchronous machine using inverter technology, to enable a seamless LV microgrid.
- Consideration of how technology can be used in distribution networks and isolated systems to support the network and increase renewable penetration.
- Implementation of a novel protection scheme for a LV microgrid installation considering both off-grid and on-grid scenarios.
- Identified challenges and risks with electrical installation supplied solely by inverter-based system. These risks relate to LV customers governed under AS/NZ 3000. A white paper has been developed for peer review
- Development of computer simulation models of the microgrid installation for network analysis, such as RMS dynamic simulations and short-circuit analysis.
- Based on the findings, the project recommends:
- Further development of protection philosophies in relation to LV electrical installations supplied solely by inverter-based generation. This applies to microgrids and standalone applications. This needs to consider limitations of existing standards to develop a new way forward.
- Development of a microgrid connection standard considering all network levels, from LV customers to HV connections. This should consider grid-forming and grid-parallel capabilities of inverters (i.e. grid-forming but also grid-connected).

Further investigation of how grid-forming inverter technology can be used to increase renewable penetration, improve network stability and provide a cost-effective solution for traditional network issues.

4.3 Next steps

Ergon Energy and Energex are continuing to pursue development and implementation of inverter and energy storage technology for distribution network and isolated system applications.

There is also a new facility being construction in Cairns called the Microgrid and Isolated Systems Test (MIST) facility, which is to enable high power testing of large DER, renewable energy systems and synchronous machines (up to 1MVA).

4.4 More information

- For more project information, contact alan.louis@energyq.com.au
- For general enquires about DMIA demandmanagement@energyq.com.au.

