Energex
DMIA Annual Report
2018-19

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Introduction

1.1 Purpose and Compliance

Energex is pleased to present the Demand Management Innovation Allowance (DMIA) Report for the 2018-19 regulatory year. The purpose of this report is to allow the Australian Energy Regulator (AER) to:

- assess Energex's 2018-19 DMIA initiatives and Energex's entitlement to recover the expenditure under the AER's Demand Management Incentive Scheme (DMIS)
- confirm Energex'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 Energex seeks approval.

6.2 For each demand management project or program identified in the response to paragraph 6.1:

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 Determination the AER decided to apply Part A of the DMIS (i.e. the DMIA component) to Energex, approving an innovation allowance amount of $5 million over the 2015-20 regulatory control period. Energex's 2018-19 DMIA program comprised seven projects active during the year. The total cost incurred for the DMIA initiatives during 2018-19 was $474,541. This total amount is exclusive of indirect costs (financial overhead and fleet on-cost).

Project name	Budget	2018-19 expenditure ($)			Status
		Capital	Operating	Total	
WP4 - Large Commercial BESS	1,535,269	$100,535		$100,535	Continuing
LV System Static-State Estimation	75,000		$8,640	$8,640	Continuing
Battery Energy Storage System Trial	1,094,932		$208,434	$208,434	Continuing
Solar Enablement Project	562,178		$108,544	$108,544	Continuing
WP4 Tesla Eagle Farm DC	285,980		$15,377	$15,377	New project in 2018/19
Enabling Dynamic Export Limits PM	181,525		$33,008	$33,008	Continuing
Springfield Net Zero	$100,000		-	-0	New project in 2018/19
Totals		**$100,535**	**$374,005**	**$474,540**	

Energex 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.

2 DMIA Project development and selection process

Energex 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 Energex to investigate and test innovative approaches to a range of network issues, customer behaviours, renewable integration and tariff enablement.

For the 2018-19 DMIA program, all nominated DMIA projects are subject to a screening and feasibility processes, consistent with the AER's DMIS. This governance process was reviewed and enhanced during the year, in-line with the merger of Energex and Ergon Network and alignment of application of DMIA funding with the respective DNSP's. The general DMIA project development and assessment process applied in Energex 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 the *Energy Queensland Future Grid Roadmap**;
- Project proponents are required to submit project ideas through the Ergon Network Innovation Framework, to ensure the idea is captured in the wider business innovation processes, which helps guide and refine the idea including through internal subject matter expert's and impacted groups in the idea assessment process;
- 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 Energex'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 Energex, current preferred contractor panel contracts and market research.

3 DMIA Project updates

This section of the report details the status of Ergon Energy's DMIA projects in 2018-19 by describing each project, its objectives, progress and findings to date.

3.1 Large Commercial BESS

Project involves integration of a 150 kW Solar PV and 250 kW BESS and development of a proprietary control platform to run both Island/off-grid modes as well as DRED DM operation of a commercial scale BESS. Additional to this was the installation of a fault level protection scheme when the system is operating in Island/Off-grid mode due to reduced fault clearance capacity of the BESS to operate the existing site LV final sub-circuit protection.

3.1.1 Compliance with DMIA Criteria

The Solar PV and BESS trial represents the first operational commercial scale system compliant to AS4755.3.5 with DRED functionality and Island operation. The system has the ability to disconnect completely from the distribution network and operate in island mode for short durations as well as the ability to inject or export energy for grid support if required.

3.1.2 Nature and Scope

The scope of the trial includes the installation of a 150 kW Solar PV and 250 kW/488 kWh BESS which was capable of site and network demand support including island/micro-grid operation and DRED functionality to AS4755.3.5. This trial was installed at an operational commercial site and additional works were required to mitigate fault level protection risk during micro grid operation identified during the initial commissioning testing.

3.1.3 Aims and expected outcomes

The aim of the project is to gain a better understanding on the commercial customer value proposition and expectations from the electricity network in taking up BESS; how Energex can leverage off the existing load control system with direct load control and tariffs to benefit both Energex and the customer and investigate how the BESS technology will integrate with the electricity network.

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

The business case for the projects was reviewed against the DMIA criteria by both Demand Management and Regulatory Departments. The projects were deemed to meet the DMIA criteria and costs confirmed to be not in any way recoverable from another source. The business cases were presented to the Energex Investment Review Committee which endorsed the projects for DMIA funding.

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

The commercial BESS and solar PV located at the Energex Eagle Farm Distribution Centre has been constructed and commissioning was completed in mid October 2018. The Trial and testing phase has been initiated.

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

The Eagle Farm Solar PV and BESS Trial consists of a separately integrated control platform which controls all aspects of the commercial scale Solar PV and BESS. This monitors and controls the energy flow throughout the site and has the ability to mitigate the network peak demand to a predetermined level by managing the Solar PV generation rate and BESS storage and injection capability. During peak demand periods, the combination of generated and stored energy supports the site demand and manages the Site NMI/Network demand to a pre-determined kVA. In times of reduced demand excess solar generation is stored within the BESS for later support. This is a dynamic process and operates on variable site demand conditions. To date it has proven reliable and enabled up to 20% reduction in peak demand and equates to approximately $10k deduction in monthly billing for the site.

3.2 LV System Static-State Estimation

The purpose of this trial was to develop, implement and test sate estimation algorithm for monitoring LV networks; project will form the basis of coordinating demand and distributed generation with respect to operational limits of local network segments.

3.2.1 Compliance with DMIA Criteria

The Low Voltage Network Power System Static-State Estimation complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme as the 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.

3.2.2 Nature and Scope

The project is to develop, implement and test an innovative state estimation algorithm for monitoring low voltage electricity distribution networks. This algorithm will form the basis for coordinating demand and Distributed Generation with respect to operational limits of local network segments. A ‘state estimator’ can provide a basis for an autonomous low-voltage network management and monitoring system. This project is a joint project between Energex, Ergon and The University of Queensland (UQ) for a period of three years.

3.2.3 Aims and expected outcomes

The objectives of the project are to support the University of Queensland to:

- Develop a Distribution System State Estimation algorithm that can be applied to low voltage networks

- Provide timely control inputs to a number of low voltage connected devices to improve the efficiency of the network
- Provide trial networks for field trials of a prototype application
- Improve the dispatch of Distributed Energy Resource
- Improve the demand management response

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

The business case for the project was reviewed against the DMIA criteria by both Demand Management and Regulatory Departments. The projects were deemed to meet the DMIA criteria and costs confirmed to be not in any way recoverable from another source. The business cases were presented to the Energex Investment Review Committee which endorsed the projects for DMIA funding.

3.2.5 How it was/is to be implemented (ie general project update)

The approach for UQ delivering this initiative is to:

- Nominate one LV network to serve as a trial and demonstration platform. A suitable trial network has been selected within Energex's network. A Single Wire Earth Return (SWER) feeder in the Ergon Energy Network is also planned for testing.
- Generate model of nominated LV network and establish network simulation capabilities. Completed.
- Identify network parts most likely at risk of operational issues and identify suitable measurement scheme for monitoring these sections. Completed.
- Install three additional measurement devices at strategic points on the selected LV network. Completed. Real-time measurement data is available to the estimator within the network's Operational Environment.
- Run State Estimation to identify best location and required size of state influencing equipment and install it. The estimator is running successfully using real-time and static data inputs. Installation of control equipment is in progress.
- Start closed loop control and record performance.
- Apply the State Estimation algorithm as part of a desktop study on additional network areas of interest.

This project will continue in the 2018-19 year.

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

This project has successfully demonstrated that Distribution System State Estimation is possible on LV networks using limited network monitoring data as input. The project was not targeting a specific quantity of peak or off peak demand reduction but is targeted as establishing platforms and capability from which sound demand management decisions can be made based on the increased network visibility provided by the state estimator.

3.3 Battery Energy Storage System Trial

A battery trial for residential homes who already have solar to understand customer and grid impacts / benefits (15 residential sites in Brisbane).

3.3.1 Compliance with DMIA Criteria

The BESS Pilot complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme. The BESS project focuses on an emerging technology that is anticipated to be taken up by customers at an increasing rate over the coming years. It is imperative that Energex gain early insights into how customers will take up BESS, how Energex can provide a direct demand load control value proposition, how the systems will be integrated into the network and what changes need to be made to the network to accommodate the technology.

3.3.2 Nature and Scope

A targeted Market Based Battery Trial in cooperation with BESS manufacturers who are selling BESS to customers in South East Queensland. The Market Based Battery Trial is being run in two stages: currently with 15 staff sites and secondly with customers in selected areas of the network. The trial is focussing on the coordination of demand response capable BESS that are compliant with AS/NZS 4755.3.5. The trial will investigate the value to the network from coordinated and standardised BESS demand response, particularly during peak demand and peak export periods.

3.3.3 Aims and expected outcomes

The aim of the project is to gain a better understanding on the customer value proposition and expectations from the electricity network in taking up BESS; how Energex can leverage off the existing load control system with direct load control and tariffs to benefit both Energex and the customer and investigate how the BESS technology will integrate with the electricity network.

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

The business case for the project was reviewed against the DMIA criteria by both Demand Management and Regulatory Departments. The projects were deemed to meet the DMIA criteria and costs confirmed to be not in any way recoverable from another source. The business cases were presented to the Energex Investment Review Committee which endorsed the projects for DMIA funding.

3.3.5 How it was/is to be implemented (ie general project update)

The Market Based Battery Trial has continued throughout the year. Using data from the trial, the University of New South Wales undertook a review of the effectiveness of the trial batteries to reduce peak demand was completed. Ongoing monitoring of the batteries was undertaken, and several operational and performance issues were identified. Resolution of issues involved working with trial participants, battery installers, manufacturers and network operations. These issues are being collated as part of the trial learnings. As planned the trial will end in 2019-20.

A report on the preliminary learnings from the trial was published in November 2017. The Energex Battery Trials Preliminary Findings Report is available on the battery trials page of the Energex website. Learnings from the battery installation phase of the trial were published in May 2017, including an Energex report on practical learnings and tips for battery installers and a Clean Energy Council (CEC) Inspections Summary report. These are also available on the Energex website.

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

The trial has produced several benefits including:

- Data for use by external parties: Data from the trial has been requested by University of New South Wales for analysis on effectiveness of battery energy systems to reduce peak demand, and by Powerlink for analysis as part of a chronological demand trace for different parts of Powerlink's network.
- Learnings and insights on battery operation and performance.
- This project has successfully demonstrated that batteries do provide peak demand reductions, and can be successfully called upon, using existing Load Control System (LCS) infrastructure, to reduce demand when required.
- Working with different third-party battery applications has highlighted the need for standardised demand response communication protocols.

3.4 Solar Enablement Project

This project involved application of state estimation technique that generates an estimate of the networks operational conditions to help assess connection of additional customer PV system to the MV network.

3.4.1 Compliance with DMIA Criteria

The Solar Enablement Initiative complies with the Demand Management Innovation Allowance criteria detailed at section 3.1.3 of the demand management incentive scheme as the improved data and information that can be achieved by application of an estimator on the Medium Voltage (MV) network level can be used to improve the benefits of demand management and coordination of Distributed Generation across the medium voltage network.

3.4.2 Nature and Scope

The project is to further develop, implement and test an innovative state estimation algorithm for monitoring medium voltage electricity distribution networks by running a trial on seven feeders across three distribution network service providers. The aim is to provide an improved understanding of electricity network behaviour to maximise the capacity of new solar PV installations and their export into the Australian grid, thereby enabling an increase in the percentage of renewable energy connected to the grid. This two year project is run by University of Queensland (UQ) in partnership with nine stakeholders including Energex.

3.4.3 Aims and expected outcomes

The objectives of the project are to support the University of Queensland to:

- Further develop the Distribution System State Estimation algorithm to be applied to the medium voltage networks
- Provide trial networks, including monitoring devices, for field trials of a prototype application
- Improve the PV connection assessment process and associated PV connection costs through the development of a network assessment tool
- Improve the dispatch of Distributed Energy Resource
- Improve the demand management response
- Minimise future network investment.

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

This was a follow on project from a previously funded DMIA project and was approved on the basis of compliance with DMIA criteria and the requirement to continue development of this project concept.

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

The approach for UQ delivering this initiative is to:

- Nominate seven MV feeders across the three project partners' networks to serve as a trial and demonstration platform. The seven trial feeders have been selected including three feeders in Energex's network, two in TasNetworks and two in United Energy. A fourth Energex feeder has been included to support real-time application of the estimator on the MV network.
- Generate models of nominated MV feeders and establish network simulation capabilities. All eight feeder of the partner networks has been successfully modelled.
- Install suitable additional measurement devices on the trial feeders where required. Completed. This was only necessary in TasNetworks.
- Re-design LV State Estimation algorithm for MV network operation. Completed.
- Develop a semi-automated network analysis tool based on the State Estimation Algorithm to be used to improve the existing PV connection assessment process. Completed
- Perform desktop analysis of scope and costs to deploy State Estimation algorithm and Network Assessment Tool on entire MV network in each project partner network.
- Perform a real-time demonstration using State Estimation to support the application of dynamic PV export limits for customer owned systems. Real time state estimation is implemented, generation of a PV export limit from the state estimation output is to be completed by Dec 2019.

This project will continue in the 2018-19 year.

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

This project has successfully demonstrated that Distribution System State Estimation is possible on MV networks using existing network monitoring data as input with limited need for additional monitoring.

Three disparate sets of input data have been tested across the three DNSP partners.

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 the state estimator.

3.5 Tesla Eagle Farm DC

Following on from the installation and commissioning of the Eagle Farm 150kW PV system and 250kW BESS identifying opportunities for network support from large scale BESS and PV.

3.5.1 Compliance with DMIA Criteria

The Solar PV and BESS trial represents the first operational commercial scale system compliant to AS4755.3.5 with DRED functionality and Island operation. The system has the ability to disconnect completely from the distribution network and operate in island mode for short durations as well as the ability to inject or export energy for grid support if required.

3.5.2 Nature and Scope

Testing of the installed system post commissioning to ensure stable operation, ability for the system to manage peak demand on site and operate for short durations in an islanded mode.

3.5.3 Aims and expected outcomes

Benefits anticipated from this project include:

- Identifying opportunities for network support from large scale BESS and integrated PV, which may typically be installed at a commercial premises
- Demonstrate load control of a large scale BESS and integrated PV via local control software and how networks can interact with the systems
- Investigate options for control via Demand Response Enabled Devices (DRED)
- Inform the development of a customer BESS control strategy for large scale systems
- Identify improvement opportunities for existing IES connection standards
- What modes a customer may operate in and how this might affect their connection to the network (i.e. connection agreements, tariffs, ADMD's, etc.)
- Identify knowledge and skills
    - To enable effective integration
    - Impacts on planning

- Impacts on forecasting
- Impacts on switching
- Impacts on fault finding

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

This was a follow on project from a previously funded DMIA project and was approved on the basis of compliance with DMIA criteria and the requirement to continue development of this project concept.

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

Using the system installed at Eagle Farm testing will be carried out.

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

The combination of battery and solar has enabled overall management of the peak demand of the site. It has highlighted the importance in BESS and PV design in enabling effective levels of demand management without worst case failures.

3.6 Enabling Dynamic Export Limits

This is a trial to demonstrate the benefits to customers and network of moving from zero export limits to dynamic export limits.

3.6.1 Compliance with DMIA Criteria

The objective of this trial is to demonstrate the benefits to customers and our network of moving from zero-export limits to dynamic export limits. This proposal is aligned with Stream 1 of the Future Grid Roadmap - Managing two-way energy flows, specifically around Customer Distributed Energy Resources (DER) Active Management. A number of research collaborations including the Solar Enablement Initiative (SEI), Queensland Integrated Power Platform (QIPP), Advance Queensland Platform Technology Program and the Evolve DER Project are developing techniques for more active DER management.

3.6.2 Nature and Scope

The scope of the trial includes the installation of a commercially available 50 kW, 3 phase Solar PV system complete with a Dynamic Export Limit Controller (DELC) which enables the solar inverter to respond to near real-time network demand support requests. The DELC system responds to published demand requests based upon the local network LV transformer demand status. The purpose of this trial is to investigate the viability of enabling energy flow from renewable sources rather than the typical zero export connection agreements more regularly resultant for connections by small to medium commercial Solar PV customers.

3.6.3 Aims and expected outcomes

The potential learning objectives will include the following:

- Customers
    - Understanding customer drivers and barriers to taking up Solar PV with active DER control.
    - Understanding what level of control can be implemented which has minimal impact on customers' use of the Solar PV whilst providing maximum benefit to the network and the customer.
- Technology
    - Foster and drive the development of technologies and interface techniques required for active management of Solar PV.
    - Gain a better understanding of the technology impacts of potential increased levels of solar PV penetration with active management take up on the electricity network and how Energex/Ergon might need to evolve the LV network design to accommodate customer technology requirements (Solar PV, BESS, and Energy Management Systems).
    - Gain a better understanding of the Inverter technology configurations, sizing and optimal control methodologies to enable active DER to support network real-time conditions and load requirements.
- Energex/Ergon
    - Gain an understanding of what role Energex/Ergon should play in the Solar PV enablement market incorporating active management of DER.
    - To demonstrate operational real-time active DER response to network constraints as part of the Solar Enablement Initiative.
    - Test if the existing Energex/Ergon connection requirements allow easy access to increased levels of Solar PV output with active management capability on the EQL distribution network.
    - Determine how to minimise the technological changes required to enable active DER management.

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

The business case for the projects was reviewed against the DMIA criteria by both Demand Management and Regulatory Departments. The projects were deemed to meet the DMIA criteria and costs confirmed to be not in any way recoverable from another source. The business cases were presented to the Energex Investment Review Committee which endorsed the projects for DMIA funding.

3.6.5 How it was/is to be implemented (ie general project update)

The Enabling Dynamic Export Limits for Commercial Solar PV trial has been constructed and commissioning was completed (mid August 2019). The Trial and testing phase has been initiated.

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

The site has the capability to export excess Solar PV generation beyond the site demand to support the local LV and 11 kV feeder network, to date up to 32 kW of peak demand network export support have been measured at the NMI. This is a near real-time dynamic network support based upon the actual network measured requirements rather than a fixed export value.

3.7 Springfield Net Zero

This project involves partnering with Springfield Master Planned master planned community in the development of Net Zero energy community (Energy transitions; Mobility; District services (cooling/heating); Water).

3.7.1 Compliance with DMIA Criteria

Working directly with a developer researching net zero sub divisions will provide a detailed insight on how DNSPs can interact with developers, and what strategies, programs or initiatives could be implement to manage lowest cost net zero whole of development demand, in the face of rapidly changing use of energy technologies, including distributed energy resources.

3.7.2 Nature and Scope

Springfield group are exploring net zero residential developments and designing a master plan for creating net zero subdivisions. this work will develop a holistic understanding of the infrastructure required for a net zero energy housing developments. The project will examine key aspects of a master planned community designed for net zero including:

- Energy transitions
- Mobility
- District services (cooling/heating)
- Water

3.7.3 Aims and expected outcomes

EQL will benefit from understanding the electrical infrastructure impacts of a net zero development and trade-offs between electrical and other infrastructure and be able to explore:

- The potential peak and minimum demand risks (impact on ADMD, risk mitigation options and net benefit to the Developer)
- The opportunity for working directly with a developer and aggregator for controllable loads/generation
- Risks associated with electric mobility, developer preferred location of charging stations
- The likely size, location and operation of energy storage

A direct output of the project will be an understanding of the energy density and load profile of various demographic segments and building designs.

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

Energy Queensland are exploring other opportunities with Springfield surrounding local energy markets, DSO, and network constraint information within the Springfield development. This project was selected as it directly supports the long term network planning, integration and control required under a DSO arrangement and can leverage learnings and knowledge from other projects.

3.7.5 How it was/is to be implemented (ie general project update)

The project will be an information sharing project and will be developed with a collaborative sharing of knowledge and information between Springfield, Springfield's subcontractors and Energy Queensland.

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

Nil at this stage as the research project is due to commence in 2019/20.