Ergon Energy Demand Management Innovation Allowance Report 2017-18

August 2018

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1. Introduction

Purpose and compliance

Ergon Energy is pleased to present the Demand Management Innovation Allowance (DMIA) Report for the 2017-18 regulatory year. The purpose of this report is to allow the Australian Energy Regulator (AER) to:

- assess Ergon Energy's 2017-18 DMIA initiatives and Ergon Energy's entitlement to recover the expenditure under the AER's Demand Management Incentive Scheme (DMIS)[1]
- confirm Ergon Energy's compliance with the annual reporting requirements of the AER's Regulatory Information Notice (RIN) issued to Ergon Energy.

This report has been completed in accordance with Schedule 1, paragraph 6 of the AER's RIN (refer to Table 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.

[1] AER (2008), *Demand Management Incentive Scheme, Energex, Ergon Energy and ETSA Utilities 2010-15*, October 2008.

Table 1: Schedule 1, paragraph 6 – DMIA compliance

6	Requirement	Section
6.1	Identify each demand management project or program for which Ergon Energy seeks approval.	Section 4
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 DMIA criteria detailed at section 3.1.3 of the DMIS	Sections 3 and 4
	(ii) its nature and scope	Section 4
	(iii) its aims and expected outcomes	Section 4
	(iv) the process by which it was selected, including its business case and consideration of any alternatives	Section 2
	(v) how it was/is to be implemented	Section 4
	(vi) its implementation costs	Section 3
	(vii) any identifiable benefits that have arisen from it, including any off peak or peak demand reductions	Section 4
(b)	confirm that its associated costs are not:	
	(i) recoverable under any other jurisdictional incentive scheme	Section 3
	(ii) recoverable under any other Commonwealth or State Government scheme	Section 3
	(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	Section 3
(c)	state the total amount of the DMIA spent in the relevant regulatory year and how this amount has been calculated.	Section 3
6.3	Provide an overview of developments in relation to projects or programs completed in previous years, and of any results to date.	Section 4

Submission summary

In its Distribution Determination[2], 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 2017-18 DMIA program comprised seven projects. The total cost incurred for the DMIA initiatives during 2017-18 was $262,000. Table 2 summarises Ergon Energy's DMIA program expenditure recovery for the 2017-18 regulatory year.

Table 2: Ergon Energy DMIA program – 2017-18

Projects	Number	Expenditure
Completed	3	$59,000
Continuing	4	$203,000
Total	**7**	**$262,000**

Ergon Energy seeks the AER's approval to recover the costs for the full amount of DMIA spent in the 2017-18 regulatory year.

In line with all Ergon Energy investments, the DMIA program follows Ergon Energy's standard gated governance framework, with built-in review for prudency and efficiency at each gate, as the project moves through the investment lifecycle.

For the 2017-18 DMIA program, all nominated DMIA projects were subject to a screening and feasibility processes, consistent with the AER's DMIS, and a subsequent cost-benefit analysis to identify the highest value projects, based on factors including their ability to shape energy load profiles, enable demand management and support our customers.

Budgets were also prepared in accordance with Ergon Energy's standard project methodology, detailing information including the projects' goals, deliverables, project milestones and resources required. Cost estimations were developed for the resources identified, as required for each phase of each project. These cost estimations drew upon various sources including the costs of similar projects undertaken by Ergon Energy, current preferred contractor panel contracts and market research. For projects with co-contributions from industry partners and research institutions, the total project budgets were inclusive of such amounts and assessed on this basis.

Ergon Energy's DMIA program is delivering strongly against its DMIA objectives, with several of the projects moving to a business-as-usual operation.

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

2. DMIA program of work

Program development

Ergon Energy considers DMIA investments an important component of its commitment to delivering customer value over the longer term. The DMIA program complements our non-network alternative program, which is geared towards 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, such as improvement of load factors, customer behaviours, renewable integration, capacity limitation solutions, tariff enablement, customer and community engagement and power quality solutions. Our DMIA program has five focus areas, as detailed in Figure 1, to support the criteria of shifting reducing demand through non-network alternatives rather than increasing supply through network augmentation.

Figure 1: DMIA focus areas

Ergon Energy considers that over the longer term, innovation in the core DMIA focus areas highlighted above will aid in the reduction of network augmentation by addressing network constraint challenges through collaborative partnerships between networks, markets and customers. This offers the entire supply chain the opportunity to reduce costs through finding solutions that better fit all stakeholder needs. As such the diversity of initiatives across the DMIA program reflects this commitment to lowering capital investments through finding alternatives for limitations driving network investments.

Program cycle

Identifying innovation opportunities

The DMIA program has enabled Ergon Energy to place greater emphasis on the importance of innovation for demand management opportunities. By drawing on its own experience and examples of industry practice, Ergon Energy has developed an environment that characterises solutions beyond the traditional network solution.

To identify and increase the innovation opportunities, Ergon Energy's innovation environment comprises three key groups to funnel innovation ideas into the DMIA program, as illustrated in Figure 2:

- the DMIA program team, providing

  opportunity for anybody in Ergon Energy to contribute
- the Smart Network Reference Group, providing senior management representation and oversight from across the business
- co-contributions from external parties such as universities, research partners and industry partners.

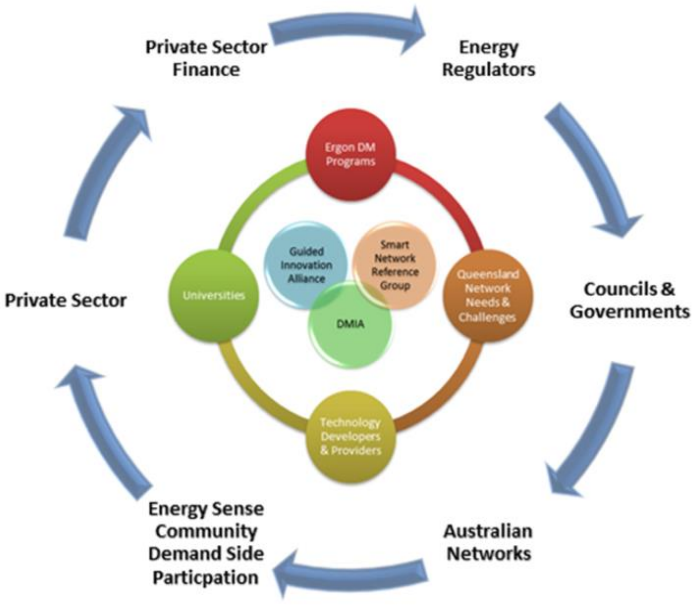

Figure 2: Ergon Energy innovation environment

Selection process

To ensure prudent investment choice and project delivery efficiency, all Ergon Energy investments adhere to our standard gated governance framework. The DMIA projects follow the same methodology, with particular emphasis placed on meeting the DMIA criteria and objectives. Accordingly, once projects are identified and nominated through the above-mentioned 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. Table 3 outlines the criteria in detail.

Provided all the specified conditions are met, then the project proceeds to the feasibility assessment and approval stages, as per the gated governance framework. All Ergon Energy DMIA projects are selected and scoped to respond to current and emerging network limitation drivers. Information from the development activities undertaken enables implementation scheduling, milestone planning and confirmation of resources.

Table 3: Ergon Energy DMIA project selection criteria

Selection criteria
• Reduces shifts or manages electricity demand through non-network alternatives or projects or programs designed to build demand management capability and capacity and explore potentially efficient demand-management mechanisms, including but not limited to new or original concepts, that support a reduction in network risk through means other than network augmentation.
• Has costs which are not recoverable under any other jurisdictional incentive scheme
• Has costs which are not recoverable under any other state or Commonwealth Government scheme
• Has costs which are not included in Ergon Energy's forecast capital or operating expenditure approved in the AER's distribution determination for the regulatory control period under which the scheme applies, or under any other incentive scheme in that determination
• Is technically feasible (based on whether, in Ergon Energy's assessment, the project is suitable for its intended application and whether it can be theoretically and physically integrated with Ergon Energy's infrastructure).

3. Budget management

DMIA program expenditure

Ergon Energy's DMIA total expenditure for 2017-18 was $262,000. The costs incurred on the DMIA program for the year were all operating expenditure with no capital expenditure. Ergon Energy seeks the AER's approval to recover the costs for the full amount detailed in the 2017-18 expenditure column of Table 4. These costs are all Ergon Energy's contribution to the projects and are over and above any external funding received from industry or government grants.

For the year, the DMIA program comprised of seven projects, with three completed and four continuing projects. All projects were developed and managed in accordance with Ergon Energy's established program management framework as outlined in the previous section.

Table 4 summarises the actual expenditure for the 2017-18 Ergon Energy DMIA program, along with the total approved budget costs, actual annual costs, program-to-date incurred costs, and any applicable comments.

Table 4: Ergon Energy DMIA program expenditure 2017-18

Project	Budget ($)		2017-18 expenditure ($)		Project to date expenditure ($)		Comment
	Total Project Budget	Ergon Energy Project Budget	Capital	Operating	Capital	Operating	
Centralised Energy Storage	450,000	450,000	-	25,000	-	275,738	Continuing
IoT Load Control (LPWAN)	263,833	263,833	-	15,000	-	163,683	Completed
ARC Customer response and risk management	1,202,644	281,911[3]	-	44,000	-	89,125	Completed
Grid Advocacy		365,000		156,000		331,887	Continuing
Home Energy Management Systems		50,000		0		20,538	Completed
IPDRED	48,174	48,174		11,000		11,000	Continuing
Large scale energy storage Lakeland	70,000	70,000		11,000		11,000	Continuing
Total	**2,118,477**	**2,827,904**	**0**	**262,000**	**0**	**902,971**	

Of note, Ergon Energy costs associated with each of the DMIA projects, as identified in Table 4, are not:

- recoverable under any other jurisdictional incentive scheme
- recoverable under any other Commonwealth or State Government scheme
- included in the forecast capital or operating expenditure approved in the AER's 2015-20 Distribution Determination or recoverable under any other incentive scheme in that determination.

Longer term trends

Ergon Energy's DMIA program progressed well over the previous regulatory control period, providing valuable knowledge and creating opportunities. We expect this to continue throughout the current regulatory control period. The DMIA program continues to collaborate with innovation partners who are willing to contribute to DMIA projects and trials. Ergon Energy has found co-contributions are a useful way to lower Ergon Energy's innovation costs, share risks and identify collaboration opportunities, share knowledge and capabilities, and gain valuable insights into emerging markets.

Table 5 presents a summary of co-contributions into Ergon Energy DMIA funded projects. It demonstrates how Ergon Energy is leveraging industry, research organisations and other

[3] The project is part funded by an Australian Research Council grant, Queensland University of Technology and Ergon Energy via the Demand Management Innovation Allowance as such Ergon Energy's contribution is a fraction of the overall project budget.

development funds to lower our DMIA costs. Importantly, the parties value these projects or programs as they are willing to make contributions towards these costs. The costs Ergon Energy is seeking to recover do not include the co-contributions received for the project.

Table 5: Ergon Energy DMIA co-contributions

DMIA Project	Funding Source	Project total budget ($)	Co-contributions Cash Total ($)	Ergon Energy Project Cash Budget ($)	Project Total Cash Amount ($)
ARC Customer response and risk management	QUT ARC	525,000	525,000	281,911	806,911
	Ergon Energy	527,644[4]			
Total		**1,052,644**	**525,000**	**281,911**	**806,911**

[4] Includes financial contribution and non-financial in kind contributions, such as access to data and expert advice.

4. Program delivery progress

Program delivery

This section of the report details the status of Ergon Energy's DMIA projects in 2017-18 by describing each project, its objectives, progress and findings to date.

Centralised Energy Storage System (CESS)

Nature and scope

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

The Centralised Energy Storage System (CESS) is a joint Ergon-Energex project to develop and evaluate a 100kW/200kWh energy storage system. The CESS is a test platform to enable further control systems development. The system will be tested, trialled and integrated in a controlled, generation test environment in the workshops 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 enable higher penetrations of customer-owned renewable generation and also develop micro-gridding functionality.

Project phase

Indicates current phase

Benefits and outcomes

- Enable higher penetrations of PV on the network using centralised energy storage
- Investigate micro-gridding functions to seamlessly transition between on and off grid.
- Provide a test platform for further development of advanced control systems

Aims and expectations

The project aims 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).

DMIA alignment

Energy storage and combined generation and storage are a promising demand management solution for reducing peak demand. As this technology develops a key barrier for broader implementation will be the integration of the many control systems in a seamless manner.

Update summary

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 a 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 underway with development of control algorithms, simulation models and engagement with the original manufacturer to help expand device functionality.

IoT

Nature and scope

This is a capability enablement project to utilise the potential offered by Internet of Things (IoT) technologies for demand response applications.

The project aims to establish, at a minimum a Proof of Concept (PoC) deployment of an IoT enabled demand response system and is funded via DIMA under the category of capability enablement. Once the PoC stage is complete the project would continue to be funded via BAU activities.

Project phase

Indicates current phase

Benefits and outcomes

- Utilise IoT technologies to enhance demand response abilities
- Explore alternative demand response communications options
- Enable more complex load control interactions

Aims and expectations

The project aims to:

- evaluate the suitability and applicability of a Low Power Wide Area Wireless Network, belonging to the family of IoT, to provide transport services for signalling and reporting of demand response enabling devices (DRED), and;
- develop an end-to-end solution and evaluate it in a PoC deployment.

DMIA alignment

IoT is a promising low cost interconnection of appliances and devices in the home, this project will explore the emerging IoT technologies and validate the cost, operational and technical benefits for managing consumer side devices for reducing peak demand.

Update summary

The project has established an IoT network and installed IoT load control devices in selected homes in Townsville. Testing has been completed and validated the ability of the IoT to send control signals to devices across a wide area under varying installation circumstances. The project is now completed, with findings being used to develop long term investment in IoT infrastructure for its use in managing network risks.

Grid Advocacy

Nature and scope

To test in a real world environment the customer impacts of cost reflective tariffs with the addition of emerging technologies such as Energy Storage, Home Energy Management Systems and.

There are knowledge gaps in the effective enablement of customer distributed energy resources. Areas of concern include: safety, functionality and efficacy of commercially available customer DER systems and the behavioural interaction of customers with tariffs and DER systems.

The INTCDER project will provide valuable insights and data relating to the integration of cost reflective tariffs and customer owned DER.

Project phase

Indicates current phase

Benefits and outcomes

- Inform the development of a demand response platform
- Increase understanding and participate in the development of advanced control systems for distributed energy resources

Aims and expectations

The project aims to:

- evaluate in a real world situation the barriers to emerging technologies such as energy storage,
- determine the impacts and benefits of these technologies when combined with cost reflective tariffs, and;
- evaluate the customer acceptance or not of these emerging technologies.

DMIA alignment

It is critical to understand the extent to which cost reflective tariffs and demand side technology can reduce peak demand and network risks. The uptake or not of cost reflective tariffs can alter the forward network risk profiles and change the need and types for demand management.

Update summary

The project has deployed and tested in a real world environment a combination of solar PV generation, energy storage, home energy management systems and cost reflective tariffs (Seasonal time of use demand). Final analysis and reporting is underway to present findings.

Home Energy Management Systems

Nature and scope

This project was to test next generation Home Energy Management Systems in a laboratory environment to determine:

1. The capability of the market segment.
2. The likely interface mechanisms for the network to interface and communicate to such systems.
3. Potential barriers for consumer adoption.

Project phase

Indicates current phase

Benefits and outcomes

- Establish a demand response platform and commence BAU application of the system

Aims and expectations

The project aims to:

- laboratory test the functionality of Home Energy Management Systems,
- determine the communications mediums,
- evaluate the ability for the systems to interface to consumer appliances,
- evaluate the interaction opportunities for networks to communicate to such systems, and;
- evaluate the likely barriers for consumers to uptake Home Energy Management Systems.

DMIA alignment

Home Energy Management Systems are expected to deliver value to consumers through the ability to manage appliances, minimising their energy costs. To date the Home Energy Management market has been a slow to gain traction with consumers. Understanding the Home Energy Management Systems capabilities and barriers to uptake can enable the network to develop product offerings for consumers.

Update summary

The project has been completed with the successful installation and testing of a next generation Home Energy Management System in the Cairns Innovation Laboratory. The project has identified an improvement in the capabilities of HEMS technology and the requirement for a standard communication methodology for the network to interface with HEMS technology.

Any move to commence to a business as usual application of the system has been delayed for three reasons.

- Merging of the Ergon and Energex Demand Management groups has necessitated a taking of stock of future developments;
- Regulatory changes to demand management “behind the meter” for networks; and
- The awareness of multiple solution providers with similar solutions and a need to assess their relative merits whilst promoting a wider HEMS market.

ARC Customer response and risk management

Nature and scope

The project is an Australian Research Council (ARC) project and, in collaboration with QUT, will research the customer response and risks associated with demand management, direct control of appliances and tariff signals.

The project will perform detailed research in Townsville with existing customers to gain an understanding of:

- the customers' tolerance to changes in utility service levels
- enablement of the utility to directly control appliances in the home
- the application of essential services circuits
- the utilisation of efficient technologies in rental properties.

This research will provide a platform for our future development of demand management products and the integration of tariffs with technology.

Project phase

Indicates current phase

Benefits and outcomes

- Understanding the customer tolerance to changes in utility service levels
- Understanding how to enable the control of appliances in the home
- Developing an understanding of the benefits of essential services circuits that can be backed up by energy storage
- Understanding how to engage with the rental market and enable this market to participate in energy markets

Aims and expectations

The project aims to identify:

- the customers' willingness or not to use energy at specific times based on tariff signals,
- the customers' acceptance for purchasing demand response enabled appliances,
- what tariffs and incentives are most likely to gain customer favour, and;
- what demographic segments are least likely to be able to respond to market signals.

DMIA alignment

This project aims to develop a quantitative understanding of a consumer's value of the services that energy provides and how that changes with direct control of appliances, price signals, comfort and behavioural changes. The project will inform our future demand management products and services and help to create efficiencies in our program.

Update summary

All surveys and data sharing have been undertaken. Ergon's participation on the project formally concluded on 30 June 2018. QUT continues to work on coding data into their analysis model and will be presenting a final outcomes report to Ergon; anticipated to be by 1 December 2018 Further research opportunities are being assessed by QUT.

Lakeland Solar & Storage

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.

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.

Project phase

Indicates current phase

Benefits and outcomes

- Understand how large solar and battery can be used to support fringe of grid networks
- Demonstrate PV supporting modes to improve power quality and manage demand
- Demonstrate microgrid function on MV distribution networks

Aims and expectations

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

DMIA alignment

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.

Update summary

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 is expected to start in Sep/Oct 2018, following pre-test simulations.

IPDRED

Nature and scope

The project's aim is to develop a functional specification for a third-party delivered, Internet protocol demand response enabling device. This will The allow network and end-customer management of customer loads – directly, or indirectly via a third party platform.

The IPDRED functional specification will cover areas regarding two-way communication, individual addressability and consumption data amongst other things, whilst also supporting demand management delivery using AS4755.3 suite of standards.

Implementation will comprise of releasing the Functional Specification, Finalisation will be the review of the solution provider responses.

Project phase

Indicates current phase

Benefits and outcomes

- A document that directs third party demand management solution providers
- Commencement of a process to uncover suitable third party demand management solution providers to develop a strategy for movement away from a non-AFLC demand management environment.
- Demand management market enablement.

Aims and expectations

The project aims to:

- Consolidate a network perspective to provide demand-management solution providers with direction for positive network and customer outcomes regarding network utility and bill reductions.
- reveal suitable third party demand management solution providers,
- identify functional gaps for potential solution providers.
- Seek feedback, and potentially proposals, from third party demand management solution providers to establish a program that promotes solutions to the customers,

DMIA alignment

This project is breaking new ground by testing the existing market solutions to assess suitability for network a customer requirements.

Update summary

- The functional specification's second draft is under peer-review within Energy Queensland.
- Latest changes have incorporated both AS4755.1 and AS4755.2 to broaden its scope to include demand response systems and not just DREDs.

Abbreviations, definitions and units of measure

A, kA, MA	Amps, unit of measure of electrical current, kA 1000s of amps, MA 1,000,000 of amps
AER	Australian Energy Regulator
ARC	Australian Research Council
BAU	Business as usual
CESS	Centralised Energy Storage System
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Constraint	A condition whereby a limit, that has been pre-set to a declared criteria, is exceeded.
CTIP	Clean Technology Innovation Program
Demand (Maximum Demand MD)	The maximum electrical load over a set period of time. The figure may be for use with tariff calculations or load surveys and the units may be in either kVA, kW or amps.
Demand reduction	The amount of electrical load that can be removed for a period of time.
Demand Management	Demand Management is the design and implementation of programs designed to influence customer use of electricity in ways that will produce desired changed in system load shape.
DMIA	Demand Management Innovation Allowance
DMIS	Demand Management Incentive Scheme
DNSP	Distribution Network Service Provider
DRED	Demand Response Enabling Device
GUSS	Grid Utility Support System
IoT	Internet of Things
LED	Light Emitting Diode
LGA	Local Government Authority
LV	Low voltage – 240V or the voltage used in residential houses
PoC	Proof of Concept
PV	Photovoltaic – a technical term for solar power generation.
QUT	Queensland University of Technology
RIN	Regulatory Information Notice
SEM	Solar Energy Management System
Statcom	Static VAR compensator
SWER	Single Wire Earth Return. Distribution to customers using a single wire conductor with the greater mass of Earth as the return path.
TMR	Department of Transport and Main Roads
V, kV, MV	Volts, kV kilo volts 1000s volts, MV mega volts 1,000,000s volts

VA, kVA, MVA	Volt amps, kVA kilo volt amps 1,000s volt amps, MVA mega volt amps 1,000,000 volt amps
VAR, kVAR, MVAR	Volt amps reactive, kVAR kilo volt amps reactive 1,000s VAR, MVAR mega volt amps reactive 1,000,000 VAR
W, kW, MW	Watts, kW kilo watts 1,000s watts, MW mega watt 1,000,000s watts
Wh, kWh, MWh	Watt hours, kWh kilo watt hours 1,000 watt hours, MWh mega watt 1,000,000s watt hours

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