EECL 1314 APRIN_S1 DMIA

ERGON ENERGY

Demand Management Innovation Allowance Report 2013-14

ERGON ENERGY CORPORATION LIMITED ABN 50 087 646 062

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Introduction

Purpose and compliance

Ergon Energy is pleased to present the Demand Management Innovation Allowance (DMIA) Report for the 2013-14 regulatory period. The purpose of this report is to allow the Australian Energy Regulator (AER) to:

- assess Ergon Energy's 2013-14 DMIA initiatives and Ergon Energy's entitlement to recover the expenditure under the Demand Management Incentive Scheme (DMIS)
- 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:

- Clause 6.6.3 of the National Electricity Rules (NER), which allows the AER to develop and publish a DMIS that provides incentives for Distribution Network Service Providers (DNSP) to assess (potentially) efficient non-network alternatives or to manage the expected demand for standard control services in some other way
- Schedule 1, paragraph 6.1 (a)-(e) of the AER's RIN, which requires a DNSP to which the DMIS applies to submit an annual report to the AER on its expenditure under the DMIA.

The provision of information in this report demonstrates compliance with paragraph 6.1 of Schedule 1 of the RIN, the Notice issued (as amended) by the Australian Energy Regulator (AER) on 6 August 2014.

Furthermore, as noted by the AER in its issuance of this Notice to Ergon Energy, information provided in accordance with paragraph 6.1 of Schedule 1 of the RIN is considered to constitute the provision of an annual report for the 2013-14 regulatory period in accordance with paragraph 3.1.4.1 of the AER's *Demand Management Incentive Scheme for Energex, Ergon Energy and ETSA Utilities 2010-15*, October 2008.

This report and the information contained in the report is suitable for publication by the AER.

Table 1: Schedule 1, paragraph 6.1 – DMIA compliance

6.1	Requirement	Section
(a)	Provide an explanation of each demand management project or program for which approval is sought	Section 4
(b)	Explain, for each demand management project or program identified in the response to paragraph 6.1(a), how it complies with the DMIA criteria detailed at section 3.1.3 of the DMIS, with particular reference to:	
	(i) the nature and scope of each demand management project or program	Section 4
	(ii) the aims and expectations of each demand management project or program	Section 4
	(iii) the process by which each demand management project or program was selected, including the business case for the project and consideration of any alternatives	Section 2
	(iv) how each demand management project or program was/is to be implemented	Section 4
	(v) the implementation costs of the project or program	Section 3
	(vi) any identifiable benefits that have arisen from the project or program, including any off peak or peak demand reductions	Section 4
(c)	Provide an overview of developments in relation to projects or programs completed in previous years, and any results to date	Section 4
(d)	State whether the costs associated with each demand management project or program identified in the response to paragraph 6.1(a) are:	
	(i) not recoverable under any other jurisdictional incentive scheme	Section 3
	(ii) not recoverable under any other Commonwealth or state government scheme	Section 3
	(iii) not included in the forecast capital or operating expenditure approved; or any other incentive scheme applied by the 2010-15 Distribution determination	Section 3
(e)	provide the total amount of the DMIA spent in the previous regulatory year, and how this amount has been calculated.	Section 3

Submission summary

In the AER's *Final Decision, Queensland distribution determination 2010-11 to 2014-15*, (May 2010) for the current regulatory control period, an allowance of $5 million over the period was made for a Demand Management Innovation Allowance (DMIA) for Ergon Energy.

The DMIA is provided to investigate opportunities that are not yet commercial, in addition to any business-as-usual capital and operational expenditure allowances for demand management projects, approved in Ergon Energy's distribution determination. This provides a direct incentive for Distribution Network Service Providers (DNSPs) to assess emerging opportunities for potentially efficient non-network alternatives, or to manage the expected demand for standard control services in some other way than through network augmentation.

Ergon Energy's 2013-14 DMIA program comprised eleven projects. The total cost incurred for the DMIA initiatives during the 2013-14 period was $850,672.

Table 2: Ergon Energy DMIA program – 2013-14 summarises Ergon Energy's DMIA program expenditure recovery for the 2013-14 regulatory year.

Table 2: Ergon Energy DMIA program – 2013-14

Projects	Number	2012-13 spent ($)
Continuing projects	9	697,790
New projects	2	152,882
Total	**11**	**850,672**

Ergon Energy is seeking the AER's approval to recover the costs for the full amount of DMIA spent in the 2013-14 regulatory year.

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

For the 2013-14 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 and gain community and customer acceptance.

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.

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 innovative approaches to a range of network issues, such as improvement of load factors, customer behaviours, renewable integration, capacity limitation solutions, customer and community engagement and power quality solutions. As illustrated in **Error! Reference source not found.**, the current DMIA categorised projects align to existing and emerging problems in Ergon Energy's network.

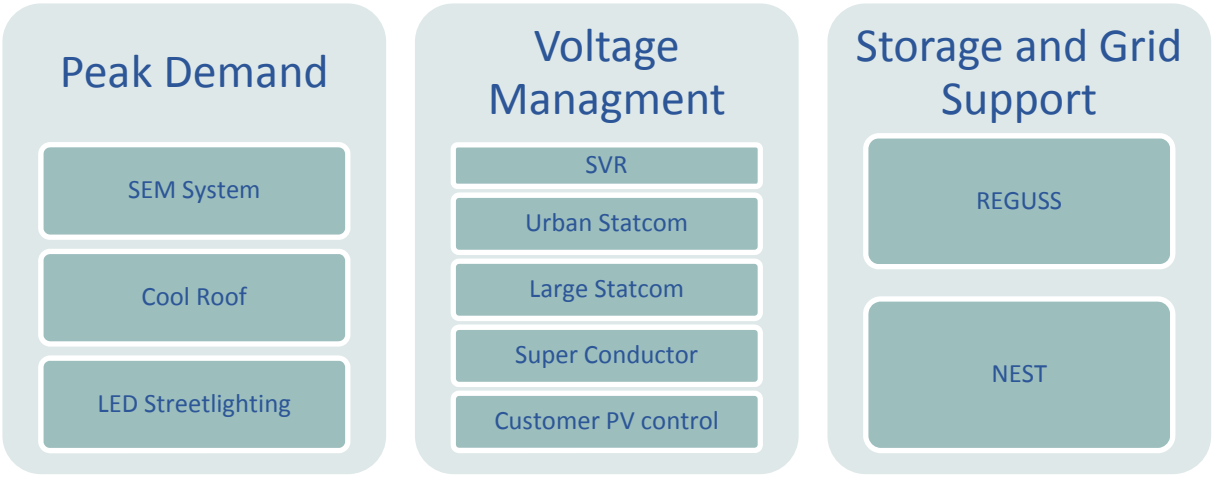

Figure 1: DMIA initiatives by network limitation drivers[1]

Ergon Energy considers that over the longer term, in addition to addressing the network constraint challenges, non-network alternatives can add significant value through providing networks and customers more optionality in solutions. This offers both customers and networks 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.

The DMIA investment portfolio demonstrates a mix of projects exploring demand management opportunities to respond to capacity requirements, voltage management opportunities to respond to voltage fluctuations from photovoltaic customer take-up, and future knowledge and capacity building. Future DMIA projects are likely to focus on emerging risks and opportunities such as residential and commercial scale battery storage, integrated consumer energy management systems and market-led initiatives.

1. Full project details are contained in the project details section of this document.

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: Ergon Energy innovation environment:

- the DMIA program team, providing opportunity for anybody in Ergon Energy to contribute
- the Guided Innovation Alliance (GIA), providing input and co-contribution from universities/researchers and industry
- the Smart Network Reference Group, providing senior management representation and oversight from across the business.

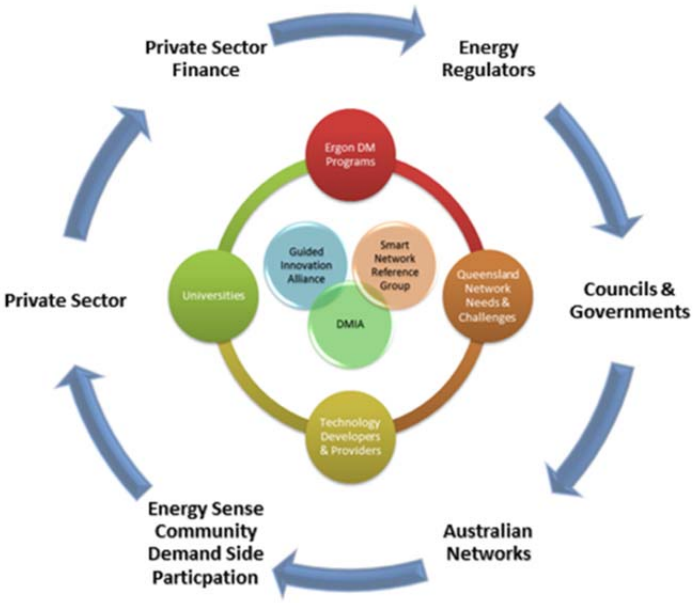

Figure 2: Ergon Energy innovation environment

Selection process

To ensure prudent investment choice and project delivery efficiency, all Ergon Energy investments adhere to a three-tiered 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 AER's *Demand Management Incentive Scheme for Energex, Ergon Energy and ETSA Utilities 2010-15*, October 2008. Table 3: Ergon Energy DMIA project selection criteria 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 and or shifts the electricity demand (to off-peak periods) of parties affected; 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 • 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).

Budget management

DMIA program expenditure

Ergon Energy's DMIA total expenditure for 2013-14 was $850,672. The costs incurred on the DMIA program for the year were all operational expenditure. Ergon Energy is seeking the AER's approval to recover the costs for the full amount.

For the year, the DMIA program comprised of eleven projects, with nine continuing projects from 2012-13 and two new 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: Ergon Energy DMIA program expenditure 2013-14 summarises the actual expenditure for the 2013-14 Ergon Energy DMIA program, along with the total approved budget costs, actual annual costs, program-to-date incurred costs, and any applicable comments.

Project	Budget ($)		2013-14 expenditure ($)		Project to date expenditure ($)		Comment
	Total Project Budget	Ergon Energy Project Budget	Capital	Operational	Capital	Operational	
GUSS Phase 2	450,000	450,000	-	227,448	-	398,729	Continuing
Large LV Statcom	348,640	348,640	-	144,609	-	293,162	Continuing
Urban LV Statcom	248,570	248,570	-	217,949	-	237,706	Continuing
Solar Energy Management Systems	593,830	146,255	-	30,532	-	95,493	Continuing
Cool Roof DMIA	334,387	231,203	-	22,653	-	227,434	Completed
Customer PV Voltage Control Project	230,000	230,000	-	134,980	-	134,980	New
LED Streetlight System (DIMA Funded)	450,000	134,000	-	17,902	-	17,902	New
Smart Voltage Regulator Validation	153,280	108,280	-	47,429	-	92,960	Completed
Network Embedded Solar Thermal DMIA	192,700	62,500	-	2,159	-	60,384	Completed
QUT Super Conductor	40,000	15,000	-	5,000	-	15,000	Continuing

Auto DR Trial	480,000	480,000	-	11	-	11	Completed
Total	**3,521,407**	**2,454,448**	**-**	**850,672**	**-**	**1,573,760**	

Table 4: Ergon Energy DMIA program expenditure 2013-14

Project	Budget ($)		2013-14 expenditure ($)		Project to date expenditure ($)		Comment
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Urban LV Statcom	248,570	248,570[2]	-	217,949	-	237,706	Continuing
Solar Energy Management Systems	593,830	146,255[3]	-	30,532	-	95,493	Continuing
Cool Roof DMIA	334,387	231,203[4]	-	22,653	-	227,434	Completed
Customer PV Voltage Control Project	230,000	230,000	-	134,980	-	134,980	New
LED Streetlight System (DIMA Funded)	450,000	134,000	-	17,902[5]	-	17,902	New
Smart Voltage Regulator Validation	153,280[6]	108,280[7]	-	47,429	-	92,960	Completed
Network Embedded Solar Thermal DMIA	192,700	62,500	-	2,159	-	60,384	Completed
QUT Super Conductor	40,000	15,000	-	5,000	-	15,000	Continuing
Auto DR Trial	480,000	480,000	-	11	-	11	Completed

2. Variation request approved for project during 2013-14 from $206,570 to $248,570.
3. Ergon Energy's financial budget is $146,255. However Ergon Energy's contribution includes other non-financial contributions such as data and expert advice bringing Ergon Energy's total contribution value to $200,000.
4. The 2012-13 project budget statement wasn't clear as to Ergon Energy's project contribution vs the project budget. For clarity, the project budget is $231,203, which includes co-contribution of $201,712 plus project management costs.

5 This represents the project costs being claimed under DMIA, additional Ergon Energy costs have occurred on the project that are not being claimed under DMIA expenditure.

6. The 2012-13 project budget statement wasn't clear as to Ergon Energy's project contribution vs project budget. For clarity, the project budget is $153,280, which includes co-contributions plus project management costs.
7. Includes Ergon Energy contribution costs of $85,000, and project management costs.

Total	**3,521,407**	**2,454,448**	**-** **850,672**	**-** **1,573,760**	

Of note, Ergon Energy costs associated with each of the 11 DMIA projects, as identified in

Project	Budget ($)		2013-14 expenditure ($)		Project to date expenditure ($)		Comment
	Total Project Budget	Ergon Energy Project Budget	Capital	Operational	Capital	Operational	
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Auto DR Trial	480,000	480,000	-	11	-	11	Completed
Total	**3,521,407**	**2,454,448**	**-**	**850,672**	**-**	**1,573,760**	

, are not:

- recoverable under any other jurisdictional incentive scheme
- recoverable under any other state or Commonwealth Government scheme
- included in the forecast capital or operating expenditure approved in the AER's 2010-15 distribution determination for the current regulatory control period under which the DMIS applies or under any other incentive scheme in that determination.

Of the 11 projects, three projects reached completion and final closure during 2013-14. They are:

- Network Embedded Solar Thermal
- Smart Voltage Regulator

- Cool Roof.

The Auto Demand Response Trial had minor carry-over expenses from 2012-13 into the 2013-14 financial year, this project is closed and work is continuing on business-as-usual integration of the capabilities.

Further information on the completed and closed projects is presented in Section 4, with a summary of key findings presented in the appendix section.

Longer term trends

Ergon Energy's DMIA program has progressed well over the regulatory period to date, and has provided some valuable insights and knowledge as well as creating the opportunity to move innovation from concept to business as usual. 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: Ergon Energy DMIA co-contributions presents a summary of co-contributions into Ergon Energy DMIA funded projects. It shows that Ergon Energy has lowered its DMIA costs by $1,010,514 through levering industry capabilities and experience, and is conducting research that promotes research from industry and the research community. Importantly, the parties value these projects or programs as they are willing to make contributions towards these costs.

Table 5: Ergon Energy DMIA co-contributions

DMIA Project	Funding Source[1]	Co-contributions ($)	Co-contributions Total ($)	Ergon Energy Project Budget ($)	Project Total Amount ($)
Network Embedded Solar Thermal	AUSTELLA	42,500			
	ACRE	85,000			
	Ergon Energy	65,200	127,500	65,200	192,700
Solar Energy Management Systems	CSIRO	163,830			
	GWA	230,000			
	Ergon Energy	200,000[8]	393,830	146,255	593,830
Super Conductor	QUT	25,000			
	Ergon Energy	15,000	25,000	15,000	40,000
Smart Voltage Regulator Trial	QUT	25,000			
	Microplanet	20,000			
	Ergon Energy	85,000	45,000	108,280[9]	153,280
Cool Roof Trial	StrongGuard	55,291			
	SmartGrid	10,000			
	QUT	37,893			
	Ergon Energy	201,712	103,184	231,203[10]	334,387
LED Streetlight system trial	CTIP	316,000			
	Ergon Energy	134,000	316,000	134,000	450,000
Total			**1,010,514**	**699,938**	**1,764,197**

8. Includes financial contribution and non-financial in kind contributions, such as access to data and expert advice.
9. Ergon Energy total project budget includes co-contribution costs and internal project management costs.
10. Ergon Energy total project budget includes co-contribution costs and internal project management costs.

Program delivery progress

Program delivery

This section of the report details the status of Ergon Energy's DMIA projects in 2013-14 by describing each project's objectives, progress against defined milestones and findings to date.

To measure the DMIA implementation progress, Ergon Energy uses a Red-Amber-Green (RAG) rating system against the defined targets. A brief explanation of the RAG ratings and a summary of the implementation progress are presented in the table below:

Table 6: Ergon Energy DMIA implementation progress 2013-14

Definition	Rating	Number achieved
Green flag indicates that the target was substantially or fully achieved		16
Amber flag indicates that the target was partly achieved		-
Red flag indicates that the target was not achieved		1

As the performance targets indicate, 16 of the 17 milestones (or 94%) of the project performance targets were achieved for the year. The exception was the LED Streetlight trial, which incurred delays due to availability of the luminaires.

GUSS Phase 2 (REGUSS)

Nature and scope

The goal of the project is to further develop the Grid Utility Support System (GUSS) – medium scale storage, grid interface inverter, system control and monitoring – to allow for the connection of renewable energy systems, in particular photovoltaics (PV), in such a way as to optimise the value the renewables can present, both to the network and to the customer. Appropriate integration will allow generated renewable energy to be stored, when it is not of value, and released at times of need.

Automated operation, to manage the system and support the network in the most effective way, is a key objective that will benefit all future energy storage products for the SWER networks (Single Wire Earth Return).

The REGUSS project specifically addresses integration of PV into our SWER networks and enables the generation of PV energy to be stored and shifted to peak demand and network need times.

Aims and expectations

The aims and expectations of this project are to:

- improve the value renewable energy can provide to the distribution network and low voltage connection points
- reduce the impact peak demand has on specific network constrained areas through the combined use of renewable energy and storage
- develop and integrate an automatic operating algorithm that effectively manages the system and supports the network without the need for upstream communication
- ensure the equipment is grid ready, and there are processes to support their connection to the network.

Project phase

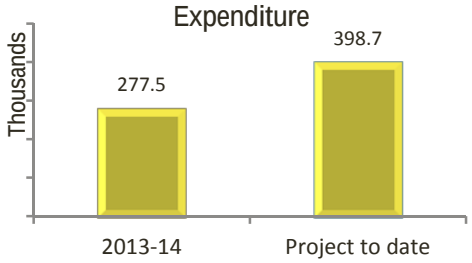
☆ Indicates current phase

Benefits and outcomes

- Test and trial complete – the project has been installed and commissioning at the trial site. Monitoring and data analysis is continuing
- Improved automated functionality – successful integration and laboratory trial of automated grid support mode
- Continued energy storage learnings – provided learnings to feed into other energy storage trials/products

Issues

- Continued developmental issues – issues typical in new technologies and improvements occurring all the time



Implementation progress (as at July 2014)

1. Factory acceptance testing complete
2. Installation at trial site and site acceptance testing
3. Trial monitoring and evaluation
4. Final reporting

Ratings

Update summary

The REGUSS project has been tested and trialled in the field, and is proceeding towards data analysis, final reporting and project closeout. The trial has yielded good outcomes pursuant to the project goals, in particular with the integration between energy storage and renewable energy. The additional testing at Queensland University of Technology has proven vital in optimising the automated mode and in reducing the issues of field trials.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Smart Voltage Regulator Validation

Nature and scope

The Smart Voltage Regulator (SVR) Validation project will laboratory test the effectiveness of three phase SVRs in maintaining distribution network power quality in light of increasing penetration of renewable generation.

The full validation will need to be conducted in a phased way, roughly split between single device testing and validating, and a subsequent larger-scale deployment in selected areas of the network, depending on the agreed application of the device.

Aims and expectations

A staged process is proposed to effectively assess the SVR and enable an informed commercial decision to be made:

- Firstly, a full functional test of the SVR will be conducted by the Queensland University of Technology (QUT), at their Banyo test laboratory.
- A network model of the SVR will be developed by QUT, which is suitable for use within Ergon Energy Network Modelling tools.
- If the above-mentioned laboratory testing shows that the SVR's performance is suitable, a study will be performed to compare cost/benefit/performance against other competitor technologies, such as the regulating transformer Statcom.

Project phase

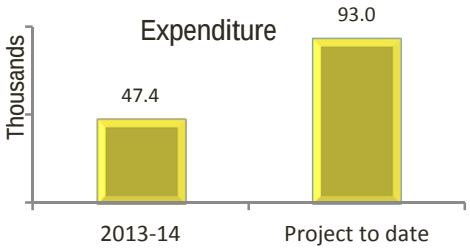
Indicates current phase

Benefits and outcomes

- Understanding the operation of in-series voltage regulation
- Understanding of where in-series voltage regulation may assist with low voltage (LV) Management

Issues

- The optimal location to place these devices on LV networks to ensure maximum benefit
- Procedures and risks with failure or by-pass of the unit, which may cause voltage supply issues to customers



Implementation progress (as at July 2014)

		Ratings
1.	Completion of laboratory tests	
2.	Preliminary report	
3.	Modelling of SVR	
4.	Final report and close project	

Update summary

The project delivered all its milestones, with the successful laboratory testing and reporting on the performance of the unit completed. The unit performed above expectations, with one minor operational issue when used in a reverse power flow situation (this will be fixed in the next release of the product).

The business is now considering its options and how this product fits into our LV management plans.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Urban Statcom

Nature and scope

The increasing prevalence of residential photovoltaic (PV) systems and non-linear loads is starting to have a significant impact on our network and customer supply.

These impacts include over-voltage and voltage swings on the low voltage network, affecting customer loads, causing PV systems to trip off (reducing output) and necessitating (partially effective and expensive) network augmentation and potential restriction of PV system connection.

Ergon Energy has placed a high priority on identifying solutions and products to mitigate these problems including lower cost, more effective alternatives to network augmentation.

Aims and expectations

This project, laboratory tests and field trials two different products from different manufacturers.

Product 1 is a single phase 10kVAR capacitive only type of unit. For this product, the distribution transformer would be tapped down then the unit would supply capacitive VARs to boost the voltage when needed. This system can address out-of-balance voltages.

Product 2 is a three phase 20kVAR Statcom that can act as both a capacitor and inductor. Although the product is a three-phase unit, it does not address out-of-balance issues on the network.

Field trials will be undertaken in Townsville on a low voltage network that suffers from voltage fluctuations, as a result of both high load and high PV. This will allow practical assessment of the capability of LV Statcoms to mitigate PV related voltage issues in a real situation.

Project phase

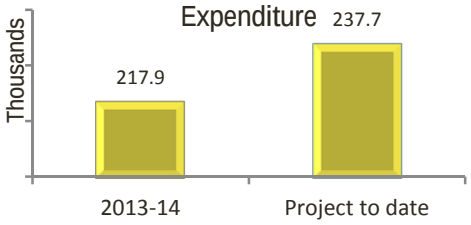
Indicates current phase

Benefits and outcomes

- Improved low voltage supply quality
- Allows for increasing amount of PV without the need for network augmentation
- Can be installed in brownfield sites that do not have customer VAR inverters but are experiencing low voltage network issues

Issues

- One of the products on order does not address out-of-balance issues. While not impacting the project, having this feature (as they are further developed) would provide better network outcomes



Implementation progress (as at July 2014)

1. Statcom units supplied from suppliers
2. Laboratory testing
3. Field trial installation and commissioning

Ratings

Update summary

Products have been purchased from Varentec and ZBB. Both products have been laboratory tested and installed in the field as part of the field trial evaluation. Project is currently collecting data. Final report is due at the end of October 2014.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Large Statcom

Nature and scope

Ergon Energy has extensive networks of long rural and remote feeders that are being stressed by the increasing demands placed on them by modern customer electricity needs, and by the increasing prevalence of distributed generation, particularly residential PV.

The Large LV Statcom project will trial a three-phase 300kVAR unit on the Ergon Energy network. The main application is to support the voltage on a long medium voltage rural feeder with voltage regulation issues, partially due to higher penetration of PV, and avoid the conventional network upgrade, which may otherwise be required.

Aims and expectations

Distributed LV Statcoms are low voltage power electronic products that have the ability to inject both capacitive and inductive reactive power into the electricity network. Project expectations are:

- confirmation (or not) of the learning hypothesis
- identification of the control methodology for large LV Statcom to optimise voltage profile while avoiding deleterious impacts such as inter-unit hunting
- broad brush investigation of optimal placement of these devices
- evaluation of product capability to provide the desired performance
- comparison of the value of large LV Statcoms coupled to the MV, versus small distributed LV Statcoms in LV networks.

Project phase

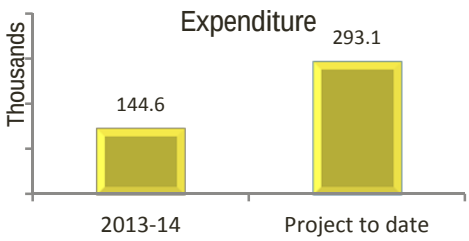
☆ Indicates current phase

Benefits and outcomes

- Operation and deployment
  - Settings and impacts determined through modelling
  - Costing information provided to planning for inclusion in AER submission
  - Control procedures and processes developed with system controllers
- Design and installation
  - Civil works complete
  - Lines works currently being installed
- Ongoing trial and evaluation
  - Trial system has operated with no major problems
  - Statcom continuing to support the network

Issues

There are no current issues in the project



Implementation progress (as at July 2014)

1. Factory acceptance and laboratory testing completed
2. System delivered
3. Trial installation and commissioning

Ratings

Update summary

The Large Statcom project is currently in the field trial phase with ongoing monitoring and performance analysis. The Statcom is continuing to support the network through reactive power control, with no major problems. The trial is due to finish in October 2014. Based on current performance and results, the business will review potential deployment of the solution.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Customer PV Voltage Control

Nature and scope

The rapid uptake of residential solar photovoltaic (PV) systems is having a significant impact on the Ergon Energy low voltage (LV) network, particularly on the quality of voltage that a customer will receive. Both over and under voltages are experienced, affecting customer appliances and potentially causing PV systems to trip (reducing output). This restricts PV system connection and can lead to expensive network upgrades.

New grid connected inverters are now becoming available on the market with advanced Reactive Power control functionality. A possible lowest cost option to avoid Voltage Rise issues is to use customer owned inverters with Reactive Power functionality to self-manage their voltage levels on the LV network.

Project phase

☆ Indicates current phase

Benefits and outcomes

- ▲ Fixed non unity power factor testing completed and successful results
- ▲ Dynamic control functionality testing has been completed, analysis currently underway

Issues

- ▼ Final report has been delayed, because of delays with laboratory testing

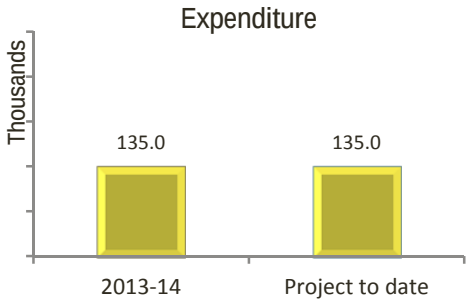
Aims and expectations

The project has two main stages of the evaluation:

1. Fixed non unity power factor
2. Dynamic control functionality

The project aims to test and evaluate the suitability of using customer-owned inverters to self-manage their voltage levels on the LV network.

- Market survey to identify suitable products
- Modelling and simulations
- Laboratory testing
- Field trial
- Final report



Implementation progress (as at July 2014)

1. Develop test plan
2. Modelling, simulations and lab testing
3. Installation and commissioning
4. Analyse data and produce final report

Ratings

- Develop test plan: ■
- Modelling, simulations and lab testing: ■
- Installation and commissioning: ■
- Analyse data and produce final report: ■

Update summary

In January 2014, the interim report was completed, which detailed the result from Stage 1 of testing. This work contributed to formulation of the updated IES connection policy, which calls for 0.9lag power factor for IES greater than 2kVA.

Field trials for the dynamic control functionality have occurred and data analysis is currently underway. Some minor parts of the laboratory testing are still to be completed and the final report is due in the coming months.

■ Target is fully achieved within the timeframe. ■ Target is partly achieved within the timeframe. ■ Target is not achieved within the timeframe.

Solar Energy Management system

Nature and scope

This project represents development of a world-first firm solar system with a Solar Energy Management (SEM) controller that is capable of continuous operation, overcoming solar intermittency, displacement of electrical consumption, increasing the penetration of cost-effective renewable energy technology, and providing reliable renewable energy.

As a utility energy management tool the system is capable of simultaneously satisfying both renewable energy supply and electricity network demand management objectives.

This project will develop, prototype and evaluate this firm solar system through the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in collaboration with Ergon Energy and heating and cooling manufacturer GWA Group.

Aims and expectations

The expectation is that an operating model is produced that shows the demand reduction and energy-related benefits to both the customer and Ergon Energy of the SEM system. In effect it will assist in determining the opportunity to develop a solution for residential air conditioning that removes the electrical demand from the distribution network when needed.

Ergon Energy being involved in such an activity will allow a significant opportunity for improving both its community standing both in the electricity industry and the residential market.

Project phase

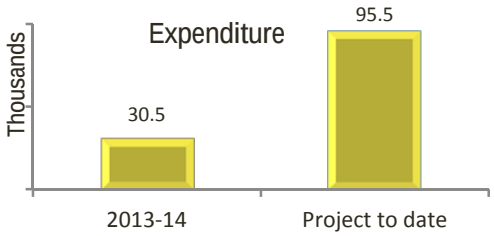
☆ Indicates current phase

Benefits and outcomes

- Engagement of customers
- GWA delivered the prototype to CISRO in Newcastle
- Conduction first round of testing
- Completion of milestone 1 and 2 leading to secure further project funding
- Ergon Energy allocated a dedicated channel to activate the DRED control to test Control Centre sending signal on regular basis to residential sites

Issues

- Data gathering phase to continue in order to develop detailed learnings from project



Implementation progress (as at July 2014)

Ratings

1. Start of project
2. Milestone 1 achieved: customer engaged, baseline data collected, first project report delivered
3. Milestone 2 achieved: design of the system completed, prototype delivered, first test result displayed

Update summary

The Project team have designed, developed and assembled a SEM prototype, including developing a technical specification, and have undertaken testing and planning in relation to system installation at the three host sites. The following activities are now completed: draft specification provided to Ergon Building and testing of SEM prototype; development of technical design, implementation and installation guide. The project will provide a new product that is able to avoid energy cost on air conditioners. The testing was successful so far and the test units provide cooling for the test families. All project partners agreed that further testing will occur even if the project is closed because the results are vital for the deployment of the product.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Network Embedded Solar Thermal

Nature and scope

The Network Embedded Solar Thermal (NEST) project quantified the key economic benefits that may arise from developing Concentrating Solar Thermal (CST) electricity generation in the distribution network, namely the potential network benefits in grid constrained areas, and the employment that could ensue from CST development, with the correct policy settings.

The project further developed some of the specific issues raised in the Australian Solar Institute's (ASI) *Review of the Potential for Concentrated Solar Power (CSP) in Australia*, which was undertaken by IT Power.

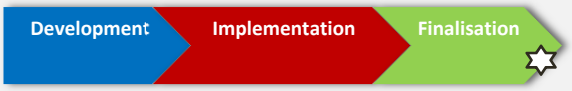
The project also focused on the considerable barriers that network connection may pose to CST development and potential macro-economic benefits of CST development.

Aims and expectations

The project completed the following aims:

- identified and mapped locations where CST could provide cost-effective network support, quantify the value that providing 'network support services' could yield for CST electricity generators, and the resulting cost-effective CST capacity that could be installed between now and 2025
- quantified the potential employment deriving from various scenarios of Australian CST deployment.

Project phase



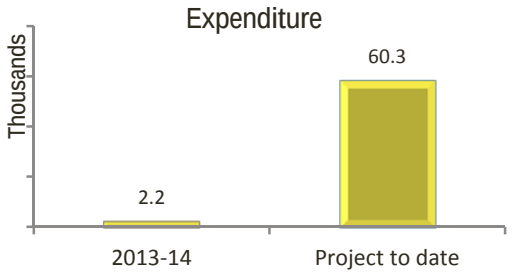
☆ Indicates current phase

Benefits and outcomes

- Identify network constraints in Ergon Energy area and other locations across the National Electricity Market (NEM) capable of supporting solar thermal solutions
- Develop key case studies using the latest Levelised Cost of Energy (LCoE) pricing assumptions for solar thermal technologies and possible revenue streams including gap funding requirements
- Ergon Energy has demonstrated good working relationships with the Australian Solar Thermal Industry and its supporters

Issues

- The cost analysis reported is based on a Levelised Cost of Energy calculation (LCoE) and does not report a project developer view with Net Present Value (NPV) and cash flow methodologies. Ergon Energy raised this as an interpretation issue with readers of the report.



Implementation progress (as at July 2014)

Ratings

1. The final report was completed by the project team before 31 August 2013

Update summary

The Final Report *Breaking the Solar Gridlock* was reviewed by ARENA and officially launched in Brisbane on 6 February 2014. Ergon Energy was well represented, presented at the opening and supported the workshop activities. The project achieved all of its targeted objectives.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

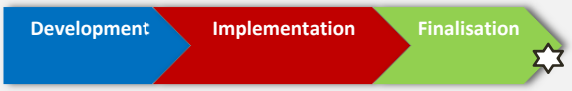
Cool Roof Trial

Nature and scope

Ergon Energy is facing critical challenges in managing peak demand and utilisation of its distribution network.

This is a collaborative project with industry partners and Queensland University of Technology (QUT), bringing together multi-disciplinary expertise in the electricity sector, infrastructure, scientific testing and modelling, in developing a roof coating system that maximises energy and demand reductions for customers.

Project phase



☆ Indicates current phase

Benefits and outcomes

- ▲ Good range of trial sites chosen (commercial, school, university and residential) and application of coating system applied
- ▲ International desktop study completed by QUT. Measurement and verification commenced following roof coating application

Issues

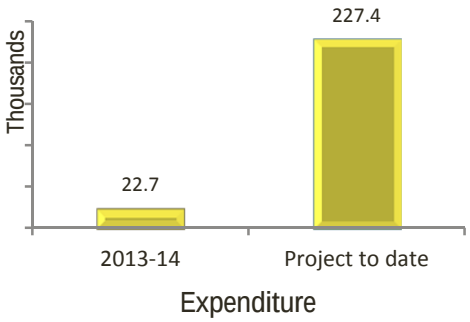
- ▼ Delays with completion of final report

Aims and expectations

The trial aims to develop a scientifically valid testing regime that validates the performance of cool roof products, and quantifies the energy and demand reductions with prescribed confidence.

With assistance from industry expertise the trial will also look to shape a product for the end market user.

Ergon Energy's requirement is a product that has been tightly specified to achieve quantifiable demand reductions across the life of the product.



Implementation progress (as at July 2014)

Ratings

1. International desktop study completed by QUT
2. Field trial sites completed
3. Measurement and verification period completed, providing valuable data on energy and demand effect. Final report completed and circulated

Update summary

Project completed and closed out. Final field report completed and circulated to internal stakeholders.

The final project report fell short of some of the desired expectations and project outcomes. The project did demonstrate proven temperature and consumption reduction (kWh) from the application of cool roof paint. The findings with respect to demand remain somewhat inconclusive, with variability across different trial sites. The intent was to quantify the impact on demand reduction such that the application of this Energy Management Concept could be quantified so a 'deemed value' could be used for other demand management projects.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Adaptive LED Streetlight Systems

Nature and scope

The Adaptive LED Streetlight Systems project will validate 'smart' lighting system performance in both laboratory and field conditions.

The project has received Australian Government funding under the Clean Technology Innovation Program (CTIP). It is collaboration between the Guided Innovation Alliance (Ergon Energy as project lead, with QUT and Smart Grid as partners), LED Roadway Lighting, and three site hosts – Townsville City Council, Ipswich City Council, and Brisbane Airport Corporation.

This Adaptive LED Streetlight Systems project will validate their performance and builds off previous and recent trials. Successful completion of the project will lead to a deployable product that provides benefit to public lighting customers and Ergon Energy.

Project phase

☆ Indicates current phase

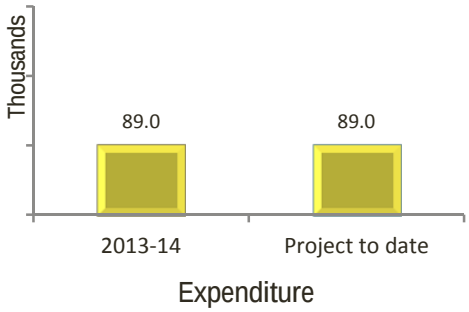
Benefits and outcomes

▲ Demonstrate the performance ability of adaptive LED technology in relation to demand savings

Aims and expectations

The project aims to:

- laboratory and field test the Adaptive LED Streetlight technology
- measure the energy performance of P and V Class LED luminaires compared with existing HID light (Mercury Vapour and High Pressure Sodium)
- demonstrate the enhanced LED light control systems ability to further increase energy and demand savings, from 60% with its current LED luminaire to 80% with the adaptive light control system.



Implementation progress (as at July 2014)

Ratings

1. Formal collaboration agreements established with host sites, lighting manufacturers and testing laboratories
2. Detailed lighting designs completed

Forthcoming

3. Training in installation requirements
4. Site installations
5. Laboratory testing of light

Update summary

The project is slightly behind schedule but with no material impact on the final project milestone and completion date. The key focus of the project has been on activities related to formalising agreements with host sites and determining lighting designs.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Super Conductor

Nature and scope

High Temperature Superconducting (HTS) power cables significantly increase the network capacity and flexibility by replacing conventional electrical assets with new cryogenic technology. It is expected that HTS will become a standard technology to be implemented in Ergon Energy's network beyond 2020.

To begin the HTS program, Ergon Energy intends to implement 600 metres of HTS power cable in Toowoomba network as a pioneer project in 2015-20. The experience gained from the design, construction, implementation, maintenance and operation, will benefit the future of this technology in Ergon Energy.

QUT is involved in the HTS implementation study. The academic support provided by QUT plays a key role in the whole process of HTS technology implementation.

Project phase

☆ Indicates current phase

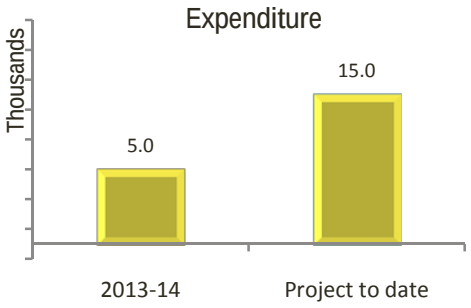
Benefits and outcomes

- Knowledge transfer of HTS technologies between partners
- QUT establishing the first 'Applied Superconductivity Lab' (ASL) in an Australian university
- ASL to pursue applied research with potential involvement from the power industry. These applied research topics would be expected to have a near term application for benefits and improvements in the Australian power grid.

Aims and expectations

The project aims to provide research findings on the introduction of HTS into the power network to:

- manage long-term capacities (>20 yrs) of the future power systems in heavy-urban, high-density and the CBD areas in their major centres
- eliminate multiple voltage transformations where possible
- use distribution voltages to supply sub-transmission and transmission loads
- replace 132kV and 110kV feeders in heavy density urban areas with HTS underground networks
- use 11kV and 22kV switching stations instead of 33/11kV, 66/11kV, 110/11kV, 110/33/11kV, 66/22kV and 132/22kV zone substations, especially in urban areas where sites for the future zone substations and transmission corridors are always problematic
- manage increasing fault levels
- reduce capital investment for the network.



Implementation progress (as at July 2014)

Ratings

1. Progress towards completion of HTS Business Case by October 2014

Update summary

The current investigation project is complete. However, Ergon Energy will continue a technology-watch on the HTS technology and may initiate a new project to actively test HTS for use within the network. The investigation program revealed that HTS can provide advantages to traditional network solutions under the right conditions.

Target is fully achieved within the timeframe. Target is partly achieved within the timeframe. Target is not achieved within the timeframe.

Appendices

Appendix A. Summary findings: completed and closed projects

NEST Project

Project Scope

A collaborative research study aimed to show energy derived from concentrating solar thermal power (CST) can be a cost-effective solution to augmenting Australia's power grid, saving almost $1 billion in network investment.

With electricity prices rising steeply across the country, the study reveals that CST plants, which provide large-scale energy storage, could reduce the need for new electricity poles and wires and help cut consumer energy bills. At the same time, using CST plants in the national grid could provide a pathway to significant investment in CST in Australia.

The study examined the benefits of installing CST at key points in electricity networks, where major network investment is planned to cope with growth in demand or with problems with voltage.

The Australian Solar Thermal Energy Association (AUSTELA) led the research collaboration that included the University of Technology, Sydney's Institute for Sustainable Futures (ISF), the University of NSW, and Ergon Energy.

With funding provided by the Australian Renewable Energy Agency (ARENA), AUSTELA, and Ergon Energy, additional support came in the form of essential data from seven power-network companies operating in the National Electricity Market.

Outcomes and findings

The key findings are:

- The results indicate that CST could avoid the need for network augmentation in 72% of the constrained areas examined, i.e. in 48 locations. Altogether, 93 constraints, or constrained areas, were considered, of which 67 had sufficient information to make a determination. If constraints were limited to only those with solar resources better than 21 MJ/m2/day DNI, CST could avoid the need for augmentation at 94% of locations.
- Altogether, installation of 533MW of CST at grid-constrained locations was found to be cost effective during the next 10 years, and an additional 125MW had a cost benefit between -$20 and $0 per MWh. Across all states, the average plant was 40MW, with 10 hours storage, and the average and lowest LCOE were $202/MWh and $111/MWh respectively.
- The network support payment was not found to be a crucial factor to CST plant viability in most locations, although it certainly contributed to the overall cost effectiveness, and made a major contribution in some locations.
- A key requirement is for network data to be harmonised, and rules established to enable project proponents easier access to timely data, in formats that support scenario modelling.
- While Regulatory Investment tests have provided consistency and rigour in economic analysis of network investments, adjustments may be required in order for the benefits of CST (and other forms of distributed generation) to be considered appropriately, and to enable greater scope for private investment and innovation.

Smart Voltage Regulator (SVR) Trial

Outcomes and findings

The Smart Voltage Regulator unit performed above expectations with one minor operational issue when used in a reverse power flow situation (this will be fixed in the next release of the product).

The use of this type of product presented a few operational issues which need to be considered:

- The constant voltage output of the unit results in resistive loads having fixed power consumption. When network line voltage drops in normal instances (which occurs for example when the network is highly loaded) resistive and some inductive loads reduce their power consumption, the conservation voltage reduction (CVR) effect. With this unit in place, this CVR effect does not occur for the network, which can increase overall network loading. As such the impacts on the network in utilising the product are not all positive, with the most extreme outcome being overload or voltage collapse.
- The regulation of the load side also presents issues when the unit is used to hold the voltage down to allow PV injection. Before the installation of the unit, since the line voltage would rise, the PV would trip off at 255V. With the unit, the output voltage is maintained at a constant value, thus pushing the input voltage up and this would be potentially much higher than 255V. It is only when the unit by-passes that the PV will see a voltage above the set point and trip off. This by-pass of the unit could also present a voltage step change of greater than 16V.
- The use of the unit would only be suitable for use on 100kVA transformers (if placed at the output of the transformer terminals). On larger transformers, careful monitoring of loads is required to ensure that the downstream load of the unit is within its ratings. Otherwise if the unit is placed along with low voltage feeder only, downstream customers will get the benefit of the unit while upstream customers will have to deal with the adverse effects that could arise (like higher voltages).

Cool roof Trial

Outcomes and findings

The final project report fell short of some of the desired expectations and project outcomes. The project did demonstrate proven temperature and consumption reduction (kwh) from the application of cool roof paint. The findings with respect to demand remain somewhat inconclusive, with variability across different trial sites. The intent was to quantify the impact on demand reduction such that the application of this energy management concept could be quantified, so a ‘deemed value’ could be used for other demand management projects.

Appendix B. 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
ARENA	Australian Renewable Energy Agency
ASI	Australian Solar Institute
ASL	Applied Superconductivity Lab
AUSTELA	Australian Solar Thermal Energy Association
AutoDR	Automated Demand Response – or another name for the commercial energy management system, which is the process of managing customer demand automatically
BAC	Brisbane Airport Corporation
CBD	Central Business District
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Constraint	A condition whereby a limit, that has been pre-set to a declared criteria, is exceeded.
CSP	Concentrated Solar Power
CST	Concentrating Solar Thermal
CTIP	Clean Technology Innovation Programme
CVR	Conservation Voltage Reduction
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 Side Management (DSM)	Demand Side 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.
DF	Distribution Feeder
DLC	Direct Load Control
DMIA	Demand Management Innovation Allowance
DMIS	Demand Management Incentive Scheme
DNSP	Distribution Network Service Provider
DR	Demand Reduction – amount of electrical load that can be removed for a period of time
DRED	Demand Response Enabling Device
GIA	Guided Innovation Alliance
GUSS	Grid Utility Support System
HID	High Energy Discharge Light usually Mercury Vapour or High Pressure Sodium
HTS	High Temperature Superconducting
ICC	Ipswich City Council
LCoE	Levelised Cost of Energy

LED	Light Emitting Diode
LRL	LED Roadway Lighting
LV	low voltage – 240V or the voltage used in residential houses
MD	Maximum or Peak Demand
NEM	National Electricity Market
NER	National Electricity Rules
NPV	Net Present Value
Network Limitations	A network limitation can be defined as a situation when the high voltage network is unable to supply electricity to the customer in accordance with the following supply standards. Network limitations which relate to system peak loading are: (i) Acceptable standards of reliability of supply cannot be maintained. (ii) Acceptable network voltage levels cannot be maintained. (iii) The thermal rating of plant and equipment is exceeded. (iv) The fault rating of equipment is exceeded. (v) The age, condition or specifications of equipment renders its continued use operationally unsafe, unreliable or uneconomic
PF	Power factor. The ratio of active power to apparent power. A unity power factor indicates no reactive power in the element.
PV	PV stands for photovoltaic, which is a technical term for solar power generation.
QUT	Queensland University of Technology
RAG	Red Amber Greed, project rating
RIN	Regulatory Information Notice
SEM	Solar Energy Management System
Statcom	Static VAR compensator
SVR	Smart Voltage regulator
SWER	Single Wire Earth Return. Distribution to customers using a single wire conductor with the greater mass of Earth as the return path.
TCC	Townsville City Council
UG	Underground electrical network construction.
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

Customer Service
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7.00am – 6.30pm, Monday to Friday

Faults Only
13 22 96
24 hours a day, 7 days a week

Life-Threatening Emergencies Only
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