AusNet Electricity Services Pty Ltd

Demand Management Innovation Allowance Annual Report 2014

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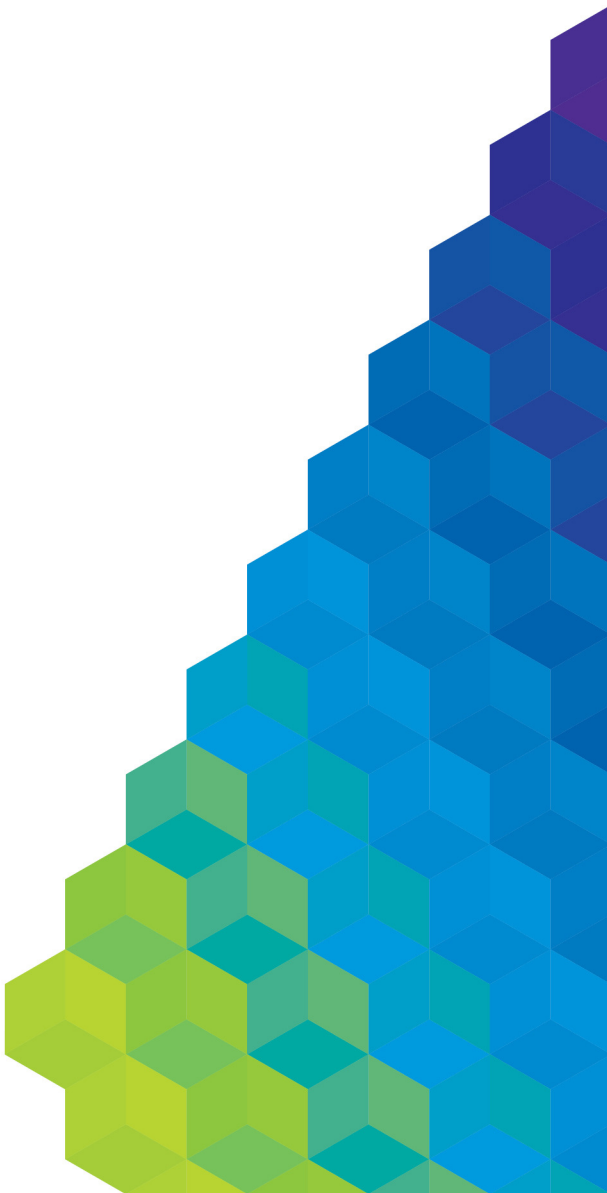

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1 Introduction

This annual report has been prepared pursuant to the Demand Management Incentive Scheme (DMIS) scheme applied to AusNet Services by the AER in the 2011-15 Victorian Electricity Distribution Price Determination (the 2011-15 Price Determination). The Demand Management Incentive Scheme provides revenue designed to encourage innovation in demand side participation.

The DMIS requires AusNet Services to submit a report on expenditure attributed to the Demand Management Innovation Allowance (DMIA) for each regulatory year. This expenditure must fulfil the DMIA criteria set out in the DMIS.

This report details the DMIA projects undertaken by AusNet Services in the 2014 calendar year which satisfy the DMIA criteria.

DMIA expenditure claims to date are summarised in the following table.

YEAR	2011	2012	2013	2014	2015
STATUS	Approved	Approved	Approved	Claimed	Pending
Mallacoota hot water time clock adjustment	$10,715				
Residential battery storage trial		$148,760	$51,643	$174,416	
Grid Energy Storage System (GESS)		$40,000	$246,095	$2,437,495	
Mallacoota sustainable energy study			$29,100	$22,010	
Solar forecast uptake study			$33,000		
Annual total	**$10,715**	**$188,760**	**$359,838**	**$2,633,921**	

2 Background to the DMIA

In the 2011-15 Price Determination the AER approved a DMIA of $3 million for AusNet Services. The DMIA is provided as an ex-ante allowance in the form of $600,000 (real 2010) of expenditure at the commencement of each year of the 2011-15 regulatory period. While it is provided on an annual basis, AusNet Services has the flexibility to select an expenditure profile over the period which suits its needs. The total amount of expenditure recoverable under the DMIA cannot exceed $3 million (real 2010) in total.

The expenditure recoverable under the DMIA must satisfy the following DMIA criteria:

1. Demand management projects or programs are measures undertaken by a DNSP to meet customer demand by shifting or reducing demand for standard control services through non-network alternatives, or the management of demand in some other way, rather than increasing supply through network augmentation.
2. Demand management projects or programs may be:
    a. broad-based demand management projects or programs—which aim to reduce demand for standard control services across a DNSP's network, rather than at a specific point on the network. These may be projects targeted at particular network users, such as residential or commercial customers, and may include energy efficiency programs and/or
    b. peak demand management projects or programs—which aim to address specific network constraints by reducing demand on the network at the location and time of the constraint.
3. Demand management projects or programs may be innovative, designed to build demand management capability and capacity and explore potentially efficient demand management mechanisms, including but not limited to new or original concepts.
4. Recoverable projects and programs may be tariff or non-tariff based.
5. Costs recovered under the DMIS:
    a. must not be recoverable under any other jurisdictional incentive scheme
    b. must not be recoverable under any other Commonwealth or State/Territory Government scheme and
    c. must not be included in forecast capital or operating expenditure approved in the distribution determination for the regulatory control period under which the DMIS applies, or under any other incentive scheme in that determination.

Expenditure under the DMIA can be in the nature of capital or operating expenditure. Capex made under the DMIA is likely to be treated as capital contributions and therefore not rolled into the regulatory asset base (RAB) at the start of the next regulatory control period. However the AER's decision on this will only be made as part of the 2016-20 Victorian Electricity Distribution Price Determination.

3 DMIA Reporting Requirements

Under Section 3.1.4.1 of the, AusNet Services' DMIA annual report must include:

1. The total amount of the DMIA spent in the previous regulatory year, and how this amount has been calculated.
2. An explanation of each demand management project or program for which approval is sought, demonstrating compliance with the DMIA criteria detailed at section 3.1.3 with reference to:
    a. the nature and scope of each demand management project or program,
    b. the aims and expectations of each demand management project or program,
    c. the process by which each project or program was selected, including the business case for the project and consideration of any alternatives,
    d. how each project or program was/is to be implemented,
    e. the implementation costs of the project or program, and
    f. any identifiable benefits that have arisen from the project or program, including any off peak or peak demand reductions.
3. A statement signed by a director of the DNSP certifying that the costs of the demand management program:
    a. are not recoverable under any other jurisdictional incentive scheme,
    b. are not recoverable under any other state or Commonwealth government scheme, and
    c. are not included in the forecast capex or opex approved in the AER's distribution determination for the next regulatory control period, or under any other incentive scheme in that determination.
4. An overview of developments in relation to projects or programs completed in previous years of the regulatory control period, and any results to date.

4 Residential Battery Storage Trial

4.1 Project Overview

AusNet Services' Residential Battery Storage Trial investigates the capability of battery and inverter systems connected to consumer homes to reduce residential peak demand. The systems are fully programmable and can be remotely controlled by AusNet Services.

The battery systems are capable of shifting customer demand from peak to off-peak times by discharging whenever the customer's instantaneous demand is high, and by re-charging overnight when the customer's demand is low, or recharging using excess solar generation. The flexibility provided by the programmable inverter makes this type of system capable of both addressing specific network constraints and providing broad-based demand management across the network if rolled-out in sufficiently large numbers.

DMIA expenditure was approved for this project in 2012 and 2013 and AusNet Services is claiming an additional $174,416 under DMIA for this project in 2014. Further DMIA costs are expected to be incurred during the completion of the operational phase of the project in 2015.

4.2 Nature and scope

This trial delivered an integrated residential storage solution to ten customers, with a combination of batteries, solar PV, inverters, metering and energy management systems. The storage systems have internet connectivity enabling remote changes to system settings, retrieval of data and manual control of system operation. Data from the trial has been collected for a period approaching years.

4.3 Aims and expectations

This trial explores how battery storage at the residential level can be used for management of customer peak demand. The main aims of the trial were to:

- Ascertain whether local storage can be used to flatten the network demand profile;
- Ascertain whether Solar PV / Storage combinations can be used to manage peak demand;
- Inform the potential effect of controlled/uncontrolled charging of electric vehicles;
- Inform the economic viability view of distributed storage as a means to manage peak demand and defer network asset investment; and
- Investigate the behaviour of solar PV systems and their contribution to network voltage management challenges.

4.4 Process of project selection

An important issue for the electricity supply industry is the management of network peak demand, given that this is a key driver of augmentation capital expenditure. One method of managing network peak demand is to reduce or smooth individual customers' own demand profiles. Methods to achieve this include offering time of use tariffs, utilising Demand Response Enabled Devices (DRED) and the use of battery storage technology. Battery storage was identified as an emerging technology with a strong but untested potential to generate both network and customer benefits.

Another issue that is predicted to emerge is the impact to the network caused by a growing uptake of electric vehicles. In order to effectively manage the network, utilities need to better understand this technology and the changes to customer demand patterns it may drive.

The Residential Battery Storage Trial has been selected as it has the potential to address both of the above issues. The Residential Battery Storage Trial will assess the ability of residential batteries to

effectively shift peak demand to off peak periods and to simulate the impact of electric vehicles on the network by operating the residential battery in a similar manner to an electric vehicle.

4.5 Project implementation

By the end of 2013, the project transitioned from the installation phase to the operational phase. During 2013, nine out of ten systems were installed and undergoing site acceptance testing to validate functionality and data collection.

Figure 4.1 An installed Residential Battery Storage System (batteries in lower compartment of cabinet, inverter/charger and control system in upper compartment), and wall-mounted solar inverter.

In early 2014, all ten systems were installed and operational. Data gathered during the summer of 2013/2014 was analysed and led to the identification of several potential operational improvements to the systems. These improvements have since been implemented and are currently being trialled during the summer of 2014/2015.

4.6 Implementation costs

The approximate total cost of this project is $374,819. The expected cost has increased since last year due to the development of new operational functions and algorithms following the first summer of operation.

Expenditure in 2014 amounts to $174,416 and includes both capex and opex components. These costs are made up of:

- The accrued costs of the residential battery storage system hardware;
- Development costs for system design, programming and testing;
- Contractor services for electrical works to install the systems; and
- Costs related to project management, data analysis and project implementation and monitoring.

4.7 Benefits

The expected benefits of the project are to enable AusNet Services to:

1. Assess the potential for deferred network augmentation through managing transformer and feeder peak demand. This can be measured by observing whether a battery is able to supply sufficient charge to limit the household peak demand.
2. Support the transition to smarter networks by studying how energy management solutions such as batteries and EVs can be integrated into the network for demand management. This can be measured by observing the installation of the system at a household level. This benefit will be realised through future planning for storage and EVs in the network.
3. Understand and test the use of domestic storage coupled to local renewable resources to mitigate intermittency of renewable generation and thereby provide a demand management facility that extends the usefulness of the solar PV into the domestic peak demand period.

5 Grid Energy Storage System (GESS) Trial

5.1 Project Overview

In 2012 AusNet Services initiated a Grid-scale Energy Storage System (GESS) project to trial the use of a large battery storage system to defer asset augmentation by managing peak demand and at the same time to explore other benefits of storage systems to network management.

The GESS will shift demand on a particular feeder from peak to off-peak times by discharging during feeder peaks and re-charging overnight when the feeder demand is low. In practice, the GESS is suited to addressing a specific network constraint, and is containerised to allow portability to different locations as required.

Whilst not yet cost competitive, this innovative technology is being trialled in anticipation of lower battery prices in the future. Large battery systems offer demand levelling and voltage support services which can not only defer asset investment but also improve the quality of supply to customers.

By the end of 2014, the GESS was installed, operational and undergoing testing. The system is located in Thomastown and is connected part-way along the WT12 feeder from Watsonia zone substation. A two year trial plan including the summers of 2015/16 and 2016/17 has been developed and is now underway. A report will be issued at the end of every summer / winter period setting out results, limitations and learnings. The findings of this trial will inform AusNet Services' asset management and demand management strategies in the future.

DMIA expenditure during 2012 and 2013 has been approved for this project and AusNet Services is claiming an additional $2,437,495 of expenditure under DMIA for 2014. Further DMIA costs are expected to be incurred for this project during the operational phase in 2015.

5.2 Nature and scope

The project involves installing a large (1 MW / 1 MWh) battery system including four-quadrant inverter to support the peak load on a 22kV distribution feeder that exhibits a mix of residential and commercial customers. The trial will provide operational data to verify performance of the battery, inverter and control system to support the grid for peak demand, voltage and power factor. The system has been designed to provide a full 1 MWh of storage capacity after 10 years of service therefore the initial installed capacity is in excess of the nominal 1 MWh rating.

The system includes a 1 MW diesel generator set to extend the MWh rating of the battery system to provide full coverage of the peak demand period. This has been done in order to keep the costs of the entire system down while fully simulating a larger capacity battery system. Battery prices are expected to decline in the medium term offering good potential for an efficient low emission solution for grid support. The system is capable of working in both grid parallel and island mode as required.

Only the battery, inverter, controller and associated costs are claimed under the DMIA.

5.3 Aims and expectations

AusNet Services is exploring grid connected storage as a means of managing network demand and deferring augmentation in areas of forecast capacity constraint. The benefits of additional functions such as voltage support, power factor correction and phase imbalance will also be explored.

Ongoing development of batteries and smart controllers has made battery storage an attractive technical option. AusNet Services intends to gain knowledge and experience in this technology by conducting this trial project. It is expected that if the trial is successful, the grid storage solution will have potential for wider deployment subject to sufficient reduction in battery prices in the medium term.

5.4 Process of project selection

In 2012 AusNet Services conducted a feasibility study into a trial of large scale energy storage in terms of the costs and the availability of the technology and suppliers. It was found that the technology was available and that there were adequate numbers of experienced suppliers in the market to implement such a trial.

Six potential locations for the trial were considered: Euroa (BN1), Clyde North (CLN21), Ringwood North (RWN26), Thomastown (both TT7 and WT12) and Watsonia (WT13). These locations were evaluated based upon the peak demand levels, voltage support requirements, islanding potential and demand growth forecasts.

Thomastown WT12 was chosen as a preferred location to conduct the trial based upon the evaluation results and because it offered flexibility to conduct experimentation, which is an important part of the trial. After the initial trial, it is expected that the system will be relocated to a more critical location. All units are containerised so that they can be moved to alternative locations once the trial period is complete.

5.5 Project implementation

In March 2013 a Request for Proposal was issued which closed on 21st June 2013. Twelve tender submissions were received. The submissions indicated that there were sufficient reputable and experienced suppliers with proven equipment at comparable prices to ensure that the probability of a successful trial was high.

After a formal and competitive tendering and assessment process, a contract was awarded to ABB Australia Pty. Ltd. (consortium of ABB Australia as lead party, and Samsung Korea) for the design and construction of the GESS.

By the end of 2014, the GESS hardware had been delivered and installed, and commissioning tests were underway to allow the trial phase to begin during the summer of 2015/16. Delays were experienced during project design, delivery and testing as a result of the complexity and uniqueness of the system, with new approaches required to be developed to implement the system within the AusNet Services network operations environment.

Figure 5.1 The GESS, installed and operational. Battery containers are in the background, with the inverter, transformer and switchgear containers in the foreground.

A two year trial plan has been developed including the summer peak periods of 2015/16 and 2016/17. The trial plan comprises a comprehensive range of tests including: peak demand lopping, power factor (pf) correction, voltage support, voltage waveform harmonics, current waveform

harmonics, negative sequence voltages, phase load balance, flicker and islanded operation including transitions to and from islanded supply. A report will be issued at the end of every summer / winter period setting out results, limitations and learnings.

The supplier will continue to support AusNet Services with an ongoing service and maintenance contract for a 2 year period after final commissioning during the trial period.

5.6 Implementation costs

The total costs for the GESS including a two year trial period are estimated to be around $6.6 million. This is made up of both company initiated capex and opex, and the DMIS utilising the Demand Management Innovation Allowance (capex and opex).

The DMIA has allowed the trial to take place, and learnings to be captured in preparation for large scale storage systems becoming available as cost effective and innovative non-network solutions to manage peak demand as well as improve a range of other network parameters.

In 2014 the $2,437,495 of claimed DMIA costs are related to:

- Stage payments due as per the contract for supply, delivery, testing and commissioning;
- GESS site annual lease; and
- Project management and engineering costs including appropriate labour charges.

5.7 Benefits

The expected benefits of using large-scale storage connected at grid-level include the ability to defer asset augmentation, improve power quality and reduce the risk of customer outages. A key output of the GESS project will be an ability to quantify these benefits.

Specifically, the trial will provide AusNet Services practical experience to better understand and assess the level of network value that grid-scale energy storage offers in:

- Managing peak demand;
- Reducing levels of network energy-at-risk;
- Deferring asset augmentation;
- Offsetting operational costs such as hire of temporary generators;
- Improving power factor, voltage and other power quality parameters; and
- Supplying customers in islanded mode.

Benefits of undertaking the trial also include gaining experience in the practical considerations of deployment and grid-integration of large-scale battery systems such as protection settings and supporting infrastructure requirements. Significant experience has already been gained in this area through the process of implementing the system within the AusNet Services network operations environment.

The trial will inform future innovation and applications of the grid-scale energy storage in other areas of the distribution network. This trial will help to establish whether battery storage is a credible non-network solution to managing demand and set the parameters around when it can be economically deployed for the benefit of energy consumers.

6 Mallacoota Sustainable Energy Study

6.1 Project Overview

AusNet Services has partnered with the Mallacoota community through the Mallacoota Sustainable Energy Group (MSEG) and the East Gippsland Shire Council (EGSC) to investigate non-network alternative electricity supplies to the Mallacoota community.

During 2014, AusNet Services contributed to funding a consultancy to prepare a feasibility study into distributed electricity supply options that provide improved reliability of supply to customers and incorporate sustainable generation technologies.

The study essentially covers options to meet customer demand via a mini-grid (embedded generation, storage and control systems) and therefore reduce reliance on bulk network supply. This approach is suited to addressing specific localised areas on AusNet Services' network, such as remote locations, where there is a high cost of augmentation to serve increasing demand or improve reliability. In such locations, the use of non-network alternatives such as mini-grids may provide a significantly lower cost option to network augmentation.

DMIA expenditure was approved for this project in 2013, and AusNet Services is claiming an additional $22,010 of costs for this project under the DMIA for 2014. This claim covers AusNet Services' portion of the final payments to the consultant for the feasibility study. This report is now publicly available via the EGSC website.

6.2 Nature and scope

The project involved the commissioning of a consultancy report into the feasibility of sustainable distributed energy supply options to Mallacoota that improve customer supply reliability and can potentially avoid network upgrades. The study was commissioned by a consortium involving AusNet Services, MSEG and the EGSC.

The scope of the study included analysis of Mallacoota's energy supply needs, review of recent electricity network performance and outages, review of current network infrastructure, availability of local renewable energy resources, assessment of generation and storage technology options, availability of demand management and energy efficiency potential, conceptual design of potential distributed energy supply solutions and preliminary financial modelling.

The study focussed on energy supply options involving a mini-grid arrangement that can supply the Mallacoota community in islanded mode during times of outage on AusNet Services' network.

6.3 Aims and expectations

The study aims to provide workable and financeable energy supply options that can improve customer reliability in the Mallacoota community in an environmentally sustainable manner. The results of the study form a base for commercial proponents to potentially take a project into development.

AusNet Services will apply the result so the study to help identify avenues for AusNet Services to invest in innovative non-network supply options to the extent that they are financially justifiable in improving supply reliability compared to increasing reliability of supply through network augmentation. The results of the study are also applicable to instances where there are emerging network constraints in remote areas and where network upgrades would otherwise be required address the constraint.

6.4 Process of project selection

The project was initiated by an approach made to AusNet Services by the Mallacoota community in 2011 expressing concern regarding the negative impact on the community of electricity supply outages. Being located at an extremity of AusNet Services' rural distribution network, Mallacoota experiences a relatively high number and duration of outages. These outages are primarily the product of the length of the overhead conductor, the highly vegetated terrain that the network traverses and the general exposure to natural events such as bushfires and flooding.

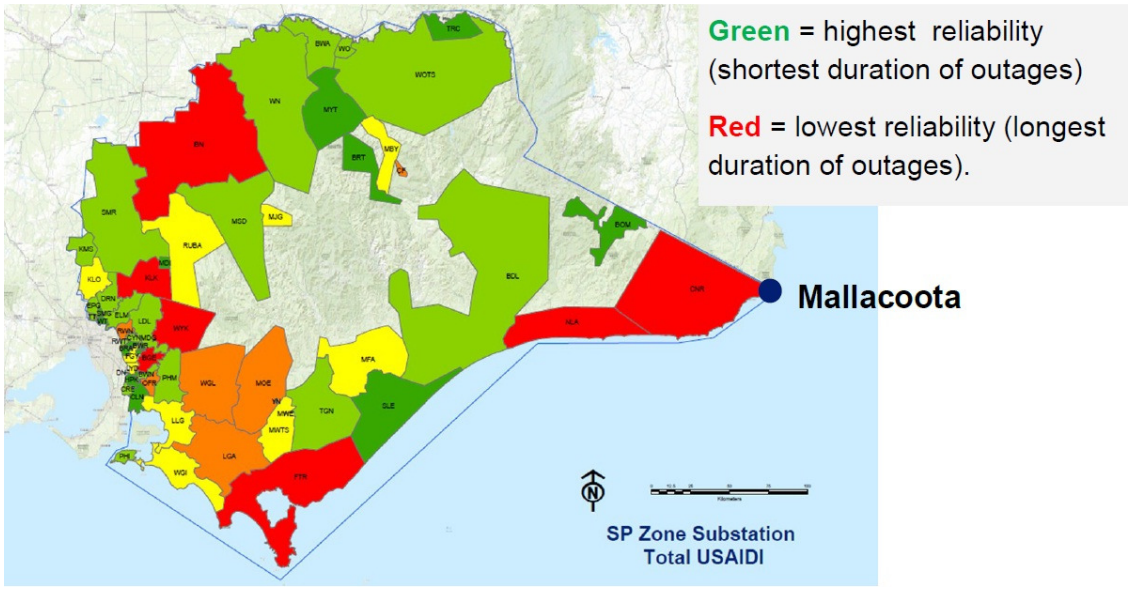


Figure 6.1 Relative network reliability by zone substation in 2013, excluding major events

AusNet Services has already invested in a number of initiatives to improve the reliability of supply and management of demand in Mallacoota, however the major causes of outage cannot be cost-effectively addressed through network solutions.

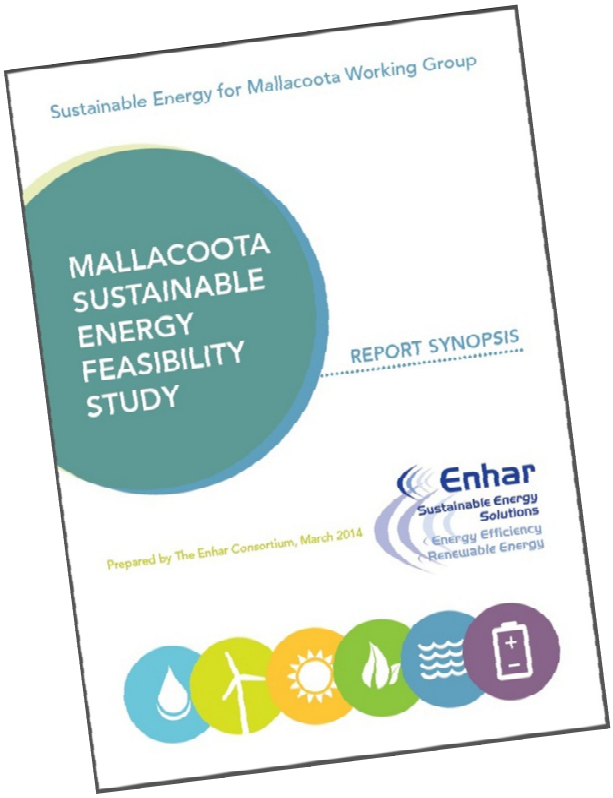
The Mallacoota community's decision to approach AusNet Services was therefore identified as an opportunity to work in partnership with a community to investigate innovative non-network alternatives such as embedded generation and storage to supply the Mallacoota community and improve customer reliability.

6.5 Project implementation

The project was implemented by the formation of the Sustainable Energy for Mallacoota Working Group (the Working Group), a consortium comprising AusNet Services, MSEG and EGSC.

The Working Group agreed to commission consultant to undertake a feasibility study and issued a Request for Proposal in May 2013. The contract was awarded in August 2013, a draft report was delivered in December 2013 and the final report was completed in April 2014.

A synopsis of the final report has been made publicly available on the EGSC website at: http://www.eastgippsland.vic.gov.au/Plans_and_Projects/Mallacoota_Sustainable_Energy.



The EGSC website also contains a link to request a copy of the full report.

6.6 Implementation costs

As a partner in the Working Group consortium, AusNet Services is contributing a portion of the consultancy costs for the feasibility study. During 2014 AusNet Services incurred costs of $22,010 (opex). AusNet Services claimed $29,100 (opex) for 2013, bringing the total nominal DMIA claim for this project to $51,110.

6.7 Benefits

The application of a mini-grid that can operate in islanded mode during times of outage on AusNet Services' network offers potential benefits in improving reliability for Mallacoota customers at a lower cost than network augmentation.

This study has put AusNet Services on a better footing to capture these benefits, both for Mallacoota and other locations, through:

- Increased technical and commercial knowledge of options to locally supply remote communities through embedded generation and mini-grids.
- Increased corporate awareness of the potential reliability benefits of non-network alternatives to remote power supplies.

7 Certification of costs

Appendix-1 of this report contains a statement signed by a director of AusNet Services confirming that the costs of the above demand management projects:

a. are not recoverable under any other jurisdictional incentive scheme,

b. are not recoverable under any other state or Commonwealth government scheme, and

c. are not included in the forecast capex or opex approved in the AER's distribution determination for the regulatory control period under which the DMIS applies, or under any other incentive scheme in that determination.

8 Developments in previous DMIS projects

The project to manage peak demand at Mallacoota (manage hot water peak) claimed against the DMIA in 2011 was completed in the same year and resulted in the net peak reduction of 0.5MW as reported. There are no further developments from this project to report.

The project to improve solar uptake forecasting claimed against the DMIA in 2013 was completed in the same year and resulted in updates to the forecasting model used by AusNet Services. There are no further developments from this project to report.