SP AusNet

Demand Management Innovation Allowance Annual Report 2013

March 2014

SP AusNet
A member of Singapore Power Group

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1 Introduction

This annual report has been prepared pursuant to the Demand Management Incentive Scheme (DMIS) scheme applied to SP AusNet 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 SP AusNet 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 DMIA the project undertaken by SP AusNet in the 2013 calendar year which satisfies the DMIA criteria.

2 Background to DMIA

In the 2011-15 Price Determination the AER approved a DMIA of $3 million for SP AusNet. The DMIA is provided as an ex-ante allowance in the form of $600,000 (nominal) of expenditure at the commencement of each year of the 2011-15 regulatory period. While it is provided on an annual basis, SP AusNet 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 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 next (2016-20) Victorian Electricity Distribution Price Determination.

3 DMIA Reporting Requirements

Under Section 3.1.4.1 of the, SP AusNet's 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

SP AusNet's Residential Battery Storage Trial will use battery and inverter systems connected to consumer homes to provide demand management and to simulate the potential capability of vehicle-to-grid enabled electric vehicles. The battery systems are fully programmable and can be remotely controlled by SP AusNet.

The battery systems are intended to shift 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. 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 SP AusNet is claiming an additional **$51,643** under DMIA for this project in 2013. Further DMIA costs are expected to be incurred during the operational phase of the project.

4.2 Nature and scope

This trial is delivering an integrated residential storage solution to ten customers, with a combination of a battery and solar photovoltaic (PV) cells and their associated inverters, metering and energy management systems. The storage system will have internet connectivity so control signals can be sent to start charging or discharging and to retrieve measurement data. Data from the trial will be collected for a period of two years.

4.3 Aims and expectations

This trial will explore how battery storage at the residential level can be used for peak DM to defer network augmentation as well as developing key insights into how electric vehicles may interact with the network in the future. Specifically over a two year trial period the project will endeavour 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 emerging issue for industry is recognising the need to reduce and/or smooth peak demand given that peak demand is a key driver of augmentation capex. Methods to smooth peaks include offering time of use tariffs, utilising Demand Response Enabling Devices (DRED) and the use of battery storage technology.

Another issue that is predicted to emerge is the impact to the network that may be caused by a large scale uptake of electric vehicles. In order to effectively manage the network, utilities need to better understand this technology and the behaviours which 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 the 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 was transitioning from the installation phase to the operational phase. During 2013, 9 out of 10 systems were installed and were undergoing site acceptance testing to validate functionality and data collection. The final of the 10 systems is scheduled for installation in early 2014.

The first of the systems was installed in early 2013. Operational testing at this site uncovered some issues that required a change of specification for the remaining systems, including the addition of PV to all sites, and subsequently delayed their installation until towards the end of 2013.

The operational phase of the trial will run for 2 years with continuous data capture and regular data analysis.

4.6 Implementation costs

The approximate total cost of this project is $300,000. The expected cost has increased since last year due to a change of system specification (following initial field testing) to include solar PV as part of all 10 systems.

Expenditure in 2013 amounts to **$51,643** and includes both capex and opex components. These costs are made up of:

- the accrued costs of the residential battery storage systems;
- contractor services for electrical works to install the systems; and
- costs related to project management, data investigation and analysis and project implementation and monitoring.

4.7 Benefits

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

1) Analyse 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 EV in the network.

3) Understand and test the use of domestic storage coupled to local renewable resources (solar PV, wind) and how it can assist to mitigate intermittency of 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 SP AusNet 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 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.

This project is to conduct the grid energy storage trial at Watsonia (feeder WT12). The findings of this trial will inform SP AusNet's asset management and demand management strategies in the future.

DMIA expenditure was approved for this project in 2012 and SP AusNet is claiming an additional **$246,095** of costs for this project under DMIA for 2013. Further DMIA costs are expected to be incurred for this project once the system is placed into service.

5.2 Nature and scope

The project involves installing a large (1 MW / 1 MWh) battery system to support the peak load at Watsonia. It is expected that the trial will provide operational data to verify performance of the battery, inverter and the controller to support the grid for peak demand, voltage and power factor.

The system includes a 1MW 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 but to fully simulate a larger battery system. Battery prices are expected to decline in the medium term offering good potential for an efficient low emission solution for grid support.

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

5.3 Aims and expectations

SP AusNet is exploring grid connected storage to manage network demand and to defer augmentation works until a clear demand growth trend emerges guaranteeing higher level of asset utilisation. Additional functions such as voltage support, power factor correction and phase imbalance will be explored to add to the benefits.

Ongoing development of batteries and smart controllers have made battery storage an attractive technical option. SP AusNet intends to get knowledge and experience in this technology by conducting this pilot at Watsonia. It is expected that if the trial is successful, the grid storage solution will have potential for wider deployment subject to the tipping point in the battery prices happening in the medium term.

5.4 Process of project selection

In 2012 SP AusNet 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 is available and there is adequate experience and suppliers in the market for such a trial.

Six potential locations for the trial were selected-Euroa (BN1), Clyde North (CLN21), Ring Wood North (RWN26), Thomas Town (TT7), Watsonia (WT12) and Watsonia (WT13). These locations were evaluated based upon the peak demand (unserved energy), voltage support, islanding and the demand growth.

WT12 was chosen as a preferred location to conduct the trial for 3 years based upon the evaluation and also 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 in the future after the trial.

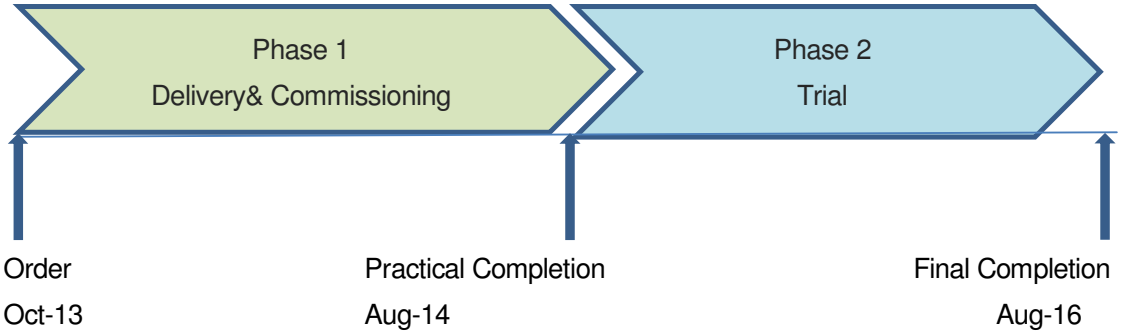
5.5 Project implementation

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

After a formal and competitive tendering and assessment process, a contract has been awarded to ABB Australia Pty. Ltd. for the design and construction of the GESS.

It is planned that project commissioning will occur in August 2014 and the GESS will be available for the summer 2014-15 and beyond.

The supplier will continue to support SP AusNet with an ongoing service and maintenance contract for a further 2 years after final commissioning during the trial period. During the 2 year trial the system will be used to manage; peak demand, voltage imbalance, power factor correction, reactive power control and various other power quality functions in grid parallel and island modes.



5.6 Implementation costs

The total costs for the GESS including two years trial are estimated to be around $5.2 million. This is made up of both company initiated ex-ante DM capex and pass-through costs, funded through the DMIS utilising the demand management innovation allowance (DMIA capex and opex).

The DMIA funds allow us to bring forward the trial and create knowledge in preparation for large scale storage systems becoming innovative, low emissions, non-network solutions that manage peak demand and other network parameters in a cost effective manner.

In 2013 the **$246,095** of DMIA costs are related to:

- Payment due upon signing of procurement contract
- Land survey for site design
- GESS site annual lease
- Project management and engineering costs.

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 SP AusNet practical experience to better understand and assess the level of network value that grid-scale energy storage offers in:

- managing feeder-level peak demand;
- reducing levels of network energy-at-risk;
- deferring asset augmentation;
- offsetting operational costs such as hire of temporary generators, and
- improving power quality.

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.

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

SP AusNet 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 2013, SP AusNet contributed to funding 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 SP AusNet's 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 on non-network alternatives such as mini-grids may provide a significantly lower cost option to network augmentation.

SP AusNet is claiming **$29,100** under DMIA for this project in 2013, and expects to incur further DMIA costs upon completion of the study in 2014.

6.2 Nature and scope

The project involves the commissioning of a consultancy report into the feasibility of sustainable distributed energy supply options to Mallacoota that improve customer supply reliability. The study was commissioned by a consortium involving SP AusNet, MSEG and the EGSC.

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

6.3 Aims and expectations

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

SP AusNet expects that the study will also provide avenues for SP AusNet 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 will also be applicable to instances where there are emerging network constraints in remote areas and where augmentation would otherwise be required address the constraint.

6.4 Process of project selection

The project was initiated by an approach made to SP AusNet 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 SP AusNet's 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 bush-fire and flooding.

SP AusNet 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 avoided through network solutions.

The approach to SP AusNet by the Mallacoota community was therefore identified as an opportunity to work in partnership with the 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) comprising SP AusNet, MSEG and EGSC.

The Working Group agreed to commission a feasibility study and issued a Request for Proposal in May 2013. The contract was awarded in August 2013 and the final report is due in February 2014.

6.6 Implementation costs

As a partner in the Working Group consortium, SP AusNet is contributing a portion of the consultancy costs for the feasibility study. During 2013 SP AusNet incurred costs of **$29,100** (opex). The remainder of costs for this project are expected to be incurred during 2014.

6.7 Benefits

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

This study will put SP AusNet 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 Solar Forecast Uptake Study

7.1 Project Overview

This project aimed to provide SP AusNet with a model to understand and predict demand for market uptake of distributed solar power. As a major determinant of the magnitude, profile and variability of demand for network services, it is important for SP AusNet to understand PV market drivers in order to target the development of demand management strategies and projects that are effective in reducing peak demand levels. This includes both broad-based demand management initiatives such as tariffs as well as localised peak demand management projects such as the application of storage and embedded generation.

A proof of concept study was undertaken to develop a preliminary model based on prior work by University of Technology Sydney's Centre for the Study of Choice (CenSoC) in the Australian market based on consumer behaviour. A spreadsheet model and associated descriptive material were delivered for the project, in addition to a series of meetings and one on one discussions between SP AusNet and CenSoC providing detailed explanations of the materials.

SP AusNet is claiming **$33,000** under DMIA for this project in 2013. The project is now complete.

7.2 Nature and scope

CenSoC conducted a proof of concept study of roof-top solar panel uptake and use in Victoria by coupling existing models from SP AusNet and CenSoC, and thereby identifying the gaps and requirements for building a customized model to predict uptake of solar panels and expected production output of residential rooftop solar panels within the SP AusNet network.

The following are the project deliverables provided by CenSoc:

- MS Excel based model of residential solar panel uptake integrated with existing SP AusNet model:
    - The model provides a set of correlations between solar uptake (both customer number and panel size) and a set of drivers;
- PowerPoint presentation of the outcomes of the proof of concept study including the analysis of gaps between the existing SP AusNet and the CenSoC model, and a summary of the conceptual model:
    - Detailing each driver researched in the customer choice model;
    - Detailing each driver's impact on solar uptake;
    - Description of gaps between integrated model and ideal model;
    - Summary of secondary research into trends of solar uptake drivers.

7.3 Aims and expectations

The project was intended to build SP AusNet's internal knowledge and capability in regards to understanding the mechanisms that drive PV uptake and the impact on network demand.

As the uptake of distributed solar power continues to grow, it is apparent that the management of demand at the residential level of becoming entwined with the impacts of PV. This includes changes to both the timing and magnitude of localised and network-wide demand peaks. SP AusNet therefore identified that understanding the outlook for solar PV uptake is critical to the development of demand management strategies and projects, including both broad-based demand management initiatives as well as localised peak demand management responses.

A particular example is the effect that solar PV has on shifting residential peak demand to later in the evening. The time of this evening peak is subsequently an input to the setting of efficient time-of-use tariffs. In some cases PV can also result in a shorter duration evening peak which would for example influence the design of residential storage systems that aim to reduce this peak. Understanding the outlook for PV uptake allows demand management responses such as these to be more efficient and effective in reducing peak demand levels and therefore deferring network augmentation.

The principle outcome of the proof of concept study was a modification to the existing MS Excel-based model used by SP AusNet to include a model of residential solar uptake based on panel prices, electricity tariffs, and government incentives developed by CenSoC using data collected on NSW solar customer choices. The model is to be evaluated for its predictive ability in the SP AusNet network by back-casting of past solar uptake. Evaluation of the model forecast, and associated research conducted during the engagement, will guide SP AusNet to develop an appropriate method for predicting solar uptake into the future.

7.4 Process of project selection

In reviewing its capabilities in the area of solar PV impact assessment, SP AusNet identified a gap in its modelling resources and an opportunity for improvement. The UTS CenSoC was identified as having done research in this area which could contribute to SP AusNet's knowledge base. Discussions with research staff from the CenSoC on their methodology identified that their approach was one which SP AusNet wanted to pursue as it was customer choice centric.

7.5 Project implementation

The project was initiated in April 2013 and concluded by November 2013.

A number of meetings between SP AusNet and CenSoC were conducted to discuss the details of the models supplied and developed during the course of the project and the supporting research. Initial discussion ensured agreement on the requirements for the developed model. The developed model and research was supplied to SP AusNet for review to enable sufficient interrogation and clarification of the materials through a number of discussions.

7.6 Implementation costs

During 2013 SP AusNet incurred costs of **$33,000** (opex). There are no further costs expected on this project.

7.7 Benefits

Understanding the outlook for PV uptake allows the full suite of demand management responses be more efficient and effective in reducing peak demand levels and therefore deferring network augmentation.

Undertaking this project has provided SP AusNet with:

- Improved robustness of solar uptake forecasting as an input to allow more targeted and informed demand management strategies and projects to be developed.
- Increased understanding of factors driving solar uptake, especially customer driven;
- Exposure to other methods of modelling, including statistical analysis techniques, with the potential to incorporate these methods in future projects including non-solar modelling;
- Clear understanding of the requirements for subsequent work for forecasting solar uptake.

8 Certification of costs

Appendix-1 of this report contains a statement signed by a director of SP AusNet 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.

9 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.