Demand Management Innovation Allowance Submission

2013-2014 Report to the AER

October 2014

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Contents

1 INTRODUCTION 1

2 GOVERNANCE 2

- 2.1 DMIA spending in 2013/14 2
- 2.2 Compliance with DMIA criteria 2
- 2.3 Statement on costs 2

3 DMIA PROJECT SUMMARY 3

4 NEW PROJECTS 4

- 4.1 Automated demand response for non-residential customers 4
- 4.2 Pool pump demand 5

5 EXISTING PROJECTS 6

- 5.1 Dynamic load control of small hot water systems 6
- 5.2 Subsidised off-peak hot water connections 9
- 5.3 Dynamic peak rebate for non-residential customers 11
- 5.4 CBD embedded generator connection 15
- 5.5 AS4755 air conditioner and pool pump load control 17
- 5.6 Grid battery trial (Newington) 19
- 5.7 Off peak 2 summer scheduling 22
- 5.8 Large customer power factor correction 24
- 5.9 Co-managing home energy demand 26
- 5.10 Verification of demand savings from energy efficiency programs 28

1 Introduction

This submission has been prepared under the Demand Management Innovation Allowance (DMIA) scheme applied to Ausgrid by the Australian Energy Regulator (AER) in the 2009 regulatory determination.

Under Section 3.1.4.1 of the AER's final determination for The Demand Management Incentive Scheme for the ACT & NSW 2009, Ausgrid is required to submit an annual report on expenditure under the DMIA for each regulatory year. The 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 capital expenditure (capex) or operating expenditure (opex) approved in the AER's distribution determination for the next regulatory control period, or under any other incentive scheme in that determination (such as the D–factor scheme for NSW).
4. An overview of developments in relation to projects or programs completed in previous years of the next regulatory control period, and any results to date.

Accordingly, this submission details DMIA projects undertaken by Ausgrid in the 2013/14 financial year.

2 Governance

2.1 DMIA spending in 2013/14

There were ten (10) ongoing DMIA projects under implementation and two (2) new projects under development for which we incurred costs in 2013/14. Ausgrid's submission identifies claimable costs incurred totaling $2,473,150. All costs incurred were a part of operating expenditure (opex) budget.

Actual costs incurred are collected from project codes in Ausgrid's SAP reporting system. The amounts claimed are those booked to each project in the applicable year. Costs include research amd development of projects, implementation costs, project management and other directly related costs.

2.2 Compliance with DMIA criteria

Information addressing items 2 a, b, d, e and f from Section 3.1.4.1 of the AER's final determination for The Demand Management Incentive Scheme for the ACT & NSW 2009 are found in the progress update for each individual project detailed in Section 4 and 5. Item 2c of Section 3.1.4.1 is addressed in Section 2.2.1 below.

2.2.1 Project selection process

Ausgrid has developed templates & guidelines for the development and implementation of projects or programs under the DMIA allowance that seek to investigate non-network alternative to reduce demand and defer network investment. When opportunities are identified for new projects, Ausgrid uses the following methodology when assessing projects for funding under the DMIA allowance:

1. **Concept Stage**: For new concepts, approval for project research and development is carried out by the Manager – Demand Management & Forecasting who ensures that the proposed project meets the funding criteria specified under the DMIA Scheme. This component of the project is defined as a Concept Stage 1 project.
2. **Development Stage**: Where early stage research and development indicates a potential viable demand reduction solution, the project is approved to proceed to the Development Stage 2 where a project proposal for a full trial is prepared. Approval to proceed to Stage 2 is by the Manager – Demand Management & Forecasting. The project proposal is prepared according to the Ausgrid DMIA template and guidelines, including additional criteria specified by Ausgrid (repeatability, suitability to geographically specific network constraints, and potential to be cost effective ($/kVA)).
3. **Implementation Stage**: The project proposal is reviewed by the Manager – Demand Management & Forecasting to ensure it meets the funding criteria specified under the DMIA Scheme and checks are also made to ensure that budget projects costs are within the DMIA allowance. After consideration of the available DMIA budget, proposed projects will be selected for inclusion in the DMIA program and recommended for authorisation at the appropriate delegation level. Projects approved to proceed to a full trial are defined as Stage 3 projects.

2.3 Statement on costs

In submitting this program for inclusion in the DMIA Scheme, Ausgrid confirms that the program costs:

- are not recoverable under any other jurisdictional incentive scheme;
- are not recoverable under any other State or Commonwealth Government scheme;
- are not included in the forecast capex or opex approved in the AER's distribution determination for the next regulatory control period; and
- are not eligible for recovery under the D-Factor Scheme.

3 DMIA project summary

Project	2013/14 Actual Cost (excl GST)	Year initiated
New projects (initiated in 2013/14)		
Automatic Demand Response	$24,931	2013/14
Pool pump demand study	$8,450	2013/14
New projects sub-total	**$33,381**	
Existing projects (initiated prior to 2013/14)		
Dynamic load control of small hot water systems	$20,642	2010/11
Subsidised off-peak hot water connections	$10,602	2011/12
Dynamic peak rebate for non-residential customers	$1,269,686	2011/12
CBD embedded generator connection (Phase 1 and Phase 2)	$101,636	2011/12
AS4755 air conditioner and pool pump load control	$585,715	2012/13
Grid battery (Newington)	$259,026	2012/13
Off Peak 2 summer scheduling	$100,531	2012/13
Large customer power factor correction	$75,506	2012/13
Co-managing home energy demand	$12,537	2012/13
Verification of demand savings from energy efficiency programs	$3,889	2012/13
Existing projects sub-total	**$2,439,769**	
Total	**$2,473,150**	

4 New projects

4.1 Automated demand response for non-residential customers

4.1.1 Project nature and scope

This project will investigate the use of automated demand response technologies as a more efficient and flexible way of delivering customer demand reductions than traditional demand response aggregation techniques. Automated Demand Response (Auto DR) technologies have been designed to provide end-to-end automatic load reduction in response to a dispatch event, enabling eligible customers to initiate pre-programmed DR strategies throughout their facility without manual intervention.

Once Auto DR technology is installed at a customer's facility (eg. integrated into the building or energy management system), the investment made in Auto DR technology and systems can potentially deliver financial benefits for multiple numbers of years. The recent introduction of standard communication protocols and platforms such as the OpenADR protocol can potentially simplify, standardize and automate Demand Response so customers can more cost-effectively participate in demand response programs run by electricity utilities.

4.1.2 Project aims and objectives

The project objectives are:

(a) Investigate the Auto DR technology market and customer's willingness to adopt the Auto DR technology to determine the viability and size of the potential market for this demand management technique.

(b) Test the Auto DR technology and systems at customer's sites, preferably using an open standard communications protocol such as OpenADR.

(c) Test various levels of financial and in-kind incentives to explore customer participation, including the costs for installation of Auto DR technologies.

(d) Measure and verify the demand reductions achievable across a sample of participating customers.

4.1.3 Implementation plan

The project is still in the research and development stage with an implementation proposal due to be completed during 2014/15. The implementation plan is likely to include a trial of automatic demand response technologies and systems at customer sites during summer 2015/16.

4.1.4 Results

No results from the project can be reported as yet, with the project research and development stage scheduled for completion in 2014/15, and implementation of the project likely to occur from 2015/16 onwards subject to final approval of the implementation proposal.

Results from customer trials as part of the Dynamic Peak Rebate project (section 5.3) have indicated that customers with automated switching were able to respond with greater accuracy and speed to a demand response event, hence indicating the viability of Automatic Demand Response as a cost effective demand management solution.

4.1.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Budget Item	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Project research and development	$24,931	$25,000	$49,931
Total (excl GST)	**$24,931**	**$25,000**	**$49,931**

4.1.6 Project progress & identifiable benefits

Up until the end of June 2014 the main progress made has been in the research and development stages of the project.

No identifiable benefits have yet been defined for this project.

4.2 Pool pump demand

4.2.1 Project nature and scope

Pool pumps are a large residential appliance with an estimated 180,000 pool owners in Ausgrid's network area. The summer peak demand from residential pool pumps is estimated to be between 90 to 146 MW across the Ausgrid network area. The focus of this project will be to trial an energy efficient pool pump rebate offer for a sample of Ausgrid customers in a selected area of the Ausgrid network.

4.2.2 Project aims and objectives

The project has the following primary objectives:

(a) To test customer take up rates and marketing approaches for offering an energy efficient pool pump rebate in a selected trial area of the Ausgrid network.

(b) To measure and verify the diversified summer peak demand reduction achievable when an energy efficient pool pump (5-star or more) replaces a standard pool pump, taking into account real world conditions for customers in the Ausgrid network area.

4.2.3 Implementation plan

The project was still in the development stage as at June 2014 with implementation anticipated to proceed in 2014/15 once the implementation (stage 3) proposal is approved. It is envisaged that this project will involve marketing of a pool pump rebate offer to customers in a selected area of the Ausgrid network area for the purchase and installation of an energy efficient pool pump (5-star or greater). As part of the project, the demand reductions achievable across a sample of participants will be measured and verified.

4.2.4 Results

No results from the project can be reported as yet, with the majority of the project being planned to occur in the 2014/15 period.

4.2.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Budget Item	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Project research and development	$8,450	$10,000	$18,450
Project implementation		N/A	N/A
Total (excl GST)	**$8,450**	**N/A**	**N/A**

4.2.6 Project progress & identifiable benefits

Up until the end of June 2014 the main progress made has been in the research and development stages of the project including development of the project implementation proposal.

No identifiable benefits have yet been defined for this project.

5 Existing projects

5.1 Dynamic load control of small hot water systems

5.1.1 Project nature and scope

Ausgrid estimates that there are approximately 400,000 electric hot water systems in our network area not currently connected to a controlled load tariff (Off Peak 1 and 2). The majority of these systems would not be eligible for one of the existing controlled load tariffs due to their size (e.g. small electric storage hot water tanks in apartments less than 100 litres). In addition, there may also be systems that are eligible for an off peak tariff but the customer may have chosen not to connect, these systems may include medium or large size electric storage systems, solar electrically boosted or heat pump water heaters.

This project is aimed at trialling a load control option for small and medium sized hot water systems that involves turning off electricity supply to the tank for periods of typically three to five hours but only as necessary to actively manage network demand (5 to 10 days per year).

5.1.2 Project aims and objectives

The primary objective of this project is to determine the level of technical and financial viability for the dynamic control of small and medium sized hot water cylinders. Specific objectives can be summarised as follows:

(a) To determine a dispatchable control regime for application to small hot water heaters that provides satisfactory customer service and reductions in relevant peak demand.

(b) To determine the proportion of customers for whom this would likely be acceptable, and what level of marketing effort would be needed to achieve various take-up rates. Also to test the relationship between the take-up rate and the size of reward offered.

(c) To determine the level of diversified demand reduction per customer referenced to typical zone substation peak demand characteristics.

(d) To accurately estimate the costs of such a program for local, commercial implementation.

5.1.3 Implementation plan

The main elements of the project implementation plan are summarised below:

1. **Pilot (Phase 1)**: The concept of the pilot is to trial control of small hot water cylinders at approximately ten customer's premises. This pilot will test the workability of controlling such cylinders and will be demonstrated by the customer experience. Assuming the majority of installations pass the customer experience test then additional data from the trial will be evaluated in terms of, demand impact, metering profiles – pre and post control, percentage of time reset button used, etc. Phase 1 will also include having the data read and analysed for 30 random cylinders that have dedicated interval meters installed as part of a previous research project. This data will be used to provide an initial view of the load profile and diversity of usage of continuously supplied hot water cylinders; be the basis of analysis of the potential for control and design of the control regime; provide an element of the control group for analysis of impact of control on coincident demand. Some of these customers may become members of the larger trial.
2. **Market Research (Phase 2)**: Assuming that the pilot trial meets customer acceptability requirements, the next stage is to conduct survey / market research to refine product offerings. Typically a market survey would be undertaken to better understand the potential take-up rate, what reward structure would be required and how sensitive the take-up rate would be for the reward structure.
3. **Larger Trial (Phase 3)**: If the results of the pilot trial are positive, and the results of the market survey indicate that a satisfactory take-up rate could be achieved, then a larger trial will be undertaken to further prove the product viability as well as establish better information on performance and cost structure. This trial would cover up to 100 participating customers and as far as possible mimic the product, including enabling communications to the devices, realistic dispatching, and recovering meter data. Following this element, results will be analyzed and any issues arising from the trial will be addressed to determine how and if a further trial should proceed.
4. **Full Scale Trial (Optional Phase 4)**: A final optional phase is to undertake a full scale trial comprising about 1,000 participating customers to provide statistically significant results. Such a trial would also test all operational aspects as well as technical aspects of an actual deployment.

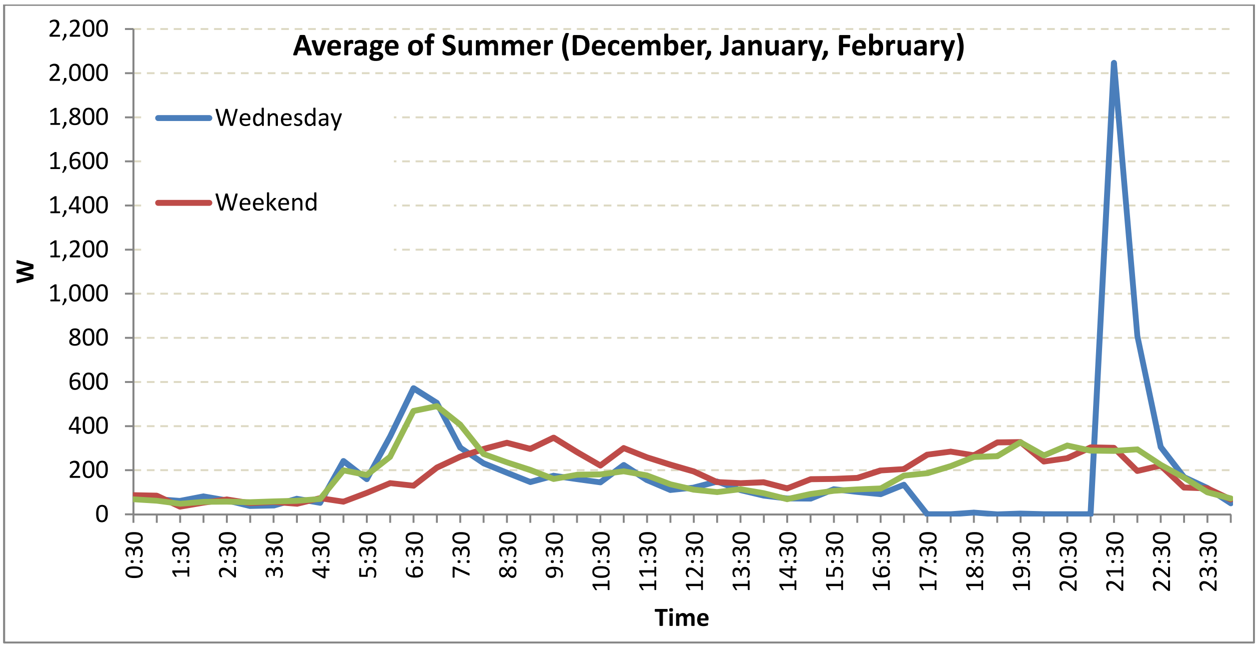
As reported in Ausgrid's DMIA submission to the AER for 2012/13, it was decided that there was insufficient justification to progress to Phase 4.

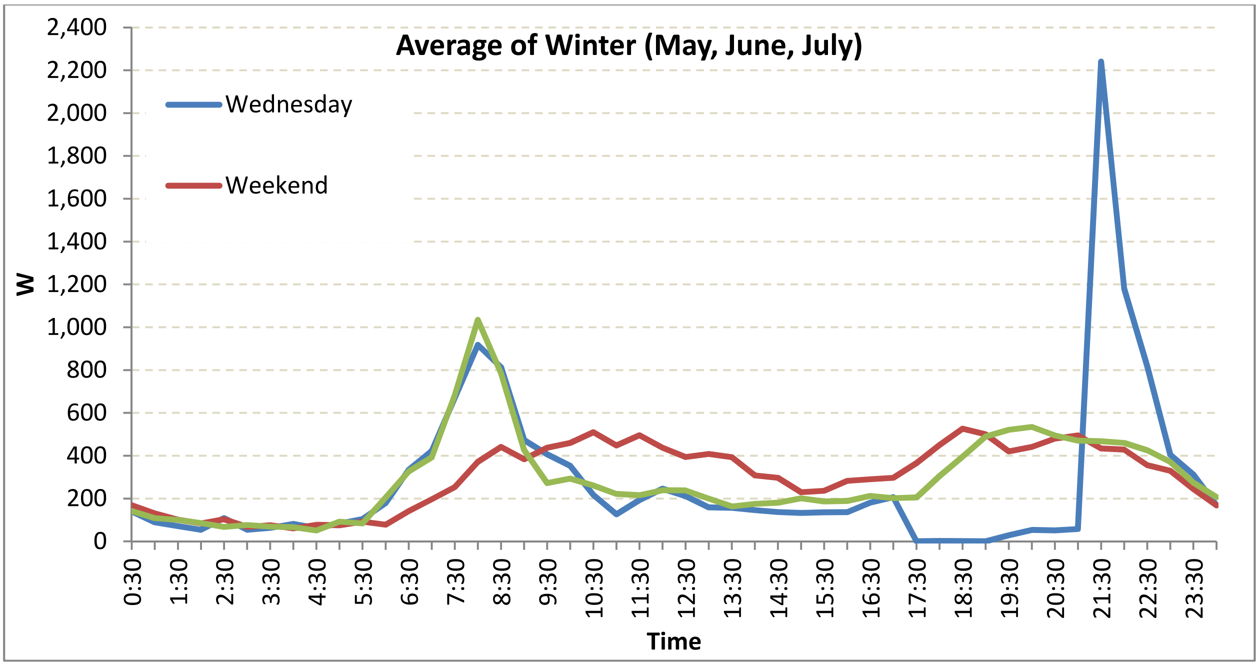
5.1.4 Results

During the 2011/12 and 2012/13 years the project progressed from the Phase 1 proof of concept pilot to the latter phase 2 and 3 parts of the project which encompassed a trial of controlling small electric hot water cylinders at approximately 60 customers premises. The marketing and technical results of this project were recorded in some detail in Ausgrid's DMIA submission to the AER for 2012/13.

During 2013/14 the main activities involved the decommissioning and removal of the control equipment from participating households after running the Phase 3 customer trial for two winters and one summer (Winter 2012, Summer 2012/13 and Winter 2013). Data collected from 19 electricity data loggers were recovered from customers' hot water electricity circuits and the data was analysed to determine the potential peak demand reductions achievable from this technique. The intention of the data loggers was to confirm, from a representative sample of cylinders, that the cylinders were actually switching off during the required time slots, and also to calculate the after diversity demand reduction that was actually achieved by switching the cylinders off during the control period.

Two graphs which summarise the summer and winter results respectively are shown below. The graphs compiled from the logger data confirm that the hot water cylinders were in fact being controlled according to program (off for four hours every Wednesday evening during the trial). Also the data gives indication of the after diversity demand, during the period of the whole day, for such cylinders. It can be seen that the after diversity demand at say 7pm in winter is in the order of 500 Watts per cylinder, whereas for example at 3pm on a summer afternoon the after diversity demand is only in the order of 180 Watts per cylinder. This information is essential in calculating any prospective benefits from broad based programs that may contemplate controlling these HW systems. The large restoration spike at the end of the control period is only because the cylinders in the trial were subject to the same control period. In practice this is managed by staggering the restoration time of hot water cylinders.





- A summary of the key lessons from the phase 3 trial include:A personally addressed letter is more effective than a personally addressed marketing piece.
- The amount of financial incentive, or level of subsidy, is only one of many factors affecting outcome.
- Strong sales support is needed to prevent registrations from dropping away.
- Take-up rate is challenging on a limited customer acquisition (marketing) budget.
- No negative feedback was received from customers as a result of having their small hot water systems cylinders turned off occasionally for several hours on one evening per week.
- The after diversity demand reduction for controlling the small hot water cylinders (afternoon or evening) is in the range of 180 to 500 Watts per cylinder depending on the time of day and the season.
- Install costs need to be reduced further for the method to be a cost-effective demand management solution for a targeted, or broad based, deployment. Development of a standardized demand response interface under the AS 4755 Australian standard for hot water cylinders may help to reduce complexity of installing a load control device and associated costs in the future.
- Until a lower cost acquisition model is verified, there is insufficient justification at this stage to undertake a broader rollout of the solution or its use for targeted demand management projects.

5.1.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

The phase 1 and 2 parts of the project were in collaboration with Transgrid, the transmission network service provider, considering the potential demand management benefits for the whole electricity network. Transgrid provided funding to conduct activities for the first two phases of the project.

Actual and projected project costs:

Budget Item	**2010/11 Actual**	**2011/12 Actual**	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Actual Ausgrid Expenditure (excl GST)	$15,296	$91,102	$120,463	$20,642	$40,000	$287,503
Actual Transgrid (phase 1 & 2 only)	$0	$27,000	$0	$0	$0	$27,000
Total (excl GST)	**$15,296**	**$118,102**	**$120,463**	**$20,642**	**$40,000**	**$314,503**

Transgrid has been invoiced for phase 1 and 2 only. Phase 3 operations are funded 100% by Ausgrid. The project is scheduled for completion in 2014/15.

5.1.6 Project progress & identifiable benefits

During 2013/14 the main project progress was the completion of the phase 3 trial period and commencement of close out activities for the project including analysis of results. Due to difficulty in contacting some of the participants, it is envisaged there will be a small amount of close-out work still required in 2014/15 to complete the project including final report writing.

The project has provided significant knowledge and learning on the cost structure of undertaking such a demand management technique. A key outcome from the project is that it has identified that typically small to medium hot water cylinders can withstand a reasonable amount of dynamic control. This point was not clearly understood prior to the trial. When the AS4755 interface is introduced for small to medium hot water cylinders, Ausgrid would revisit this approach to identify the cost effectiveness of controlling AS4755 compliant hot water cylinders in order to defer network investment.

As the trial was relatively small there are no material peak demand reductions achieved from this project.

5.2 Subsidised off-peak hot water connections

5.2.1 Project nature and scope

It is estimated that there are up to 100,000 electric hot water systems in houses across Ausgrid's distribution area that are currently connected to continuous electricity supply but could potentially be connected to off peak supply. These systems include electric storage, solar and heat pump models which can contribute up to 600 watts to winter peak demand and 200 to 300 watts to summer peak demand each year.

The subsidised off peak connection project was aimed at encouraging customers to connect eligible electric hot water systems to off-peak electricity supply by providing a connection subsidy. The implementation of the project initially included two phases; a market research phase and a customer trial including direct marketing of a subsidised off peak connection offer to customers in four different areas of the Ausgrid network area.

A third phase of the project commenced in 2013/14, involving the collaborative development of a pilot project with NSW Land and Housing Corporation (LAHC) to market a subsidised connection offer to NSW Housing tenants.

5.2.2 Project aims and objectives

To develop & demonstrate marketing approaches that will achieve high take-up rates of conversion of electric hot water systems from continuous supply to off peak electricity supply for the purposes of reducing peak demand in specific network locations. This demand management technique also has significant potential to reduce household energy bills.

5.2.3 Implementation plan

The initial project included two major phases of work in the implementation plan:

1. **Phase 1:** Market research to determine why large systems are not currently connected to controlled load and what barriers need to be overcome for customers to move them to off peak supply. This research was used to refine estimates of market size, marketing messages for customers, demand savings and determine take up rates for various price points.
2. **Phase 2:** A market offer of a subsidised off peak connection for eligible households with existing large electric hot water systems (over 100 litres) not connected to controlled load. For most customers, a flat fee of $99 or $199 was offered for this service, which included the meter and installation, wiring and documentation.

A third phase to the project was commenced in 2013/14 involving the exploration of an alternative marketing approach in collaboration with the NSW Land and Housing Corporation.

3. **Phase 3:** Subsidised off peak connection pilot offer to NSW Housing tenants. This phase involves the trial of a collaborative approach to customer acquisition so as to reduce program costs and improve cost effectiveness. In this phase, Ausgrid and NSW LAHC will share property and hot water system data to better identify eligible households.

5.2.4 Results

Summary of results for Phase 1 and 2

The project commenced with market research in September 2011 to determine current customer perceptions and barriers to connecting to controlled load. This research was followed by customer offers in the Phase 2 part of the trial with letter and marketing materials sent to 14,800 residential customers in four different areas of the Ausgrid distribution network area. The total completed jobs of those customers who registered interest was 104 giving an overall take up rate of only 0.7%.

For Phase 1 and Phase 2, the results were reported in detail in the 2012/13 DMIA Ausgrid annual report. Some of the key learnings from Phase 1 and Phase 2 included:

- Personally addressed letter is more effective than a personally addressed marketing piece.
- Amount of financial incentive, or level of subsidy, is only one of many factors affecting outcome.
- Strong sales support is needed to prevent registrations from dropping away.
- The acquisition cost per customer was high using this method and subsidy structure.
- Take-up rate is challenging on a moderate marketing budget.
- Until a lower cost acquisition model is verified, there is insufficient justification at this stage to undertake a broader rollout of the solution or its use for targeted demand management projects.

Development and implementation of Phase 3 pilot

Given the high cost of customer acquisition and relatively low take up rates of the Phase 2 customer trial, an alternative approach was investigated to explore more cost-effective customer acquisition approaches and to also target the offer towards low income and vulnerable households where the reduction in electricity costs might be more attractive. This alternative approach involved collaboration between Ausgrid and NSW LAHC who own and manage NSW government assets including 144,000 social housing properties across NSW. NSW LAHC hold details of the hot water system types and sizes at all of the properties they manage, which allows more efficient identification of properties for receiving an offer.

A project agreement between Ausgrid and NSW LAHC was signed during 2013/14 which allowed data sharing and identification of eligible properties in three Local Government Areas for an offer to be sent to around 100 selected households. The distribution of letters and management of the electrical works for connecting the eligible hot water system of interested customers to an off peak tariff is scheduled to occur during 2014/15, and will be managed by NSW LAHC.

5.2.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

The Phase 1 and 2 parts of the project were in collaboration with Transgrid, the transmission network service provider, considering the potential demand management benefits for the whole electricity network supply chain. Transgrid provided funding to conduct activities for the first two phases of the project.

Actual and projected project costs:

Budget Item	**2011/12 Actual**	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Phase 1 & 2: Ausgrid expenditure	$79,007	$35,818	$0	$0	$114,825
Phase 1 & 2: Transgrid expenditure	$12,000	$95,000	$0	$0	$107,000
Phase 3: Ausgrid expenditure	$0	$0	$10,602	$90,000	$100,602
Total (excl GST)	**$91,007**	**$130,818**	**$10,602**	**$90,000**	**$322,427**

5.2.6 Project progress & identifiable benefits

The project has provided significant knowledge and learning as to the cost structure and practical issues associated with the marketing of such a demand management technique. The trial has indicated that this approach to reducing peak demand is viable but as a long term broad based approach rather than for specific near term constraints due to the low take-up rate and likely resultant low volume of demand reductions.

The Phase 3 pilot with NSW LAHC was setup during the 2013/14 year, and implementation of this pilot is planned to occur during 2014/15. Learnings from this pilot will enhance our understanding of the cost structure for alternative marketing approaches for this demand management technique and also inform Ausgrid of the take up rates of this offer to low income and vulnerable households.

As the trial was relatively small there are no material peak demand reductions achieved from this project to date.

5.3 Dynamic peak rebate for non-residential customers

5.3.1 Project nature and scope

The Dynamic Peak Rebate (DPR) trial provided a financial incentive to medium to large non-residential customers to reduce their demand during the summer peak demand period on the 5-10 days of the year when network assets are operating at maximum demand.

Demand response is a common approach to reducing peak demand for short periods to defer capital investment and remove or reduce load at risk. In North America, some networks offer customers the opportunity to place their bid for demand reductions into an open tendering system in much the same way that network operators manage generators.

In the non-residential sector, the equipment type, usage and the financial and operational factors associated with demand reduction are likely to be highly variable and so the source of the demand reduction is also expected to vary. The DPR approach allows the customer to discover their own least cost demand reduction to supply reductions for network deferral or minimise load at risk.

The rebate approach is an alternative to the tariff approach where customers are penalised for electricity use during these peak events. For a distribution network business, rebates offer a number of benefits in comparison with tariffs:

- Rebates are believed to be viewed more favourably than tariffs (carrot vs. stick), potentially leading to higher takeup rates and lower acquisition costs
- Rebates do not require retailer participation, avoiding negotiation and billing management costs.
- Formal tariffs would have higher setup costs, whereas the lower setup costs for rebates would allow for a more nimble and responsive program operation, often required when delivering demand management programs
- Only those customers from network tariffs 305 and 310 have been selected for the trial. These customers use more than 160 MWh per year each and are supplied at low voltage. There are about 13,000 customers in this group and they use 9100 GWh of electricity each year (30% of total network delivered electricity).

5.3.2 Project aims & objectives

The high level objective is to determine the level of demand response (DR) available from the medium to large, low voltage, non-residential customer sector from a dynamic peak rebate offer.

Specific objectives are to:

(a) determine an offer structure which encourages market participation from aggregators,

(b) develop a methodology which fairly and accurately estimates expected customer electricity demand and determines the rebate levels from the customer response,

(c) identify the take-up rate for various incentive levels and for a range of customer types for both interruptibility and generator supply.

(d) identify the response rate from customers to reduce demand at peak periods in winter and summer.

(e) discover price point for range of DR types.

5.3.3 Implementation plan

The implementation plan included the following main phases:

1. **Program design & development**: Trial Program development included the preparation and release of a discussion paper to seek the views of key stakeholders (aggregators, energy consultants, technology providers, big retail customers, energy associations etc) about key issues of a final program design.
2. **Phase 1 – summer 2012/13 dispatch trial**: This phase commenced with the preparation and release of a discussion paper to seek the views of key stakeholders (aggregators, energy consultants, technology providers, large retail customers, & energy associations) about key issues of a final project design. This was followed by the release of the DPR offer, selection of aggregators, dispatch events, analysis of results and determination of recommendations for Phase 2.
3. **Phase 2 – summer 2013/14 dispatch trial**: The implementation plan for the summer 2013/14 dispatch trial consolidated the recommendations from the 2012/13 dispatch trial, including an offer release date earlier in the year to allow a longer lead time for aggregators to identify and contract demand response from customers. Final project analysis and reporting will occur at the conclusion of the summer 2013/14 dispatch season.
4. **Analysis & final reporting**: Final project analysis and reporting at the conclusion of the summer 13/14 dispatch season.

5.3.4 Results

Summary of results from Phase 1

The Phase 1 dispatch trial was completed in 2012/13 and is reported in more detail in Ausgrid's submission to the AER for 2012/13. Phase 1 results showed that significant demand reductions can be achieved by a DPR program targeted at non-residential customers, even with short notice (day ahead notice) and where larger high voltage sites are excluded. The baseline methodology was also successfully trialed, as were new dispatch criteria and a new dispatch portal. The selected aggregator for Phase 1 enrolled a total of 18 facilities which were able to deliver demand reductions through both load curtailment and generator dispatch. Peak demand reduction capability at each accepted site ranged from 40 to 600 kVA, providing a total committed demand response of 2.2 to 2.8 MVA, between the hours of 12 noon to 6 pm on working weekdays. Each site was dispatched 4 times and each event lasted for 4 hours. Knowledge from Phase 1 was incorporated into the second phase for the summer 2013/14 dispatch trial.

Summary of results from Phase 2

Phase 2 of the dispatch trial (or DPR II) was conducted during 2013/14. There were a number of key differences compared to the Phase 1 trial including:

(a) A larger trial area encompassing Epping/Ryde/Macquarie Park north of Sydney Harbour and Revesby/Padstow/Milperra to the south.
(b) Testing a variety of rebate levels depending on:
   i. type of advance notification (including "day of" and "day ahead")
   ii. type of demand response (ie load curtailment or generator dispatch)
   iii. location on the electricity network.
(c) Extending the marketing and customer enrolment time to five (5) months.
(d) Testing of a new *Adjusted High 4s of 5* baseline methodology.
(e) Allowance of compensation for partial delivery between 70% and 100% of committed demand reductions (CDR).

Four companies responded to the Invitation to Bid for Phase 2, and two aggregators were selected for the trial program. An important learning from Phase I was to allow sufficient time for customers to become "dispatch ready", and the marketing and customer enrolment time was extend to 5 months in Phase 2. This timeframe was to allow for:

(a) Marketing, development proposals and executing contracts
(b) Activating customer meter pulse ports (which can take up to 2-3 months)
(c) Installing site servers for real time monitoring and control
(d) Training of site personnel and acceptance testing of dispatch activation.

Demand reductions for the Phase 2 trial were sourced from a total of 38 customers representing a wide variety of types including telecommunication exchanges and broadcasting centres, a school, TAFEs, a university campus, a shopping centre, RSL clubs, a hotel, a data centre, commercial buildings, a beverage can manufacturing facility and a few small & light manufacturing businesses.

A summary of the dispatch performance for Phase 2 of the DPR trial is shown in the table below & on the following page.

Aggregator #1 **Event date**	**Type of dispatch**	**No of participating customers**	**Committed demand reduction (CDR) in kVA**	**Average delivered demand reduction (DDR) in kVA**	**DDR/CDR%**
10-Dec-13	DO & DA	34	7,330	6,900	94%
20-Dec-13	DO & DA	28	5,568	5,513	99%
16-Jan-14	*DO only**	*6*	*2,874*	*2,671*	*93%*
17-Jan-14	DO & DA	23	5,399	4,518	84%
31-Jan-14	DO & DA	24	5,358	5,109	95%
26-Feb-14	DO & DA	26	6,495	6,068	93%
5-Mar-14	*DA only**	*21*	*3,596*	*2,991*	*83%*
Aggregator total			**36,620**	**33,769**	**92%**

Aggregator #2 Event date	Type of dispatch	No of participating customers	Committed demand reduction (CDR) in kVA	Average delivered demand reduction (DDR) in kVA	DDR/CDR%
10-Dec-13	DO & DA	4	1,495	1,688	113%
20-Dec-13	DO & DA	4	1,354	1,392	103%
16-Jan-14	*DO only**	*No dispatch - contract limited to only 4 events*			
17-Jan-14	DO & DA	*No dispatch - contract limited to only 4 events*			
31-Jan-14	DO & DA	4	1,452	1,321	91%
26-Feb-14	DO & DA	*No dispatch - contract limited to only 4 events*			
5-Mar-14	*DA only**	*4*	*1,482*	*1,376*	*93%*
Aggregator total			5,783	5,778	100%
Program Total			**42,403**	**39,548**	**93%**

DO = “day of”, DA = “day ahead”

Each site was dispatched up to seven (7) times over the summer 2013/14 trial period , with five (5) of these events including both “day of” (DO) and “day ahead” (DA) notification, and one (1) event each for DO notification and DA notification only.

Summary of Aggregator #1 Performance

Aggregator #1 made an initial demand response offer of 10MVA. The maximum contracted demand reduction was 7.3MVA across 34 sites. For the events with both DO & DA notification, the total demand reductions delivered were estimated to range between 4.5 to 6.9 MVA, with credit for partial delivery performance being allowed. This is equivalent to an average performance of between 84% and 99% when comparing DDR to CDR. When compared to the maximum contracted demand reduction of 7.3MVA, the average performance per event is in the range of 94% to 62%. It is interesting to note that the best performance is at the start of the summer trial period, and the worst performance is in the traditional Christmas/January holiday period, with performance improving again in the late January and February period. The three main reasons for the reduction in CDR and DDR during the course of the summer period were:

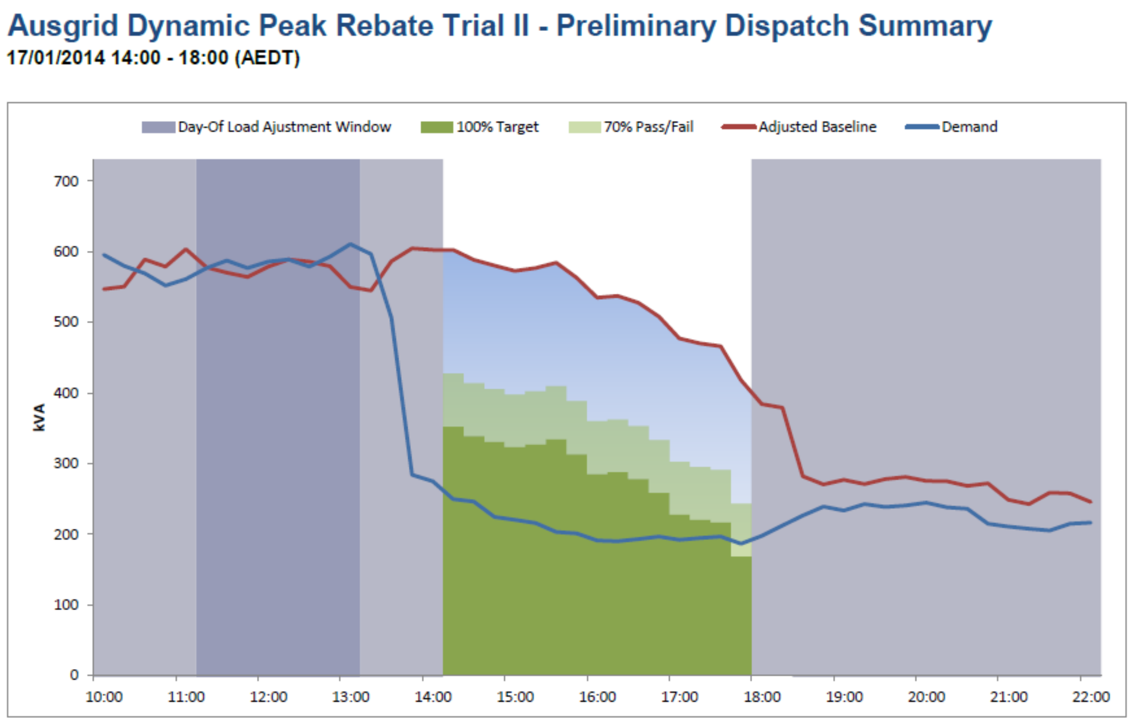
- Business activity commitments related to the Christmas period
- Manpower and BAU demand reductions due to shutdowns during the Christmas and New Year holiday period
- Technical issues.

Summary of Aggregator #2 Performance

Aggregator #2 made an initial demand response offer of 4.5MVA. The maximum contracted demand reduction was 1.5MVA across four (4) sites. For the events with both DO & DA notification, the total demand reductions delivered were estimated to range between 1.3 to 1.7 MVA, with credit for partial delivery performance being allowed. This is equivalent to an average performance of between 91% and 113% when comparing DDR to CDR. When compared to the maximum contracted demand reduction of 1.5MVA, the average performance per event is in the range of 88% to 113%.

For the whole program, 60% of the reductions were from customer generation and 40% from load curtailment.

The figure below shows an example of a successful dispatch event on 17th January 2014 at one of the participating customer sites. It shows the calculated baseline demand (red), the committed demand reduction (CDR) level (dark green), 70% of the committed demand reduction level (ie the threshold at which part compensation becomes payable to the customer) in light green, and the actual measured demand during the dispatch event (blue).



A full project close-out report for the Stages 1 & 2 of the DPR Trial will be issued by Ausgrid in the near future, including a comprehensive analysis of the program results.

5.3.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2011/12 Actual**	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Phase 1 – summer 2012/13 dispatch trial	$16,248	$315,918	$0	$0	$332,166
Phase 2 – summer 2013/14 dispatch trial	$0	$66,189	$1,269,686	$50,000	$1,385,875
Total (excl GST)	**$16,248**	**$382,107**	**$1,269,686**	**$50,000**	**$1,718,041**

5.3.6 Project progress & identifiable benefits

Both Phases 1 & 2 of the DPR trial have now been successfully completed, and no further stages are planned for this program.

The project has delivered a number of significant learning opportunities. A final close-out report will be publicly released in the near future with a comprehensive analysis of the program results.

Ausgrid plans to build upon the lessons learnt from this project by implementing this type of demand reduction technique as part of broad based activities for the 2014-19 regulatory period.

5.4 CBD embedded generator connection

5.4.1 Project nature and scope

It has been identified in several studies that embedded generation could defer or avoid the need for network augmentation investments by reducing peak demand. Proposals are becoming more common for the installation of cogeneration schemes based on natural gas fired generators. In addition, investigations have identified large numbers of standby generators located in commercial buildings in the Sydney CBD that could potentially provide network support.

To optimise potential benefits for both the customer and the network, the generators should be able to operate in parallel with the Ausgrid network. However because of the configuration of the CBD triplex network, parallel operation can cause particular technical issues which are prohibitively expensive to resolve using current approaches.

Fault levels on the CBD triplex system are generally high due to the high load densities, high capacity network assets, and a high capacity source. In many situations, the existing fault level is close to the specified fault duty limit of both network assets and customer equipment, and there is not a significant amount of fault duty “headroom”. The connection of embedded generators results in an additional contribution to the fault level, and can often result in equipment fault duty limits being potentially exceeded. Fault limiting approaches such as changing network topology, changing the point of connection, or installing fault level mitigation equipment are possible, but are only useful in limited circumstances and also relatively expensive. This factor has been the most common reason that embedded generation projects proposed for connection to the CBD system have failed to proceed.

The development of a technically feasible, economic, and practical connection solution is likely to promote a greater uptake of embedded generation in the Sydney CBD and other similar network locations. This in turn could defer or avoid the need for network capital investment by expanding the extent to which embedded generation can play a role in network support during peak demand periods.

5.4.2 Project aims and objectives

The aim of the project is to develop, design and test an alternative embedded generator connection in the Sydney CBD that is cost effective and addresses the potential fault level issues which are currently a barrier to their widespread uptake in these types of network locations.

Further, the proposed solution should be applicable to typical generator sizes in the majority of CBD locations and be substantially less expensive than current solutions.

5.4.3 Implementation plan

The implementation plan included two main components:

1. **Phase 1**: Consideration and analysis of the network design options to enable connection of generators at 11kV level while addressing the fault level and feeder imbalance issues, and identification of the preferred approach and conceptual design of the preferred option.
2. **Phase 2**: Identification of suitable site and installation of alternative embedded generator connection including detailed connection design. Monitoring and verification of connection to verify utility as demand management resource.

5.4.4 Results

Phase 1 of the project is complete and results have been reported in the previous Ausgrid DMIA submissions. The preferred design for the auto switching scheme comprised of three main features:

a) Logic functions in a PLC within the distribution substation

b) Control mode switches on the circuit breakers on the LV side of the distribution transformers at the distribution substation

c) Integration of status and control signals from the Sydney CBD triplex network and embedded generation.

The conceptual design showed that an embedded generator can be connected in such a way that installation costs are minimized, yet with no adverse impacts on the network or customer reliability. Although there are significant issues which would need to be resolved before the proposed solution could be implemented, the conceptual design and the costing provide an excellent basis for ongoing work.

Phase 2 began in March 2014, with work on the detailed design. This initial stage involved defining the relay requirements, and completing the relay allocation. The trial site was identified and a field inspection was conducted, and an engineering brief was drafted.

One of the most significant milestones that has been achieved is the ordering of the required protection equipment, including batteries, switches, panels, relays and controllers. The detailed design work is ongoing. Relay settings will be completed and the solution is planned to be installed in time for a trial in summer 2014/15.

5.4.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2011/12 Actual**	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Phase 1 – Design options and conceptual design	$39,251	$714	$548	$0	$40,513
Phase 2 – CBD connection trial		$5,726	$101,088	$310,000	$416,814
Total (excl GST)	**$39,251**	**$6,440**	**$101,636**	**$310,000**	**$457,327**

5.4.6 Project progress and identifiable benefits

Implementation of the Phase 2 connection design and customer trial is currently underway. No peak demand reductions have been achieved from this project to date.

5.5 AS4755 air conditioner and pool pump load control

5.5.1 Project nature and scope

Air conditioners and pool pumps are the largest residential appliances with no load control option currently available to customers and offer the greatest potential for residential demand reductions. The summer peak demand from residential air conditioners and pool pumps for the Ausgrid network area is estimated to be 1300-1700 MW and 70-100 MW respectively. The focus of this trial will be to test low cost direct load control options that are independent of a smart meter interface.

The voluntary adoption of the AS4755 interface standard (Framework for demand response capabilities and supporting technology for electrical products) by a number of air conditioner and pool pump manufacturers and the development of commercially available demand response enabling devices (DREDs) has substantially lowered the cost to introduce load control to these appliances.

The project will explore the potentially cost effective method of controlling residential air conditioners and pool pumps using AS4755 compliant devices and how this solution could form a component of demand management programs.

The project scope is considered to be complementary to existing and proposed trials by other Australian DNSPs.

5.5.2 Project aims and objectives

The primary objective of the trial is to test a minimum of two communication platforms and associated Demand Response Enabling Devices (DREDs) by which AS4755 compliant appliances can be controlled.

Secondary objectives of the trial include testing of the customer acquisition options to determine take-up rate and acquisition costs, to trial various dispatch methods and monitor customer acceptance and satisfaction and to measure and verify the peak demand reduction potential from air conditioner and pool pump direct load control.

5.5.3 Implementation plan

The project initially consisted of a research and development stage, followed by the two main implementation phases.

1. **Phase 1** of the project included testing and verification of the two communication platforms to be used for the trial through laboratory testing and a pilot with a small number of participants. The pilot and lab testing included establishment and testing of the dispatch systems and protocols as well as development of the Demand Response Enabling Devices (DREDs) to be used. A secondary objective in phase 1 was to test customer acceptance of the appliance control with a controlled group of participants (small pilot).
2. **Phase 2** of the project involves a customer trial which includes testing and development of techniques to identify and sign up participants from the general public (with around 100 participants planned), determine take-up rates and acquisition costs, further verify the communication platforms and DREDs, determine the response rate from customers to reduce demand and monitor customer acceptance and satisfaction.

5.5.4 Results

Phase 1 – technology pilot, technology development and customer response

The Phase 1 pilot was mostly completed during Summer 2012/13 with a small number of participants recruited to test the new DRED technology. The Phase 1 work included development of a prototype SMS DRED that utilises the publicly available mobile phone telecommunications network. Results from the Phase 1 part of the project have been reported in the previous Ausgrid DMIA report for 2013/14. These participants have been incorporated into the Phase 2 customer trial which is planned to continue until March 2015 to capture more data on performance.

Phase 2 – CoolSaver customer trial in Lake Macquarie and Central Coast areas

Phase 2 of the project is a customer trial, with the aim of testing a product offer with customers for direct load control of AS4755 compliant air conditioning systems, including the testing of the two signal receiver communications platforms (ripple signal and SMS communications). Participants in the trial areas were recruited to participate from December 2013 to early February 2014 with the trial planned to occur over two summer periods (Summer 2013/14 and Summer 2014/15).

A total of 16,000 customers supplied from selected zone substations in the Central Coast and Lake Macquarie areas were invited to participate in the trial by direct marketing techniques including personalised letters and phone calls. A total of 1200 customers (7%) registered their interest online, with 134 having an AS4755 compliant air conditioner (11% of total online registrations). The relatively low volume of AS4755 compliant air conditioners was not unexpected as AS4755 remains voluntary to date resulting in a limited number installed. In future we expect higher volumes of compliant units due to the voluntary adoption of the standard by many manufacturers and the expected modification to the standard to mandate adoption.

From the eligible air conditioners, 40 were fitted with ripple DREDs (Lake Macquarie trial area) and 68 with SMS DREDs (Central Coast trial area). Dispatch events were called on 9 separate days during the summer season with no negative feedback from participants. For the SMS DREDs, customers had the opportunity to override the dispatch event with no customers requesting an override through the automated SMS system. This phase of the trial will continue in 2014/15 to further test customer response to dispatch events.

Phase 2 also included further development of the mobile phone DRED by Ausgrid in order to customise the functionality. The SMS DREDs utilised for the Phase 2 air conditioner customer trial (CoolSaver) had customised communications modules and incorporated current sensors and data loggers for the purposes of measuring and verifying the demand reductions achievable. The development of a miniaturised version of the 3G SMS DRED was undertaken by a supplier who was able to provide 10 prototypes of the more compact unit for further testing. It is planned that these pre-commercial prototypes will be further tested in the laboratory and in customer pilots and trials to test their reliability and utility. The wide customer coverage, two-way communications and individual addressability available with the 3G SMS DRED offers a greater flexibility not available with ripple DREDs and it is these capabilities that will be explored further in future phases of the trial.

5.5.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Project research and development	$18,666	$0	$0	$18,666
Implementation Phase 1 – Pilot, lab testing and Demand Response Enabling Device (DRED) development	$140,342	$0	$0	$140,342
Implementation Phase 2 – Customer trial and further DRED development	$16,000	$585,715	$90,000	$681,715
Total (excl GST)	**$175,008**	**$585,715**	**$90,000**	**$840,723**

5.5.6 Project progress & identifiable benefits

Progress so far includes the successful development of a new prototype SMS DRED utilising the publicly available mobile phone telecommunications network and the installation of these prototypes on several air conditioners involved in the Phase 1 pilot as well as 68 customer air conditioning systems in the Central Coast area of the CoolSaver trial (Phase 2 part of the project). A prototype dispatch and control system has also been developed including the ability for the customer to override the demand response event via mobile phone text. In addition, as part of Phase 2 activities miniaturised prototypes of the SMS DRED have been developed by an external device supplier utilising 3G communications modules, with the intention of progressing this potential solution to the pre-commercialisation stage of development.

The Lake Macquarie area of the CoolSaver trial involved the installation of 40 ripple DREDs on customer air conditioning systems, which were activated through business as usual ripple signal generators located at the zone substations in the trial area and centrally controlled by the Ausgrid Newcastle control room. The processes for dispatching a modified ripple control signal on days of peak demand were shown to be successful and involved some customisation development of the control interface for the Newcastle control operators for the zone substation ripple control system.

Measurement and verification of the results from the summer 2013/14 period for both trial areas is in progress, and the trial will continue through to March 2015 to collect another summer of customer response results.

At this stage there are no material peak demand reductions achieved from this project.

5.6 Grid battery trial (Newington)

5.6.1 Project nature and scope

This project will investigate the potential benefits of using battery storage as a means for reducing peak demand on the network with a summer trial that is now planned for the summer 2014/15 period. This project will seek to investigate how a network grid-side battery can be operated reliably and effectively for summer peak reduction purposes and to potentially improve power and supply quality parameters of the network. Another area of importance is an assessment of the reliability and performance of battery storage devices during the hotter summer months as well as the optimum battery management and control methodologies.

The project was extended to complete the project objectives by continuing the trial over the summer 2014/15 period. This enables the trial to be conducted over a complete winter 2014 and summer 2014/15 period.

5.6.2 Project aims and objectives

Primary objectives:

(a) Summer peak reduction network benefits: To trial the control and scheduling methodology of the grid battery during the hotter summer months to reduce summer peaks in the local area

(b) Summer battery performance and reliability: To test the grid battery performance during the hotter summer months when battery performance may be more adversely affected by temperature.

Secondary Objectives:

(c) Renewable load smoothing (Solar PV): Simulate using the battery to store renewable energy generation from local solar systems.

(d) Power quality issues: To further test the power quality benefits of installing a grid battery in an urban network.

(e) Customer benefits: To test the potential customer benefits of installing a battery to reduce customer energy bills for a typical larger customer (e.g. demand and peak energy charges).

5.6.3 Implementation plan

The Newington grid battery was planned to be installed as part of the Smart Grid Smart City (SGSC) program but due to difficulties with securing a lease agreement for installation of the battery at the preferred site location, it was not installed under this program. All trials under the SGSC program ended in September 2013.

The grid battery project continued as a Demand Management Innovation Allowance (DMIA) project from October 2013. The issues around securing a suitable site location that had plagued the SGSC program also delayed the installation and commissioning of the battery as part of the DMIA project. It was not until May 2014 that the grid battery was commissioned after Ausgrid was able to successfully negotiate a lease with the Sydney Olympic Park Authority (SOPA) at their Newington Armory precinct. The grid battery was connected to the low voltage network that is supplied by the same 11kV feeder that supplies most of the customers in the Newington suburb. This battery is a 60kVA/ 120kWh Lithium Ion battery system supplied from ZEN Energy systems under a lease agreement.

Due to the delay in installing the grid battery the summer objectives could not be achieved in 2013/14 and an extension was approved which will allow the trial to continue into the summer 2014/15 period.

5.6.4 Results

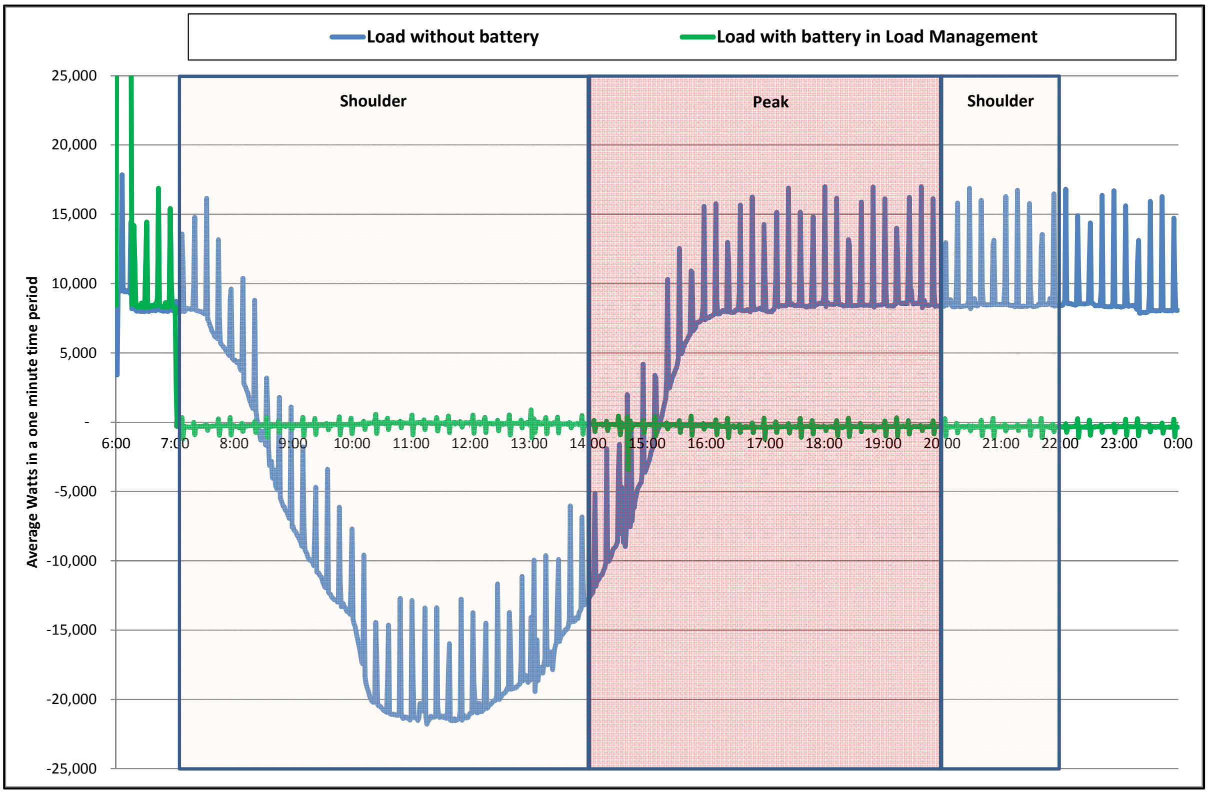
The Newington grid battery was commissioned on-site in May 2014 and pictures of the battery are shown below.

Picture: Grid Battery in-situ

Trials were conducted during May an+d June 2014 to test the battery functions according to the preliminary trial design. A summary of some of the preliminary trials and results during 2013/14 year are shown below.

Trial Objective	Description
1. Power quality trials	The preliminary trials to test the effects of the grid battery on power quality were predominantly focused on operating the battery to investigate the effects on the low voltage network. These trials included a) Simulation of increased PV penetration levels achieved by discharging the battery during the middle of the day, simulating an additional 60kW generation on top of solar generation already connected in the area. b) Discharging reactive power to test the effects on low voltage levels. c) Using the “power ramp rate control” battery management function which limits the rate of change of the local solar generation, testing the ability of the battery to smooth the effects of the solar generation output.
2. Customer benefits trial	The battery energy storage system was used to test customer benefits through reducing electricity bills. This was done by using the “load management” function with a set-point of zero power during the shoulder (7am to 2pm, 8pm to 10pm) and peak (2pm to 8pm) times on a working weekday. This had the effect of storing excess solar PV generation during the middle of the day that would otherwise have been exported to the grid, which was used to supply the customer load during the shoulder and peak times later in the day (see figure). The results showed that on a sunny day the excess solar generation would fully charge the battery during the middle of the day, and this stored energy could be used to supply customer load during the peak and shoulder times that would otherwise have been consumed from the grid.
3. Peak shaving trial	Some preliminary peak shaving trials were also conducted which involved charging and discharging the battery according to a daily schedule which was determined using historical information of the 11kV feeder load for the same time of year. Results showed that in some cases the battery was able to reduce the network peak by 60kW (short morning peak) and 30kW (longer evening peak), however, using this method highlights the importance of predicting the peak time with a limited battery storage capacity, and also the advantages of using an automatic peak shaving function (yet to be trialled).

Figure: Preliminary results from customer benefits trial with battery in Load Management operation



5.6.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2012/13 Actual**	**2013/14 Actual**	**204/15 Projected**	**Total Projected**
Project research and development	$7,115	$12,035	$0	$19,150
Winter 14 testing	$0	$246,991	$110,509	$357,500
Summer 2014/15 testing	$0	$0	$230,560	$230,560
Total (excl GST)	**$7,115**	**$259,026**	**$341,069**	**$607,210**

5.6.6 Project progress & identifiable benefits

As described in the results section, the main project progress during 2013/14 was the identification of an alternative grid battery site, securing a lease agreement with the site owner, and installation and commissioning of the grid battery. Preliminary trials were conducted over the May/ June 2014 period and will continue over the winter 2014 period, with a planned continuation of the project over the summer 2014/15 period in order to meet the primary objectives of the project.

No identifiable benefits have yet been defined for this project.

5.7 Off peak 2 summer scheduling

5.7.1 Project nature and scope

Ausgrid currently has around 160,000 customers on their Controlled Load 2 tariff (Off Peak 2), predominantly controlling domestic hot water systems. This tariff was originally intended for shifting load outside of peak times in the winter period but summer peaks are becoming the predominant driver for much of Ausgrid's growth related network investment.

This project involves trialing a new summer load control schedule for summer peak reduction for customers with Controlled Load 2 tariffs. It is estimated that the existing Controlled Load 2 customer load contributes 20 to 25 MW of load during the 4 to 5pm time period on network peak days in summer.

5.7.2 Project aims and objectives

The main objective of the project is to investigate the potential issues and barriers for implementing a summer scheduling regime for Controlled Load 2 customers across the whole network. Potential barriers include:

(a) **Customer response** due to customers having less hours of electricity supply for their controlled load 2 electricity supply during the summer months. The hot water demand requirements during the summer months is less than the winter months due to temperature effects (water and ambient air) and it is envisaged that this will not be a significant issue, but is an important aspect to be tested as part of the trial. However, in some cases other approved loads such as heating, charging or pumping loads may have been connected to the off peak 2 tariff. Any changes to the control schedule during the summer will adhere to the terms and conditions of the Controlled Load 2 tariff, but may affect customer's expectations of how the control should be scheduled. Customer complaints through our call centre will be assessed to determine the impact on customers.

(b) **Load control operational issues** due to changing of the scheduling for summer and then back to a regime for the rest of the year. For example, a summer schedule could be implemented between 1 November to 31 March and a winter/ shoulder season schedule for the rest of the year. Operational issues also include how to implement the "summer" and "rest of the year" load control schedule with the existing load controllers for all areas of the Ausgrid network.

5.7.3 Implementation plan

The project was initially proposed to consist of two phases:

1. **Phase 1 (2013/14)**: Phase 1 of the project will be to test a summer schedule of OP2 load control in two to three areas of the Ausgrid network area over the summer 2013/2014 period. The trial areas will most likely be chosen by targeting specific summer peaking zone substation areas with high levels of OP2 customers.
2. **Phase 2 (2014/15)**: Where the Phase 1 outcome demonstrates potential viability, then a Phase 2 trial will be implemented across further parts of the Ausgrid network, focusing on areas where different operational or customer issues may be encountered. At the end of the Phase 2 part of the trial, the objective is to have investigated most of the issues that would help to inform a roll-out of the summer scheduling methodology across the whole network area. The various stages of Phase 2 would roughly follow that outlined in Phase 1 with more focus on identification of areas with different operational or customer issues.

5.7.4 Results

The phase 1 part of the project was successfully completed during the 2013/14 year which involved changing the summer control schedules for the Controlled Load 2 ripple channels over the period from 1 November 2013 to 31 March 2014 for three zone substations in the Hunter region of the network (Cardiff, Mount Hutton and Edgeworth zone substations). The ripple control schedules implemented over the summer period for the three zone substations areas involved turning off electricity supply to the Controlled Load 2 load from 2.30pm in the afternoon (AEDST), and leaving the timing of the restoration of electricity supply to the original restoration times, occurring generally between 8pm to 10pm (AEDST) depending on the ripple channel.

Results from the phase 1 trial showed that it is possible to achieve a summer peak reduction of between 140 to 200 Watts per Controlled Load 2 customer with a working ripple switch between the hours of 2.30pm to 5.00pm. No negative feedback from any of the customers in the trial area (over 4,000 customer on the controlled load 2 tariff) was received and the results from the 2013/14 phase 1 part of the project met both of the objectives of investigating both customer response and operational issues with implementing this demand management technique.

5.7.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	2012/13 Actual	2013/14 Actual	2014/15 Projected	Total Projected
Project research and development	$1,343	$0	$0	$1,343
Phase 1 – Trial in 2 to 3 areas	$0	$100,531	$30,000	$130,531
Total (excl GST)	**$1,343**	**$100,531**	**$30,000**	**$131,874**

5.7.6 Project progress & identifiable benefits

During the 2013/14 year the Phase 1 part of the project was implemented and completed showing a successful result for demand reductions of between 140 to 200 Watts per controlled load 2 customer with a working ripple switch during the hours of 2.30 to 5.00pm (AEDST) on a summer afternoon. For the three zone substation areas as part of the trial, it is estimated that the total demand reductions during the 2:30pm to 5pm time period was between 250 to 360 kVA.

Due to the success of the Phase 1 part of the project and its cost-effectiveness as a demand management option, it has been decided to continue further activities planned for Phase 2 as a business-as-usual activity under the broad-based demand management plan for the 2014-19 AER regulatory period. Further close out, analysis and reporting activities for Phase 1 are planned for 2014/15.

5.8 Large customer power factor correction

5.8.1 Project nature and scope

Power factor correction (PFC) is recognised as a cost effective technique for lowering the peak demand in electrical infrastructure. The power factor is defined as the ratio of real power to apparent power. The real power, or active power, is measured in watts and represents the work provided at the load (e.g. light, motor etc). The apparent power is measured in volt-amperes (VA) and due to the resistance, inductance and capacitance of the load, can be greater than the real power.

An example of a device which has a power factor less than 1 is a motor. Where the power factor is less than 1, the network infrastructure must be sized larger to deliver the apparent power.

Correcting power factor at customer premises lowers the peak demand in kVA and reduces the electrical infrastructure requirements for networks. Ausgrid and many other networks use a kVA demand or capacity charge in their medium-to-large customer tariffs to reflect this cost and encourage customers to address poor power factor.

Encouraging customers to install power factor correction equipment is an established method for reducing peak demand and deferring network investment, but less is known about the level of customer response to various incentive levels and the customer response for a range of customer sizes (energy use) and types.

The proposed project is directed at medium to large customers whose tariffs contain a kVA capacity charge and whose power factor (PF) is currently below network standard (0.9) during peak periods. It will attempt to encourage these customers to install PFC equipment.

5.8.2 Project aims and objectives

The objectives of this PFC program are to:

1. Commence a broad-based Power Factor Correction (PFC) campaign which is as cost effective as possible and which will assist larger customers to comply with the 0.9 Power Factor requirement. The aim is to achieve 6 MVA of demand reduction by 30 June 2015.

2. Incrementally refine PFC sales, marketing and procurement approaches with the aim of identifying the optimal program design for the large scale rollout of broad based PFC in the 2014-19 Regulatory Period and also for PFC programs in targeted DM locations.

5.8.3 Implementation plan

The proposed program will be implemented in the following steps:

1. Consider alternative sales and marketing approaches which may improve the cost effectiveness of program delivery. This will include an assessment of results of previous Ausgrid and Endeavour Energy PFC programs to determine uptake rates and any knowledge gaps in previous programs.
2. Form relationships with service providers that can implement PFC at customer sites. A new procurement approach will be used, with the aim of achieving improved cost efficiencies and minimising project management involvement by Ausgrid during implementation.
3. Identify and verify target large customers using Ausgrid databases and field checks. Customers should be on EA305 or EA310 tariffs, with a demand of more than 50kVAr, existing PF significantly lower than 0.9, and estimated payback from PFC installation of less than 3.5 years. Suitable HV customers will also be considered. We will target a combination of priority Ausgrid zones (those that are most likely to reach capacity in the near term) and priority customers (those with very low power factor).
4. Contact customers by phone, email, letter and/or any other identified mechanism to achieve the target take-up of 6 MVA of PFC by end June 2015. Subsidies may be used as determined by the above sales and marketing analysis.

5.8.4 Results

Comprehensive analysis of interval meter data for all customers in the Ausgrid supply area whose tariffs contain a kVA capacity charge was carried out to identify the total technical potential of demand reductions from PFC programs. Priority network locations for demand reductions were also identified, and this formed the basis for the completion of a Broad-Based PFC Project Proposal, which was approved in November 2013.
An important first stage in the project was the development of the preferred sales, marketing and delivery approach. A number of tasks were carried out in this stage, including:

- A review of the methodology and outcomes for previous PFC programs conducted by Ausgrid
- A survey of customer participants in PFC programs conducted previously by Ausgrid.

- A review of approaches to customer PFC by other DNSPs, in particular those within Networks NSW (ie Endeavour Energy and Essential Energy).
- Consultation with legal and procurement expertise within Ausgrid.

The rollout of marketing for the PFC program started late in 2013/14. While initial customer response has been strong, no installations were completed prior to end June 2014. We estimate that 500kVA of demand reduction will be achieved in the subsidised DMIA areas by the end of 2014, with up to 6MVA achievable across Ausgrid's network by the end of 2014/15

5.8.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2012/13 Actual**	**2013/14 Actual**	**2014/15 Projected**	**Total Projected**
Project research and development	$18,859	$11,355	$0	$30,214
Project implementation	$0	$64,151	$100,000	$164,151
Total (excl GST)	**$18,859**	**$75,506**	**$100,000**	**$194,365**

5.8.6 Project progress & identifiable benefits

During 2013/14 the project progressed from the research and development stage to the implementation stage. The DMIA project is expected to continue until December 2014, at which point customer PFC activities will transition to a broad-based DM program. No peak demand reductions had been achieved from this project up to June 2014.

However, we estimate that 500kVA of demand reduction will be achieved in the subsidised DMIA areas by the end of 2014, with up to 6MVA achievable across Ausgrid's network by the end of 2014/15 under the broad based demand management program for the 2014/19 regulatory period.

5.9 Co-managing home energy demand

5.9.1 Project nature and scope

The contribution to peak demand from residential households is rising due to the increasing use of air conditioning systems. Solutions to reducing peak demand may include the contribution of peak demand reductions from households. Understanding householder's level of knowledge on peak demand and how they are responding to current demand management activities will assist in developing strategies and programs to reduce peak demand from the residential sector.

5.9.2 Project aims and objectives

The objectives of the co-managing home energy demand research project were to:

(a) Review previous demand management research undertaken by Ausgrid to identify key research findings and areas for further investigation;

(b) Improve knowledge in how householders understand, and are responding to, demand management activities;

(c) Identify potential strategies and opportunities to improve or expand existing demand management initiatives delivered through smart meters/smart grids, such as opportunities to engage with customers through education/information provision or other strategies;

(d) Gain further insight into householder's perceptions, fears and attitudes towards smart meters and how to counteract negativity; and

(e) Inform future demand management research, strategies and products.

5.9.3 Implementation plan

The research project used in-depth qualitative research with householders conducted by research leaders from RMIT University in collaboration with, and substantially funded by, TransGrid. It used a qualitative methodology to provide survey depth in a small number of households. This research approach avoids the assumptions in much quantitative research and large-scale surveys, where questions are often designed around multiple choice answers or where they direct research participants towards specific answers which may bias results. Qualitative research also identifies connections, contradictions and complexities in householder views and actions.

The project was initially comprised of three phases that involved Ausgrid's participation and a fourth phase that did not require Ausgrid's involvement:

1. **Phase 1** reviewed a range of variable pricing research conducted by or on behalf of Ausgrid over recent years with Ausgrid's residential and small business customers. A total of 13 individual studies were reviewed.
2. **Phase 2** represented the first of three stages of in-depth qualitative research with householders in the Ausgrid and Endeavour Energy distribution areas. This research focused on householder understandings of peak demand issues; existing and hypothetical understandings and acceptance of time-based pricing concepts; and discretionary and non-discretionary practices during peak times. Stage 2 research was conducted in May 2012 with households in the south Sydney local government areas of Sutherland, Kogarah, Hurstville and Rockdale. A total of 26 households and 37 individuals participated in interviews.
3. **Phase 3** of the project was conducted in August 2012 in the same region of the Ausgrid distribution area as Phase 2. The research focused on consumer trust in the electricity industry and explored opportunities for household demand management participation. A total of 24 households and 34 individuals participated in interviews.
4. **Phase 4** of the project proceeded with input from Endeavour Energy and TransGrid, without involvement from Ausgrid

During 2013/14, Ausgrid explored the opportunity to expand this project to further investigate the effect of household practices on residential peak demand. In particular, to test and develop interdisciplinary methods for studying and predicting changing practices with a specific focus on the key appliances which influence peak demand (e.g. air conditioners, hot water systems and pool pumps) so as to inform proposed demand management solutions and improve their design, delivery and cost effectiveness. The project was proposed as a collaborative effort with RMIT and to be co-funded by the Australian Research Council (ARC). The program application was submitted in November 2013 but was not successful. Due to the relatively high cost for detailed qualitative research and in the absence of funding partners, it is not proposed that this project proceed further.

5.9.4 Results

There were extensive learnings from the first four phases of the project which were reported in detail in the Ausgrid DMIA Submission to the AER for 2012/13. Expenditure and activities during 2013/14 involved analysis of the outcomes from Phases 1-4 and consultation with RMIT on the development of a focused research program to inform and improve proposed residential load control programs. A longitudinal study program was developed but has been shelved in the absence of funding partners to share in the cost of such a long term research project (3 years).

5.9.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	**2012/13 Actual**	**2013/14 Actual**	**Total Actual**
Project assistance / collaboration and further development	$8,486	$12,537	$21,023
Total (excl GST)	**$8,486**	**$12,537**	**$21,023**

5.9.6 Project progress & identifiable benefits

The three project phases in which Ausgrid participated are now complete. Further progression of the project as a joint ARC funded project was unsuccessful and activities on this project ceased during 2013/14.

The project consisted of research, so no material peak demand reductions were achieved by it.

5.10 Verification of demand savings from energy efficiency programs

5.10.1 Project nature and scope

There is currently a range of energy efficiency programs funded or run by government organisations which offer potential peak demand reduction benefits; however few organisations complete any assessment of the peak demand impacts for their programs. While this is primarily due to the fact that peak demand reductions are not a direct objective of the program, it is in part due to a lack of understanding about the differences between energy and peak demand. This project aims to identify which of these energy efficiency programs or initiatives are effective at reducing peak demand. The scope of this project involves providing in-kind support and data provision for the purpose of measurement and verification of energy and demand savings of existing energy efficiency programs.

5.10.2 Project aims and objectives

The primary objective of this project is to obtain evidence-based evaluation outcomes of the effect of energy efficiency programs on peak demand savings that can be used for the development of demand management programs. To achieve this objective an approach of collaboration with the NSW government was identified as a cost effective and mutually beneficial approach, as it leverages the outcomes and learnings from the existing state-wide energy efficiency programs. By providing electricity consumption data and expertise to inform an evidence-based evaluation of government energy efficiency programs a more detailed understanding of the effect of energy efficiency programs on peak demand savings can be achieved.

5.10.3 Implementation plan

A Memorandum of Understanding (MOU) was signed with the NSW Government Office of Environment and Heritage (OEH) with the purpose of collaborating on Data Analysis Projects of mutual benefit where electricity consumption data can be used to measure and verify the energy and demand savings of energy efficiency programs.

The projects that have been assessed under the MOU include the Home Power Savings Program, the Energy Efficiency for Small Business Program as well as the NSW Home Saver Rebate program. More information on these programs can be found at http://www.environment.nsw.gov.au/households/government-programs.htm

1. The **Home Power Savings Program** (HPSP) was a program run by the Office of Environment and Heritage (OEH) under the NSW Energy Efficiency Strategy which provides free home power assessments and power savings kits to low-income families. The program completed in April 2014.
2. The **Energy Efficiency for Small Business Program** (EESBP) was a program run by OEH under the NSW Energy Efficiency Strategy which provides subsidised energy assessments and energy action plans for eligible small businesses in NSW.
3. The **NSW Home Savers Rebate** was run by OEH and provided rebates for the installation of ceiling insulation and eligible solar, gas and heat pump hot water systems.

The proposed approach for these evaluations was for Ausgrid to provide in-kind support for the evaluation projects through expertise and providing electricity consumption data that involved data matching, extraction, cleansing and quality checking. The detailed statistical evaluations are performed by third party providers funded by the NSW government.

5.10.4 Results

Most of the data provision activities and results occurred in previous years and are detailed in Ausgrid's DMIA Submission to the AER for 2012/13. Evaluation reports that have been publicly released by OEH can be located here: http://www.environment.nsw.gov.au/energyefficiencyindustry/evaluation.htm

During 2013/14 a third stage to the Home Power Saver Program (HPSP) evaluation was initiated to better assess the effect of the program on peak demand. For this evaluation, Ausgrid supplied half hourly interval electricity meter data for 6,350 participating HPSP households and 30,000 control group households over a seven year period.

5.10.5 Summary of actual and projected costs

A summary of the actual project costs incurred in 2013/14 and previous years is shown below, as well as projected costs for the 2014/15 year. All costs incurred for this project are categorised as opex.

Actual and projected project costs:

Budget Item	2012/13 Actual	2013/14 Actual	Total Actual
Project research and development including, • Project agreements following by data matching, extraction and quality checking for each Data Analysis Project	$37,562	$3,889	$41,451
Total (excl GST)	**$37,562**	**$3,889**	**$41,451**

5.10.6 Project progress & identifiable benefits

Data provision by Ausgrid for all three Data Analysis Projects with the NSW Office of Environment and Heritage was mostly completed in 2012/13, with the addition of a further evaluation stage for the Home Power Saver Program occurring during 2013/14 involving the provision of half-hour interval meter data to better assess the impact of the program on peak energy and demand.

Identifiable benefits for this project, include the public release of evaluation reports that better inform the public and stakeholders about the effectiveness of energy efficiency programs in reducing peak demand. Evaluation reports that have been publicly released by OEH so far can be located here:

http://www.environment.nsw.gov.au/energyefficiencyindustry/evaluation.htm