

**DEMAND RESPONSE
EMERGING
TECHNOLOGIES
PROGRAM**

**SEMI-ANNUAL
REPORT 2017**

March 31, 2017



Table of Contents

Table of Contents	2
I. Summary	4
II. Completed Projects in Q4 2016 & Q1 2017	4
A. Phase Change Material for Low Temperature Refrigeration Applications for Integrated Demand Side Management (IDSM)	4
1. Overview	4
2. Collaboration	4
3. Status	4
4. Next Steps	4
B. Whole Facility HVAC - IDSM	5
1. Overview	5
2. Collaboration	5
3. Status	5
4. Next Steps	5
C. Automated Demand Response (ADR) – Wireless Lighting Controls	5
1. Overview	5
2. Collaboration	6
3. Status	6
4. Next Steps	6
III. Ongoing Projects in 2017	6
A. 10 kW / 40 kWh Flywheel Energy Storage	6
1. Overview	6
2. Collaboration	6
3. Status	6
4. Next Steps	6
B. EPRI Smart Thermostat Collaborative	7
1. Overview	7
2. Collaboration	7
3. Status	7
4. Next Steps	7
C. Electric Vehicle to Grid Integration Platform (VGIP)	7
1. Overview	7
2. Collaboration	8
3. Status	8
4. Next Steps	8
D. Battery Power Load Shedding System – ADR Evaluation	8
1. Overview	8
2. Collaboration	9
3. Status	9
4. Next Steps	9
E. Whole Connected Home	9
1. Overview	9

Demand Response Emerging Technologies Program (DR-ET)
Semi-Annual Report: 2017

2.	Collaboration	9
3.	Status	9
4.	Next Steps.....	9
IV.	New Projects in 2017	10
A.	Permanent Load Shifting Evaluation of a Refrigeration Battery	10
1.	Overview	10
2.	Collaboration	10
3.	Status	10
4.	Next Steps.....	10
B.	DR with Variable Capacity Commercial HVAC Systems.....	10
1.	Overview	10
2.	Collaboration	11
3.	Status	11
4.	Next Steps.....	11
V.	Budget.....	11

I. Summary

The Demand Response (DR) Emerging Technologies Program Semi-Annual Report is being submitted pursuant to Ordering Paragraph 59, and the discussion at pages 145 – 146 of Decision (D.) 12-04-045. During Quarter 4 of 2016 and Quarter 1 of 2017, SDG&E DR-ET completed three projects, continued to manage five ongoing projects, and initiated two new projects.

II. Completed Projects in Q4 2016 & Q1 2017

A. *Phase Change Material for Low Temperature Refrigeration Applications for Integrated Demand Side Management (IDSM)*

1. Overview

Evaluate the direct energy efficiency (EE) savings and DR potential that result from installing Phase Change Materials (PCMs) inside low temperature walk-in freezers.

2. Collaboration

The project progress and results were shared with other CA Investor Owned Utilities (IOUs) during scheduled monthly Statewide (SW) DR-ET Leadership conference calls.

3. Status

The project was completed and a Technology Transfer Meeting was conducted with all internal SDG&E stakeholders. The final report showed great functional performance, respectable paybacks, and impressive technology flexibility.

4. Next Steps

The technology was recommended for SDG&E's Energy Efficiency Business Incentives (EEBI) program based on the applications and results of the project. The vendor has reported that their first EE application has been submitted in the PG&E territory. The project has been posted to the ETCC website and can be found here: <http://www.etcc-ca.com/reports/phase-change-material-and-controls-study-low-temp-refrigeration-applications>

B. Whole Facility HVAC - IDSM

1. Overview

A complete heating, ventilation, and air conditioning (HVAC) efficiency maintenance, tune up and controls upgrade with DR capabilities is proposed for two small-medium businesses in the fast food industry. Equipment monitoring was performed before, during and after the upgrade to determine the actual reduction in electricity consumption and demand.

2. Collaboration

The progress and results were shared with the IOUs during scheduled monthly SW DR-ET Leadership conference calls.

3. Status

The project was completed and a Technology Transfer Meeting was conducted with all internal SDG&E stakeholders. The final report showed impressive EE savings and marginal DR capabilities. The economics around the technology were reasonable given the full scope of work of the project where initial system restoration was required and factored into the simple payback calculation.

4. Next Steps

Given the results of the field demonstrations the technology and approach have been recommended to Customer Programs for adoption. There is consideration from the programs team to incorporate this project into existing programs or possibly a future pilot program serving small-medium businesses. This project has been posted to the ETCC website and can be found here: <http://www.etcc-ca.com/reports/maintenance-and-advanced-rooftop-controls>.

C. Automated Demand Response (ADR) – Wireless Lighting Controls

1. Overview

The goal of the project is to assess and validate the effectiveness of new LED luminaires with integrated sensors and an embedded mesh wireless network to be controlled via a kinetic energy wireless wall switch. The switch will receive a command from the main controller to dim the lighting to a pre-established level based upon the type of signals sent by the utility. The value of this project will be the potential for increasing participation in ADR programs due to the ability to allow customer better control of levels of response based upon utility signal in a demand reduction situation.

2. Collaboration

The progress and results have been shared with other CA IOU during scheduled monthly SW DR-ET Leadership conference calls.

3. Status

The project has been completed and a Technology Transfer Meeting has been scheduled for March 2017 with internal SDG&E stakeholders.

4. Next Steps

The final report is being drafted and the results are being reviewed with internal and external stakeholders. Once accepted, the final report will be posted to the ETCC website. The link can be found here: <http://www.etcc-ca.com/reports/wireless-lighting-controls-automated-demand-response>

III. Ongoing Projects in 2017

A. 10 kW / 40 kWh Flywheel Energy Storage

1. Overview

Berkeley Energy Sciences Corporation (BESC) has been developing a low-cost flywheel energy storage device. The first generation device has the target capacity of 40 kWh / 10 kW. This flywheel uses high-strength steel as a rotor, and its design has the potential of a 20 year lifetime with over 90% AC to AC efficiency. If successful, this project could lead to BESC's second generation technology which has the capacity of 125 kW / 500 kWh.

2. Collaboration

This project is in collaboration with California Energy Commission (CEC) Public Interest Energy Resource (PIER) program. BESC received a \$1.8M grant from PIER to build the flywheel. SDG&E agreed to provide Measurement and Evaluation (M&E) support.

3. Status

M&E testing is complete. Currently evaluation of the recorded data is under way. Draft version of the final report will be ready for internal review in Q1 2017.

4. Next Steps

The next steps are collecting trend performance data for analysis and draft final report.

B. *EPRI Smart Thermostat Collaborative*

1. Overview

Define methods to translate the value proposition from multiple utility smart thermostat pilots to utility programs of the products and services in the study. Understand all the costs and benefits from the various thermostat hardware and software offerings as well as the data streams that come from the products and services.

2. Collaboration

More than 12 utilities are participating in this study, plus 15 smart thermostat products and/or services, and other stakeholders such as Environmental Protection Agency (EPA), Department of Energy (DOE), Lawrence Berkeley National Laboratory (LBNL), National Renewable Energy Laboratory (NREL), ICF International, and iTron. The information from this project is also shared with the statewide ET-DR team during monthly conference calls.

3. Status

M&E from device data is well established for DR but not for EE. The method for impact evaluations using device level data was completed via a utility project in Lincoln Nebraska. Thermostat data alongside HVAC metadata was used to calculate DR impacts. Device level data is also important as it provides operational and customer behavior insights. Summary results were provided during webinars and face-to-face collaborative team meetings. Lastly, the preliminary impact results of load-shifting project with the time of use (TOU) rate show limited load shifting capability attributed to the thermostat. However, the project did yield a 5% EE impact. The summary of these results will be presented at the next collaborative team meeting.

4. Next Steps

The next steps are to continue the evaluation of the remaining two EE and DR projects that were completed in the previous season (with Kansas City Power & Light (KCP&L) and Salt River Project (SRP)), and to perform the DR and EE evaluations in the remaining two projects that will be conducted in the summer of 2017 (with Louisville Gas & Electric (LG&E) and Gulf Power).

C. *Electric Vehicle to Grid Integration Platform (VGIP)*

1. Overview

The purpose of this project is to create requirements and use cases for a unified grid services platform that is secure, low cost, and on an open platform. It will also aide in the development of architecture and

Demand Response Emerging Technologies Program (DR-ET) Semi-Annual Report: 2017

functionality of the VGIP including OpenADR2.0b, SEP, Home Area Network (HAN). Lastly, this project will assess performance of the VGIP against utility requirements through field tests and trials. BMW, Chrysler, Ford, GM, Honda, Mercedes, Mitsubishi, Nissan, and Toyota have agreed to be study participants.

2. Collaboration

The progress and results have been shared with the IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various SDG&E internal interested groups and stakeholders.

3. Status

Chrysler officially joined the VGIP Alliance Team. Currently there are a total of six utilities signed up for this collaborative project with a potential of more utilities in the near future. PG&E and SCE are focused on leveraging this project with their Capacity Bidding Programs. Con Edison is focusing on utilizing this effort with an Off-Peak EV Customer Incentive Program. Hawaiian Electric is working with Nissan on a potential fleet infrastructure/ DR pilot. Lastly, SDG&E is contemplating on how this structure may be beneficial with charge management and/or dynamic pricing.

4. Next Steps

The next steps pertaining to the scope of work for this project are to complete the API development between Original Equipment Manufacturer (OEM) servers and VGIP servers, and to finalizing VGIP algorithms for consolidation of OEM aggregated capacity projections, allocation execution, and verification data tracking and reporting. Work will be done on the implementation of the OpenADR 2.0b virtual end node (VEN) protocol for utility interface and interoperability with the OEM's APIs.

D. Battery Power Load Shedding System – ADR Evaluation

1. Overview

The objective of this study is to evaluate the DR capability of the energy storage system. In addition to peak load shaving capability, the impact of the energy storage system on the circuit and the customer bill/economics will be studied.

2. Collaboration

The progress and results have been shared with the IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various SDG&E internal interested groups and stakeholders.

3. Status

Installation for Phase 2 of 2 has started. There have been some minor delays in the installation of the battery systems due to the wait for SGIP program to grant the installer Permission to Operate (PTO). However, the expectation is that the remaining installations will pick up in Q1-Q2 of 2017.

4. Next Steps

Begin testing DR capabilities as well as daily/monthly facility peak shaving effectiveness in accordance with the shared savings model between the battery company and the end use customer.

E. Whole Connected Home

1. Overview

Whole Home DR (WHDR) is defined as DR where multiple end use systems are triggered by a single DR signal delivered by the utility to either an in-home or a cloud gateway. The purpose of the project is to evaluate various emerging Internet of Things (IoT) and connected device technologies, as one unified system, for their capability to be developed and integrated into WHDR programs. The evaluation will consider both technologies as well as other program impact factors such as customer adoption, ease of recruitment, persistence, and data availability for M&E.

2. Collaboration

The progress and results have been shared with the IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various SDG&E internal interested groups and stakeholders.

3. Status

All three sites have been identified. The project team is preparing for the installation of the three unique unified systems in Q2 or Q3 of 2017. This will heavily depend on the multi-vendor willingness to collaborate, especially where some additional vendor product development may be necessary for complete system commissioning.

4. Next Steps

Vendor installations will occur in Q2-Q3 of 2017.

IV. New Projects in 2017

A. *Permanent Load Shifting Evaluation of a Refrigeration Battery*

1. Overview

The Project will demonstrate the Refrigeration Battery's ability to maintain the desired temperature set-points of a supermarket's medium temperature refrigeration systems without running the central compressors or condensers for up to 8 hours at a time. By turning off medium temperature refrigeration compressors and condensers during "on-peak" hours (as defined by SDG&E's rate schedule AL-TOU), the Refrigeration Battery is expected to reduce the facility's monthly peak demand by up to 75 kW, representing a decrease in monthly peak demand of up to 25%.

2. Collaboration

The progress and results have been shared with the IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various SDG&E internal interested groups and stakeholders.

3. Status

A site has been identified and audited. A full scope of work has been developed. Contracts are expected to be executed for this project in mid/late March.

4. Next Steps

M&E pre-trending will start in Q2 of 2017 on the pertinent pieces of equipment. Once contracts are executed the vendor will order parts and mobilize their labor force for installation.

B. *DR with Variable Capacity Commercial HVAC Systems*

1. Overview

This project envisions several units in field trials covering a mix of technologies, manufacturers and vendors providing DR with commercial HVAC equipment. These will be existing systems installed in the participating utilities territory which will then be fitted with any additional hardware that is necessary for enabling the equipment to provide DR capability. The M&E of this project intends to collect data for power, energy and other relevant ambient conditions (e.g., temperature and

Demand Response Emerging Technologies Program (DR-ET)
Semi-Annual Report: 2017

relative humidity). Numerous sites exist currently in the San Diego territory that can be rolled into the scope of this project.

2. Collaboration

The progress and results will be shared with the IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various SDG&E internal interested groups and stakeholders.

3. Status

Contracts are executed. Project is ready to begin.

4. Next Steps

Kickoff meeting with the selected engineering team will happen in Q2 of 2017.

V. Budget

Approved Budget per D.16-06-029 (June 9, 2016) “Decision Adopting Bridge Funding For 2017 DR Programs and Activities.”

Projected Program Budget

Program Name	2017 Budget
Emerging Technology DR	\$722,961