

DEMAND RESPONSE EMERGING TECHNOLOGIES PROGRAM

SEMI-ANNUAL REPORT 2018

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Summary

The Demand Response Emerging Technologies (DR-ET) 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 Q4 of 2017 and Q1 of 2018, San Diego Gas & Electric DR-ET Program completed zero projects but started one new project and continued to manage six ongoing projects.

I. Completed Projects in Q4 of 2017 & Q1 of 2018

No Projects were completed in Q4 of 2017 or Q1 of 2018.

II. Ongoing Projects in 2018

A. *Electric Power Research Institute (EPRI) Smart Thermostat Collaborative*

1. Overview

Define methods to translate the value proposition from multiple utilities 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 vendors, 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 DR-ET team on monthly conference calls.

3. Status

Final report for Gulf Power is completed and in progress for publishing. Held in-person Collaborative meeting to discuss thermostat implementation lessons learned as well as next steps by members of the Collaborative which includes:

- Gulf Power
- Kansas City Power and Light
- Salt River Project
- Baltimore Gas and Electric
- First Energy (Pennsylvania)

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- San Diego Gas and Electric

Listed below in Table 1 are the five completed field trials as well as two outstanding field trials to be completed in Q1 of 2018.

Table 1

Pilot	Status	Results
TVA/ Glasgow	Winter 2014/2015: Complete Summer 2014/2015: Complete	Summer DR: -0.7 to -0.9 kWh/hr/home Winter DR: -1.0 kWh/hr/home (electric heat customers); -0.2 kWh/hr/home (gas heat customers) Summer EE: -5.1% (% of summer total electricity use, not just cooling) Winter EE: -4.7% (% of winter total electricity use, not just heating) Annual EE: -4.9% (% of annual total electricity use)
SRP	Summer 2015: Complete Summer 2016: Complete	Summer 2015 load shifting: load reductions most hours Summer 2015 EE: -2.6% (% of summer total electricity use) Summer 2016 load shifting: precool increase, reductions most other hours Summer 2016 EE: -6.6% (% of summer total electricity use)
BGE	Summer 2015: Complete Winter 2015/2016: Complete	Summer DR: -0.8 to -1.0 kWh/hr/home (across 2 tstats) Summer EE: -1.5% to +2.0% (across 2 tstats) Winter EE: -4.5% to +4.0% (depending on tstat, heating type, cohort) Annual EE: -1.1% to +1.2% (across 2 tstats)
LES	Summer 2015: Complete Summer 2016: Complete	Summer DR: tstats: -0.4 to 1.2 kWh/hr/home (cycling v. offset w precool) switches: -0.5 kWh/hr/home (cycling only)
KCP&L	Summer 2015/2016: Data transfer complete Winter 2015/2016: Data transfer complete	Analysis due Q2 2018
LG&E	Summer 2017: Data transfer underway	Analysis due Q2 2018
Gulf Power	Summer 2016 & 2017: Complete Winter 2016/2017: Complete	Summer 2016 DR: n/a (no events) Winter 2016/2017 DR: -1.2 kWh/hr/home (1 event) Summer 2017 DR: -1.2 kWh/hr/home (4 events) Summer 2016&2017 EE: -3.1% Winter 2016/2017 EE: -3.6% Annual 2016/2017 EE: -3.2%

4. Next Steps

Project closeout should happen in Q2 of 2018. The closeout will include an in-person Connected Devices Workshop tentatively scheduled for July 10th-11th in Palo Alto, CA. There will also be two final smart thermostat impact evaluations with two specific objectives:

1. Compare EE impacts using EPA ENERGY STAR baseline metric vs. utility programmatic metric.
2. Evaluate DR impact in scenarios where there is no AMI data.

There are also extension projects associated with the connected device work that stemmed from the results of the Smart Thermostat Collaborative. These include:

1. Leverage of voice assistants (Google Home and Amazon Alexa) for utility applications such as whole-home DR, and
2. Development of low-cost (<\$75 thermostat) targeted for low-income customers as a replacement for the \$75 USD programmable thermostat offered in these spaces.

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3. Development of Open-Source customer-sited Distributed Energy Resource (DER) platform that is intended to test aggregation and coordinated control of mass market connected devices in response to rate signals.

B. 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 an open platform. It will also aide in the development of architecture and 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 other California Investor Own Utilities (CA IOUs) during scheduled monthly DR-ET Leadership conference calls as well as with various interested attendees at the Internal Technology Transfer meetings.

3. Status

Below are the highlights of the project from Q4 of 2017 and Q1 of 2018:

- Initiated implementation and execution of the Southern California Edison (SCE) Capacity Bidding - Residential DR aggregation pilot. Testing VGIP communications interface with SCE Green Button and Demand Response Management Systems (DRMS) started. Addressing capability to increase & decrease EV DR aggregation with load target of 100kW. Original Equipment Manufacturer (OEM) customer enrollment in process.
- Initiated launch of customer charge data pilots with American Energy Power (AEP) and Puget Sound Energy (PSE) utilities as precursor for learnings and determinants about VGI use cases and program strategies.
- Enhancing the Con Edison Smart Charge New York Program (customer off peak charging incentive pilot). Engaging Ford, Honda, and BMW in the pilot.
- Completed development of the VGIP Demand Clearing House functionality and interface testing with IoTecha eMobility server

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for ISO/IEC 15118 EVSE demonstration. Pending completion of EVSE/SECC to EV/EVCC ISO/IEC 15118 protocol implementation.

- Continued coordination of the VGIP interface lab demonstration project requirements with Southern Company.
- Initiated development team process for implementing VGIP/Utility automated customer enrollment. Addressing Business Model Process, customer authorization/registration, data privacy, security, and authentication requirements.

4. Next Steps

Below are the objectives for the VGIP collaborative project through the end of 2018-2019:

- Progress on 2018-2019 pilot program planning with recently joined utility participants New York Power Authority (NYPA), Sacramento Municipal Utility District (SMUD) and Duke Energy.
- Continued coordination with SDG&E and Pacific Gas & Electric (PG&E) in determination of VGIP pilot structure and requirements.
- Complete execution of the SCE Capacity Bidding – Residential DR aggregation pilot. Planned for 6-month operational period. Formulate data analysis summary reports.
- Complete Con Edison first phase pilot. Evaluate results and make determinations for commercial scaling of program, and potential for next phase pilots for VGI functional enhancements such as DR and dynamic pricing use cases.
- Complete the VGIP ISO/IEC 15118 EVSE/EV charging protocol functionality demonstration.
- Complete execution of the AEP and PSE customer charge data reporting pilot. Evaluate results for applications of next phase VGI program development.
- Initiate forward planning with utilities to determine requirements for scaled up 2019 commercial intent VGI programs/pilots.

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Involve California Public Utility Commission (CPUC) VGI Roadmap and VGI use cases value assessment proceedings.

- Progress on development of the VGIP/Utility/OEM interactive automated enrollment process. Validate security and authentication process/software implementation.

C. Battery Powered Load Shedding System – Automated Demand Response(ADR) Evaluation

1. Overview

The objective of this study is to evaluate the DR capability of the Energy Storage System (ESS). In addition to peak load shaving capability, evaluate the impact of the energy storage system on the circuit and analyze customer bill/economic impacts.

2. Collaboration

The progress and results have been shared with other CA IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various interested attendees at the Internal Technology Transfer meetings.

3. Status

In Q2 and Q3 of 2017, the vendor deployed a total of 20 ESS at two school districts, these systems are known as Phase 1. In Q4 of 2017 and Q1 of 2018 the vendor deployed an additional 7 ESS at one of the school districts, these are known as Phase 2.

Below are the highlights for this period:

- The total deployed capacity of the current fleet is rated at 5.47 MW with a 2-hour discharge time, or 10.94 MWh (Phase 1 + Phase 2).
- Phase 2 sites are expected to be receiving permission to operate (PTO) in Q1 of 2018.
- The measurement and verification (M&V) team submitted a Summary Report covering the analysis of Phase 1 sites in Q1 of 2018.
- DR simulations, which began in Q3 of 2017, were completed by the commissioning team for the Phase 1 sites in Q4 of 2017.
- Ending in Q1 of 2018, the M&V team performed peak savings analysis using the available data at all 20 sites in Phase 1 (16-20-

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week analysis period). This analysis was done to ascertain the performance of the fleet relative to vendor projected values at the beginning of the project.

The deployment sites and ESS sizes in each Phase are shown in the two tables below:

PHASE 1			System Size	
#	District	System Name	kW	kWh
1	District #1	Building #1	30	60
2	District #1	Building #2	250	500
3	District #1	Building #3	60	120
4	District #1	Building #4	250	500
5	District #1	Building #5	250	500
6	District #1	Building #6	250	500
7	District #1	Building #7	250	500
8	District #2	Building #1	250	500
9	District #2	Building #2	500	1000
10	District #2	Building #3	60	120
11	District #2	Building #4	250	500
12	District #2	Building #5	60	120
13	District #2	Building #6	250	500
14	District #2	Building #7	250	500
15	District #2	Building #8	250	500
16	District #2	Building #9	250	500
17	District #2	Building #10	250	500
18	District #2	Building #11	250	500
19	District #2	Building #12	250	500
20	District #2	Building #13	250	500
Total MW / MWh			4.46	8.92

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PHASE 2			System Size	
#	District	System Name	kW	kWh
1	District #1	Building #8	90	180
2	District #1	Building #9	250	500
3	District #1	Building #10	120	240
4	District #1	Building #11	120	240
5	District #1	Building #12	120	240
6	District #1	Building #13	250	500
7	District #1	Building #14	60	120
Total MW / MWh			1.01	2.02

Total MW / MWh	
5.47	10.94
MW	MWh

4. Next Steps

In Q2 of 2018 the vendor intends to install an additional seven ESS with an estimated operational date of early April. The M&V team plans to install independent electrical sub-metering systems on four of these additional ESS after they become operational.

In Q2, through Q3, of 2018 the M&V team will complete the 16-week data collection period at each site in Phase 2, and perform all analyses per the Project Plan.

In Q3 or Q4 of 2018, the M&V team will produce an Addendum to the Phase 1 Summary Report. This Addendum will cover the analysis of Phase 2, and any updates or changes to previous findings will be included in the Addendum.

D. Whole Connected Home

1. Overview

Whole Home Demand Response (WHDR) is defined as DR approach 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), connected device technologies, as one unified system for their capability to be developed and integrated into WHDR programs. The demonstration is done at three selected residences. The evaluation will consider both technologies as well as other program impact factors such as

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customer adoption, ease of recruitment, persistence, and data availability for M&V.

2. Collaboration

The progress and results have been shared with other CA IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various interested attendees at the Internal Technology Transfer meetings.

3. Status

In Q4 of 2017, EPRI and their subcontractors completed installation and commissioning of upgrades to site one and three, with site two near completion. The first and second sites had preliminary DR tests for verification of proper equipment functionality, which is critical to confirm before actual load reduction measurement. Also, the project team completed lab testing of the system functionalities prior to installation in the three sites.

In Q1 of 2018, the project team continued lab testing of various system hierarchies as well as monitoring for DR functionality. Concurrently, the project team continued refining DR Measurement & Verification (M&V) Plan. The M&V plan will highlight all the data consumption logistics and proper mathematical treatment for post data logging evaluation. The M&V plan will also be an addendum to the overall project reporting.

4. Next Steps

In Q2 of 2018, the project team will complete all necessary lab testing of the systems. While the lab testing is being completed, the project team will carry out field tests of DR events during SDG&E's DR season. Once the lab testing is completed, the team will start a preliminary data analysis recorded from the individual DR events.

In Q3 of 2018, all field tests are scheduled to be completed. The continued data analysis of field test events should also be completed in this same time frame barring any testing setbacks. Lastly, the project team will be starting the macro DR potential analysis. This analysis is aimed to quantify the technical capabilities and market availability.

E. 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

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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 AL-TOU rate schedule, the Refrigeration Battery is expected to reduce the facility’s monthly peak demand by up to 75 kW. If successful it would achieve a decrease in monthly peak demand of up to 25%.

2. Collaboration

The progress and results have been shared with other CA IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various interested attendees at the Internal Technology Transfer meetings. This project has attracted some national media attention and strong interest from EPRI who is aiming to build on SDG&E’s initial research in this space.

3. Status

The product vendor has executed their contract with their general contractor selected to perform the installation of the approved scope of work. The draft plans have been reviewed and accepted for approval by the host site where the refrigeration battery will be installed.

4. Next Steps

Permit approval and breaking-ground on the project are now slated for Q2 of 2018. The permitting approval process with the City of San Diego has taken much longer than anticipated due to an unexpected easement existing at the facility. According to the general contractor on the project, the City permit should be issued by the end of March. Project commissioning and post trending are now estimated to be completed in Q4 of 2018. Final report and transfer of the project to Customer Programs (if applicable) are expected to occur in Q1 of 2019.

F. Demand Response with Variable Capacity Commercial HVAC Systems

1. Overview

Variable Capacity systems, with their onboard instrumentation and communications capabilities, are candidates for implementing both EE and DR measures at the same time. Efficiency rebates have been in place for such equipment in certain territories but DR capabilities can push the technology further into the mainstream market, which is dominated by rooftop units, split systems and chiller / boiler combos. Commercial HVAC systems being a coincident load (peak power draw occurs during

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the hottest days) is a prime candidate for DR while being an efficient technology during normal operation.

The objectives for undertaking this study are:

- Determine the extent to which variable capacity commercial HVAC systems can provide DR services by reducing (or increasing) power draw.
- Define use cases for this advanced DR capability.
- Achieve integration of candidate systems with open protocols like OpenADR as an application layer.
- Provide operational data from field installed systems with advanced DR capabilities.
- Provide data and analysis to fulfill the needs of SDG&E's Technology Incentive Program as well as traditional DR programs such as CPP-D & CBP.

2. Collaboration

The progress and results have been shared with other CA IOUs during scheduled monthly DR-ET Leadership conference calls as well as with various interested attendees at the Internal Technology Transfer meetings.

3. Status

This project has identified a single site that currently has 13 new Daikin variable capacity commercial HVAC systems recently installed. The project scope of work has been well defined and the full project is being presented to the facility managers as well as their business units. Once the project plan and installation logistics are signed off, the project pre-trending can begin as well as ordering any necessary materials and parts.

4. Next Steps

Getting project approval by the site facilities team. Once the project is approved, the facilities team will need to sign the Field Demonstration Agreement (FDA). This will allow the kick-off of the project and ordering of equipment and materials.

III. New Projects in 2018

A. *Expansion Study of the Statewide Expansion of Auto-DR Express Solutions*

1. Overview

The DR-ET Teams of SDG&E, SCE and PG&E are engaged in discussions to develop strategies to increase adoption of Auto-DR into the Small and Medium Business (SMB) sectors. The DR-ET teams asked ASWB Engineering to study how to improve uptake on the existing “Auto-DR Express” and “FastTrack” offerings, and to develop a program model that all three utilities could adopt. The main objective of this effort is to increase automated DR market penetration of SMB customers by expanding SMB eligible measures, adding additional facility types, and increasing customer and vendor awareness of the program. This will include interviewing past program participants, proposing a streamlined model for the various IOU offerings, along with researching and addressing any barriers the customer may have with respect to program participation. A roadmap for 2018 and beyond will be developed, which focuses on the needs of SMBs (facilities with a peak demand under 499 kW).

2. Collaboration

Since this is a co-funded state-wide initiative with SDG&E, SCE, and PG&E each IOU will be updated as the project naturally progresses. SDG&E is the lead IOU on the project and will help lead all the project update conference calls. The results will also be shared with other CA IOUs during scheduled monthly conference calls.

3. Status

In Q4 of 2017, the team has initiated a kick-off meeting where all participating IOUs joined and collaborated. The contracted engineering firm started their initial outreach for survey interviews of identified Auto-DR vendors and customers. An analysis of past participants in Auto-DR was also completed. The team identified Auto-DR Express measures as well as identifying new facility types that would be optimal for the program’s design intent.

In Q1 of 2018, the engineering team completed the survey interviews of Auto-DR customers as well as previously participating vendors. That data was organized and analyzed for reporting back to the IOUs. The completed analysis was presented to the IOUs for consideration and

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feedback. The analysis centered around the logistics of streamlining the Auto-DR process, expand and clarify eligibility for FastTrack/Express type programs, and making ADR projects easier for controls companies sales staff to promote during onsite meetings with customers.

The project working group developed an offline reservation document to be used across all three IOUs. This includes the reservation document to have e-sign features, offline pre-approved lookup load-shed calculations based on climate zone and facility types.

Lastly, in Q1 of 2018, the team laid out the roadmap for the rest of 2018. The roadmap discussed the potential future of Auto-DR program design to address increasing the cost-effectiveness of DR programs in which these facilities might enroll (CBP, CPP-D, etc.)

4. Next Steps

In Q2 of 2018, the team will deliver the final program design for the small medium businesses for 2018 and beyond. To do so, the team will need to complete all necessary measure calculations to derive the pre-determined load shed values per facility type. The project team will also develop a “how to” training manual for offline reservation document to aid controls companies who are able to pitch the DR value proposition in the field.

IV. Budget

Approved Budget per D.17-12-003 (dated December 14, 2017)

Program Approved Budget 2018-2022

	2018	2019	2020	2021	2022	TOTAL
ET-DR	\$656,100	\$675,900	\$695,700	\$717,300	\$738,900	\$3,483,900