# DEMAND RESPONSE EMERGING TECHNOLOGIES PROGRAM

# SEMI-ANNUAL REPORT 2019

September 30, 2019

SDGE

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# Table of Contents

# Summary

The Demand Response Emerging Technologies (DR-ET) Program Semi-Annual Report for the period of Q2 2019 and Q3 2019 is being submitted pursuant to Ordering Paragraph 59 and the discussion at pages 145 – 146 of Decision (D.) 12-04-045. During Q2 2019 and Q3 2019, San Diego Gas & Electric DR-ET Program completed one (1) project, canceled one (1) project, continued to manage six (6) ongoing projects, and started one (1) new Demand Response project.

# I. Completed Projects during the Reporting Period

## *A. Battery Powered Load Shedding System – Automated Demand Response (ADR) Evaluation*

### 1. Overview

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

### 2. Collaboration

The progress and results have been shared with other California Investor Owned Utilities (IOUs), as well as with various interested attendees at the Internal Technology Transfer meetings.

### 3. Status

The project has been fully completed. Handoff meetings have occurred, knowledge transferred, and the final report posted to the Emerging Technologies Coordinating Council (ETCC) website for public review.

### 4. Next Steps

None.

# II. Cancelled Projects during the Reporting Period

## *A. 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 Energy Efficiency (EE) and DR measures at the same time. Efficiency rebates have been in place for such equipment in certain areas, 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 the hottest days) is a prime candidate for DR solutions besides being an efficient technology during normal operation.

The objectives for undertaking this study were:

- 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 (TI) Program as well as traditional DR programs such as Critical Peak Pricing Default (CPP-D) and Capacity Bidding Program (CBP).

### 2. Collaboration

The progress and results have been shared with other CA IOUs as well as with various interested attendees at the Internal Technology Transfer meetings.

### 3. Status

After many failed attempts of locating a site and understanding that the installation of the units to be studied are not abundant enough in SDG&E's territory, SDG&E decided to stop pursing the study.

#### 4. Next Steps

None.

# III. Ongoing Projects thru the Reporting Period

## *A. Whole Connected Home*

### 1. Overview

Whole Home Demand Response (WHDR) is defined as a 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 considers both technologies and other program impact factors such as customer adoption, ease of recruitment, persistence, and data availability for measurement & verification (M&V).

### 2. Collaboration

The progress and results have been shared with other CA IOUs as well as with various interested attendees at the Internal Technology Transfer meetings.

### 3. Status

Final draft report has been submitted to SDG&E for review and comments.

### 4. Next Steps

The next steps for the project are to incorporate the following:
Finalize report details with the vendor writing the report. Schedule and complete the handoff meeting to internal stakeholders to transfer the knowledge gained on the project and lastly post the report to the ETCC website for public review.

## *B. 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 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 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 Electric Power Research Institute (EPRI) who is aiming to build on SDG&E's initial research in this space.

### 3. Status

Per the post measurement and verification data, a decision was made to extend the post trending time period to allow for sufficient data to be collected and ensure a high(er) correlation to the money saved at the facility. The extended time period will last another few months and then the project findings will be finalized.

### 4. Next Steps

Analyze, and finalize the project's economics as well as complete the final report. The final report will be published to the ETCC website for public review.

## *C. Dehumidification & Water Purification Demand Response Project*

### 1. Overview

This project is to evaluate the electric load and demand response capabilities of two (2) types of dehumidification drinking water systems. Ten (10) dehumidification units from two different vendors were installed in buildings around the SDG&E service territory. These units cool air below the dew point to produce water. The collected water is filtered, ozone is injected, then chilled or heated to use as an office "water dispenser" for drinking water.

The primary purpose of the assessment is to:

- Determine the load profile, baseline energy use, and peak demand of the units.

- Determine the available peak load reduction of the units for a demand response event. Multiple reduction strategies may be analyzed, including but not limited to turning the unit off or adjusting the water delivery temperature set points.

The secondary purpose of the assessment is to:

- Understand the added load (load growth potential) to the SDG&E territory assuming a penetration rate.

- Use the micro data to theorize what impact these products could have on the embedded energy in water distribution throughout SDG&E service territory.

### 2. Collaboration

The progress and results have been shared with other CA IOUs during scheduled monthly DR-ET Leadership conference calls. SDG&E ET is also collaborating with our Energy Innovation Center (EIC) to place two units for comparison study.

### 3. Status

All units have been placed in facilities throughout the SDG&E territory. Small operational issues have been detected with both vendor units in the study, but all issues have been very minimal in scope and have typically been attributed to the need for ongoing maintenance. One demo site where a unit was placed decided to close their business so potential relocation of that unit is taking place. Lastly, the trending of the units has been ongoing and will continue into 2020.

### 4. Next Steps

The next step for this project is to continue trending the units additional load it brings to a facility as well as start to focus on the Demand Response performance aspect of the units in early/mid 2020.

## *D. SDG&E's Energy Innovation Center (EIC) – Demonstrating DR Performance of a Variable Refrigerant Flow (VRF) – Indirect Evaporative Cooling (IEC) Hybrid System*

## 1. Overview

Rooftop package air condition systems, or RTUs, are typical for many small to medium commercial office buildings. Replacing RTUs with more energy efficient HVAC alternatives, such as heat humps, offers significant energy savings potential. Within the category of heat pumps, variable refrigerant flow (VRF) heat pumps offer even greater savings potential.

The selected vendor is also contracted with the California Energy Commission (CEC) to demonstrate the application of a hybrid system that combines VRF heat pump systems with Indirect Evaporative Cooling (IEC) units to possibly provide even greater energy savings. While the focus of the CEC project is to document the energy savings impact of the VRF-IEC hybrid system, the DR capability of this hybrid system is beyond the scope of CEC's direction.

However, the DR potential of the VRF-IEC hybrid system could be a potentially compelling value proposition that merits demonstration. Being able to understand the DR characteristics of the hybrid system regulated by a "master controller" during all modes of operation (IEC Only, VRF Only, and simultaneous IEC and VRF) is critical to validate and quantify their DR impact.

## 2. Collaboration

This scope of work is an add-on to a larger CEC project that is focusing on the EE potential of the same combination of equipment and controls strategy. The results are also to be shared with other CA IOUs.

## 3. Status

All controller units have been tested in the lab for integration with the data monitoring devices to ensure data accuracy. Post testing the devices have been installed/commissioned at SDG&E's Energy Innovation Center (EIC). The Demand Response testing has been scheduled and executed with the facility staff team to ensure minimal customer disturbance while maintaining testing accuracy. The DR testing included day ahead notification, 1-hour ahead notification, and 15-minute ahead notification. The DR signals will trigger changes in the modes of mechanical operation based on the following: Ambient Temperature & Humidity, Indoor Temperature & Humidity, Indoor Temperature Setpoints, & Occupancy based load (based on CO2 sensors). The measurement and verification captured by the on-site instruments are monitoring the power for the VRF compressors, the VRF fans, the IEC units, and the thermostat device information.

### 4. Next Steps

Once the post trending period is concluded the next steps are to analyze all the data and draw conclusions about the overall efficiency of the hybrid system as well as define the range of DR event participation with different event notification time frames. Post project analysis, the final report will be drafted and published on the ETCC website for public review.

## *E. In-Home Display & Smart Phone Application (PEEK) Behavioral Conditioning with Time of Use Billing for Energy Efficiency & Demand Response*

### 1. Overview

The Peek Smartphone App is available for customer download, registration and activation. The application is complimentary to the in-home device, enabling the customer to view time-of-use (TOU) pricing periods and period prices via their smartphones. The application can also provide other functions such as SDG&E message pushes to the customer, helpful links and other functionality as developed by the vender.

The goal of this project is to see if a SDG&E residential customer will:

1. Interact with the in-home display;
2. Interact with the smart phone application;
3. Yield any meaningful annual kWh savings verified using the NMEC (Normalized Metering Energy Consumption) analysis;
4. Yield any Demand Response values due to smart phone application messaging using regression analysis as well as a 3-in-5 baseline; and/or
5. Yield a positive residential program design in the form of Total Resource Cost (TRC), Program Administrators Cost (PAC), and Ratepayer Impact Measure (RIM) tests.

### 2. Collaboration

The progress and results will be shared with other CA IOUs. SDG&E's Emerging Technology Department is also collaborating with internal Residential Customer Program Advisors to keep them informed of potential measure value as the project yields positive cost-effectiveness. The ET Team is also collaborating with SDG&E's rates team and marketing groups to ensure effective messaging efforts take place and reach a total number of 500 targeted participants for this project.

### 3. Status

Project marketing has taken place to acquire residential participants for the study. To ensure there is a sufficient Randomized Encouragement Design

(RED) additional marketing efforts need to take place to obtain more participants. The secondary marketing effort is to be completed within the next 30-60 days.

### 4. Next Steps

The next step in this process is to mail the devices to the study group for home installation and commissioning. Product commissioning is said to take less than 15 minutes. Our vendor for this project will bear the responsibility of ensuring maximum product commissioning before any post trending or demand response analysis may begin. Post trending is expected to start in the November/December time frame.

## *F. Voice Activated Assistant for Energy Savings (Integrated Demand Side Management Project)*

### 1. Overview

Voice Assistant type products have found nearly a 30% market penetration in the US in under a year. This is an incredible rate compared to hubs for energy management that have been tried and tested over the last 15 years. Given that voice assistants have now become a gateway for many consumer products, it is critical to understand how they can advance utility customer engagement and drive energy benefits acting as the point of entry for residential customers (and potentially small commercial customers as well). EPRI research from 2017 and 2018 indicated the potential for voice assistants to enable growth in customer engagement from basic messaging to personalizing customer experiences, with varying degrees of engagement in between. From a customer programs perspective, it is important to understand how voice assistants could play a role in allowing new programs or increasing adoption of existing programs.

**This project will consist of the following tasks:**

Task 1: Site identification. SDG&E will provide EPRI with up to five (5) qualified sites where the site owners are willing to accept proxy (or actual) TOU rates. EPRI intends to interview potential site owners to convey optimal and suboptimal scenarios with new technologies, gauging the potential site owner's interest to engage despite potential outcomes. Site owners will also be interviewed by EPRI to see if they can be adopted into SDG&E's TOU rates with bill payment protection. Selected site owners will be required to provide EPRI with access to two years of prior Advanced Metering Infrastructure (AMI) data to conduct the evaluation.

Task 2: EE cost saving measure selection for individual sites. This project will involve a total of up to five homes, with up to three of those homes with behavioral load management, providing messaging through voice assistants for higher cost periods and emergency events, and up to three of those homes with a mix of energy tools for cost savings through TOU rates. The site owners will be allowed to select from a pre-approved pool of end-use systems and devices illustrated in the table below:

| | |
|---|---|
| Thermostats | Ecobee, Venstar, Rheem |
| Batteries | Sonnen |
| Water Heaters | Rheem |
| Blinds | Hunter Douglas |

Task 3: Development of Voice Assistant Skills:

EPRI will work with SDG&E to develop versions of voice assistant skills that may include:

1. Integration of voice assistants to end-use devices using cloud-based integration. This is a technically complex initiative, EPRI has prior experience with some end use devices.
2. Messaging to homeowners about upcoming high price periods.
3. Messaging a high-price period and recommend a specific set of changes for customers to make (reset thermostats, etc.).
4. Messaging a high-price period and, based on customer response, automatically adjusting settings on end-use devices.
5. Provide customers feedback using AMI data (and device data as available) on energy use during normal and high-price periods using the voice assistants.
6. Providing customers an opt-out functionality for high-price periods (a “don’t bother me” command).

Task 4: Device installation and testing. This task involves working with the homeowners to install devices (voice assistants or voice assistants + energy management devices). The end-use devices selected for installation may be influenced by the time required for procurement, installation, and code official approval. Should the time for installation of end-use devices jeopardize the time schedule required by SDG&E, those

devices may be omitted from the project. Homeowners will then be required to enroll in the SDG&E TOU plans. Information is expected to be delivered through the voice assistants on pricing and energy savings. The intent is to measure customer engagement and end-use device performance over a range of weather conditions, including summertime when the potential for electric use reduction is high. If batteries are to be installed, EPRI will need to seek and obtain permits, which have a variable timeline. EPRI will notify SDG&E and seek permission (if needed) for installation contractors selected.

Task 5: DR events. This task initiates DR events through the voice assistants and measures impact through Normalized Metering Energy Consumption (NMEC) at the meter. This measurement is expected to provide a sum of both behavioral operation and automated device operation for DR. Up to 4 events should be implemented in each home during the summer of 2019.

Task 6: Analysis. The project seeks to compile energy use data using both AMI data and additional monitoring points (using device level data and circuit metering). The energy data should then be correlated with pricing signals to understand cost savings over the test period. These cost savings should be extrapolated to annual savings using building energy performance models. Working with SDG&E, the resultant data is expected to be plugged into program development tools for subsequent filings.

Task 7: Reporting. The reports will include a preliminary report that outlines the costs and implementation challenges for voice assistants in a programmatic setting as well as any measured savings using real TOU rates for selected homes. A final report is anticipated in October 2019 that includes both EE and DR impacts over the summer. A formal project handoff to internal stakeholders through a final presentation is expected at the end of 2019.

## 2. Collaboration

The progress and results have been shared with other CA IOUs. SDG&E's ET team is also collaborating with our Residential Program Advisors to keep them informed of potential measure value as the project yields positive cost-effectiveness.

## 3. Status

Installation of the Alexa devices have completed in 4 of the 5 homes in the SDG&E territory. Alexa commands have been tested in the lab for

compliance and scope execution. The Alexa commands will be applied to all 5 homes once Alexa is successfully installed in all 5 homes.

#### 4. Next Steps

The next steps for this project are to complete the QA/QC on the Alexa commands in the lab and then overlay those commands in the devices in the home. Once that portion of the scope is completed, post trending can start to occur as well as planning for DR events for the coming summer.

# IV. New Projects in 2019

## *A. SDG&E Territory Battery Market Study*

### 1. Overview

This study seeks to better understand the commercial & residential battery market in SDG&E's service territory. The focused research shall uncover the current and future state of the market in the territory, understand key drivers, and identify opportunities. Specifically, this project seeks to understand the following issues:

- Number and size of batteries,
- Major battery companies active in the San Diego area,
- Usage patterns,
- Demographics of early commercial and residential adopters,
- The nature of the contracts between the battery vendor and the commercial site or home owner,
- Rates that commercial battery-owning customers are on,
- Peak kW control setpoint of the installed commercial batteries, and
- Battery participation in other non-Company DR programs, including capacity markets, CAISO, etc.

The end goal of SDG&E is to enable customer choice, foster a growing battery marketplace, maintain grid reliability and affordability, and identify opportunities for the utility to reap the benefits of new technologies. This market study will draw from all available information resources, including first-person interviews from numerous industry stakeholders (e.g. manufacturers, system integrators, contractors, consultants, analysts, business customers). Contractor staff will manage engagement with dozens of stakeholders in creating this market study.

### 2. Collaboration

The progress and results will be shared with other CA IOUs.

### 3. Status

The following are the major project milestones that have been completed:

- Industry survey deployed and will close at the end of September
- Currently collected two dozen responses from industry participants
- Draft report framework is being created

### 4. Next Steps

The next major step in the project is to complete the data collection phase. Once the data is collected and analyzed an attempt at deriving a snap shot of the SDG&E territory specifics will take place. If there are large assumptions still being made in the report, an additional effort may take place to gather more specific information from the industry.

## V. Budget

**Program Approved Budget 2018-2022**[1]

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

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