



*Pacific Gas and  
Electric Company®*

# **Emerging Markets & Technology Demand Response Projects 2017 Q1 – Q2 Semiannual Report**

**September 30, 2017**

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## I. Summary

Pacific Gas and Electric Company (PG&E) submits this semiannual report as directed in *Decision Adopting Demand Response Activities and Budgets for 2012 through 2014*, D.12-04-045, Ordering Paragraph (OP) 59 and continued per D.14-05-025 and D.16-06-029 adopting Bridge Funding for 2015-16 and 2017 respectively.

PG&E's Demand Response Emerging Technologies (DRET) program continues to explore new technologies and applications that have the potential to enable or enhance demand response (DR) capabilities and can include hardware, software, design tools, strategies, and services. Examples of some of the types of enabling technologies that have been investigated are advanced energy management control systems (EMCS), direct load controls, and advanced heating, ventilation, and air conditioning (HVAC) controls.

PG&E's DR Portfolio Strategy centers on addressing both customer and grid needs today and in the future, taking into account Rule 24, and the enablement of DR integration into the ISO wholesale markets. In addition, PG&E acknowledges the rapid development of "smart" devices, storage, and other technologies that are seeing increasing customer adoption across sectors, and have the potential to help customers better perform on DR programs.

PG&E, Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E), collectively referred to as the Investor Owned Utilities (IOUs), share updates on individual projects, including project status and findings, at monthly DRET conference calls as well as via participation in the Emerging Technologies Coordinating Council (ETCC) quarterly meetings.

## II. Projects Completed in Q1 & Q2 2017

### A. ***Lab Test to Understand Existing Technologies' Ability to meet CAISO Telemetry Requirements for PDR***

#### 1. Overview

CAISO has telemetry requirements for Proxy Demand Resources (PDRs) that are greater than 10MW or provide ancillary services. The ability for Demand Response Providers (DRPs) to meet the telemetry requirements in a cost effective manner could unlock more DR to be bid into the wholesale market and meet the various needs of the grid. In 2015, PG&E commissioned a white paper to explore the landscape of existing technologies that could meet the CAISO requirements.

Two possible solution sets emerged:

1. Use the existing SmartMeter™ AMI network, owned and operated by Silver Spring Networks (SSN) to communicate along the existing AMI mesh network, “alongside” billing data and, ultimately communicating to a SSN Remote Intelligent Gateway (RIG) which was not yet developed.
2. Enable the SmartMeter’s™ Zigbee radio to communicate with a HAN gateway which can push data to an existing 3<sup>rd</sup> party RIG.

Based on the findings of this paper, a lab study was designed and implemented to explore the technical feasibility of the second solution set: using a Zigbee to broadband gateway communicating to a cloud RIG. The lab study tested two devices: the Rainforest EAGLE and the Universal Devices ISY and used Olivine’s CAISO approved RIG.

## **2. Collaboration**

The DRET team worked in collaboration with the PG&E ATS lab, various PG&E DR staff engaged in the Supply Integration Working Group, representatives from CAISO, and the three vendors mentioned earlier (Olivine, Rainforest Automation, and Universal Devices) to conduct this assessment.

## **3. Results/Status**

Lab test findings showed that both devices operated as expected in the lab under various scenarios. Scenarios included testing characteristics about how devices reconnect when a power or internet connection is lost, investigations of security and time synchrony between the various parts.

With respect to meeting CAISO’s requirements for polling frequency and accuracy, the lab study showed that both devices could meet the CAISO requirements for one minute and five minute telemetry. Accurate four-second polling, needed for spinning reserve, is unable to be achieved with the architecture tested.

## **4. Next Steps**

A final report describing the lab study and key findings was released on the ETCC website. The report describes some potential improvements that can be submitted to the CAISO through their BPM change process to reduce barriers to participation in DR.

Based on lab study’s demonstration of the devices’ performance, a field study was launched in Q1 2017 to further test and demonstrate whether the architecture and technical solutions tested in the PG&E lab environment

could work at a larger scale and outside of a lab. The field study will aim to achieve better understanding of the costs, as well as the challenges of physical deployment and provisioning in customer homes.

## **B. Title 24 – Marketing Education and Outreach**

### **1. Overview**

Title 24, part 6 requires non-residential buildings be built and commissioned with several components of automated demand response infrastructure. There is a code compliance “industry” that has evolved as a result of past building commissioning requirements and the need to ensure that code required activities are known of by those who need to comply and completed properly.

While energy efficiency has been pro-actively promoted within the compliance industry for many years, automated demand response is relatively new to the industry, and many people in the building and construction industry are not familiar with the state’s DR (and integrated demand side management, IDSM) policies, code requirements, or utility DR program offerings available. Anecdotal evidence obtained through standards trainings and demand response program activities indicate that outreach activities designed to increase awareness and understanding of the broader DR policy objectives, code requirements, design strategies, and Auto DR program offerings will improve compliance with the automated demand response systems, and ultimately enable greater participation in DR.

The objective of the project is to educate and inform key market actors who will be impacted by the requirement or can exert an impact throughout the compliance industry. These include equipment manufacturers and design professionals, installers that implement the designs, acceptance test technicians that verify the proper operation, and building department staff that enforce the requirements.

The project reached out to each major target audience via trade/industry organizations to identify opportunities and to determine the best approach to disseminate DR-related information within each group.

### **2. Collaboration**

This study is partnering internally with the Energy Efficiency Codes and Standards team, Auto-DR program and PG&E’s Pacific Energy Center. Coordination with the Codes and Standards team at SCE is also underway as the findings from this study are expected to be useful statewide.

### **3. Results/Status**

A kickoff meeting was conducted at the beginning of 2016 and the first phase of the assessment was to create an Outreach Plan that identified three to four target audiences and document the proposed communication approach for each. During the first half of 2016, the project team developed informational and educational materials which included a fact sheet, web-site enhancements and presentations targeted at various compliance industry actors.

During the second half of the year, the team presented at over 25 in-person meetings and webinars combined. The in-person meetings provided opportunities for deeper engagement, allowing the project team to understand challenges faced by those in the compliance industry when applying the DR-specific code. For example, while many understand Demand Response as a concept, the study showed that there was a loss in knowledge and understanding about how the building code has any relevance to supporting its enablement.

### **4. Next Steps**

A final report on the efforts conducted and lessons learned was published on the ETCC website in the first half of 2017. The findings were shared with statewide codes and standards teams to encourage improved quality of communication about demand response. Future efforts to look specifically at demand response program enrollment, in conjunction with code compliance education and communications can ensure this work has an even more complete impact on demand response participation.

## **III. Projects Initiated in Q1 & Q2 2017**

### ***A. Automated Demand Response (ADR) Assessment of Residential Incentives and Technologies***

#### **1. Overview**

LBNL has worked with PG&E on demand response (DR) and automated demand response (ADR) programs since 2004. Most recently, LBNL has worked with PG&E to support the ADR program with research and analysis to support customer outreach efforts, technical review of proposed customer projects, and program training and recruiting materials. The purpose of this project is to conduct a review of the ADR program currently provided by PG&E and how the lessons learned can provide information needed for enhancing the ADR program in the 2018-2022 cycle. The project will be constructed around a set of 2 tasks and deliverables that include:

- 1) Evaluating logic and thought around midstream and upstream DR device markets and opportunities for residential and SMB customers
- 2) Evaluate a new incentive structure for the ADR Program. For example, offering an incentive based on the incremental cost of the ADR communication technology embedded in the end-use device.
- 3) Develop a list of potential end uses for the residential ADR program

## **2. Collaboration**

This study is partnering internally with the ADR program team and externally with LBNL and PG&E's ADR program implementer.

## **3. Results/Status**

A kickoff meeting was conducted at the beginning of 2017 and LBNL has accomplished the following so far:

- Conducted interviews with Smart Thermostat manufacturers and platform providers to solicit feedback on mid and upstream DR Enabling Technology incentives.
- Conducted additional analysis that leveraged the Phase 2 DR Potential Study conducted for CPUC to identify the potential load reduction of residential end uses such as Pool Pump, EV Charger, HVAC, Battery and Water Heater to provide guidance for expanding PG&E's Residential ADR Incentive Program beyond Smart Thermostats.
- Provided additional rigor to explain the load reduction assumption methodologies for DR Potential on residential DR Enabling Technologies in the Phase 2 DR Potential Study
- Using the Auto-DR Express Solution tool, and a selected number of AutoDR field sites, compared the LBNL results with those from the tool, focusing on the control strategies of "thermostat adjustment" and "Cycling on/off". Initial analysis indicates that the LBNL results are close to the results from express tool at the average level, and the tool reasonably predicts the load shed changes observed with the peak outside air temperature recorded on the DR event days. This result can be used to develop a new incentive structure.

## **4. Next Steps**

The study is scheduled to be completed by the end of the year. Results of this study will be reported in a technical memo to PG&E which will include a set of technical appendices summarizing the data collected. A publicly available version of this memo will be posted to the ETCC or CALMAC.

## **B. Telemetry Field Study**

### **1. Overview**

PG&E's DRET program has been exploring the topic of how to meet CAISO's Telemetry requirements<sup>1</sup> for two years. This field study builds directly on two previous studies<sup>2,3</sup>, each indicating that a zigbee to broadband gateway may be able to serve as a scalable solution to provide telemetry for residential demand response. The ability for Demand Response Providers (DRPs) to meet the telemetry requirements in a cost effective manner could unlock more DR to be bid into the wholesale market and meet the various needs of the grid.

To test the solution architecture in the field, PG&E deployed approximately 380 Rainforest EAGLE gateways in customer homes. For participants, the field study involved installing a Rainforest EAGLE gateway in their home for a fixed period of time, and responding to a brief survey to assess the features of the home that serve as predictors of zigbee or broadband communication barriers. Meanwhile, the gateways were auto-provisioned by PG&E, and pre-configured to send data in 5 minute and 1-minute intervals to Olivine's cloud remote intelligent gateway (RIG).

Data will be collected from the sample of 380 customers and analyzed in a fashion consistent with the lab study that was completed in 2016, with the goal to understand if CAISO's requirements for data accuracy and speed are met outside of a lab environment.

### **2. Collaboration**

This study is partnering internally with PG&E's StreamMyData program. External partners include Olivine Inc, BMW of North America, and Rainforest Automation.

The field study's population was enrolled alongside customers who were enrolling in BMW of North America's IChargeForward study<sup>4</sup>. This collaboration made sense, as both studies required the use of a Home Area

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<sup>1</sup> CAISO has telemetry requirements for Proxy Demand Resources (PDRs) that are greater than 10MW or provide ancillary services.

<sup>2</sup> Veregy Consulting for PG&E. *Assessment of Technologies Available to Meet California Independent System Operator (CAISO) Telemetry Requirements for PDR*. May 2016. Available at [etcc-ca.com/reports](http://etcc-ca.com/reports)

<sup>3</sup> Anderson, Robert; Piell, Sam. *CAISO Telemetry Solution Over Broadband Lab Test and Proof of Concept*. May 2017. Available at [etcc-ca.com/reports](http://etcc-ca.com/reports)

<sup>4</sup> <https://www.bmwchargeforward.com/#program-overview>



Network gateway to provide real time SmartMeter data, albeit for different purposes.

### **3. Results/Status**

By the end of Q2, approximately 380 BMW and PG&E customers were recruited to the study and had Rainforest EAGLEs successfully installed in their homes.

### **4. Next Steps**

Data collection and data analysis are underway in Q3 2017. The study is scheduled to be complete, with a final report published by the end of 2017.

## **IV. Projects Continued in Q1 & Q2 2017**

### **A. *Testing Statistical Sampling Methodologies and Alternative Baseline***

#### **1. Overview**

The CAISO evaluates Proxy Demand Resource (PDR) and Reliability Demand Response Resource (RDRR) wholesale market performance using one of two North American Energy Standards Board (NAESB) measurement and verification standard baseline types (a.k.a. “Type-I” and “Type-II”), with Type-I being the default methodology. Under Type-I, a resource’s performance is based on aggregated interval Revenue Quality Meter Data (RQMD) for all customer locations comprising that resource. However, Type-II is available for resources that do not have interval RQMD available for all locations, which would meet the CAISO’s required timelines. Using Type-II, performance evaluation uses statistical sampling to estimate the performance of the entire resource based on interval RQMD for a subset of the locations in that resource. In order to use the Type-II methodology, a proposal specific to the resource, which demonstrates 10% error at a 90% confidence interval must be submitted to and approved by the CAISO<sup>5</sup>.

The purpose of this project was to develop and analyze a Type-II methodology so that all residential customers may be able to participate in CAISO’s wholesale markets. Phase 1 of the project utilized the residential customers participating in PG&E’s Supply-side Pilot (SSP) to develop a proposal for CAISO’s consideration.

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<sup>5</sup> For more detail on the proposal requirements, see:  
<http://www.caiso.com/Documents/RevisedDraftFinalProposal-EnergyStorageDistributedEnergyResources.pdf>

Phase 2 of this project will allow PG&E to further validate the CAISO approved statistical sampling methodology. The DRET team is planning to work with the Stanford Linear Acceleration Center (SLAC) to test the existing methodology and DR baselines using the VISDOM tool. The Visualization and Insight System for Demand Operations and Management (VIDSOM) tool developed by Stanford is a platform for gaining insight into utility customer behavior using their observed energy consumption data combined with traditional demographic and psychographic attributes.

## **2. Collaboration**

In Phase 1, PG&E worked in partnership with Olivine, the SSP program implementer and Scheduling Coordinator (SC). This study was conducted in concert with the SSP. In Phase 2, PG&E will work with SLAC.

## **3. Results/Status**

In 2016, CAISO approved a sampling plan that was developed for a participant in PG&E's Supply Side Pilot. The approval of the sampling plan was significant, as it was the first Type II baseline proposal to go through a previously unspecified process.

After the sampling methodology was established and approved, the team planned to assess the accuracy of the plan by comparing the projected performance against actual available meter data. The sampling methodology was developed for a participant in the SSP who ultimately proved unable to enroll a sufficient number of kW's to be able to participate in the pilot and therefore the remainder of the assessment could not be pursued.

Meanwhile, PG&E's Measurement and Evaluation team conducted an assessment on the CAISO approved statistical sampling methodology by applying it to the Smart AC program's population and comparing it to the existing methodology, which requires a bigger population than the CAISO approved statistical sampling. Preliminary results indicate that PG&E's approach is more accurate compared to the CAISO approved methodology due to the large population RQMD customers already participating in the SAC Program. PG&E may explore comparing the two methodologies using a control group with only the RQMD population in 2017.

## **4. Next Steps**

PG&E will continue to consider if other residential aggregators are good candidates for statistical sampling for Phase 1, and if so, an assessment of the Type II baseline can be reconsidered. For Phase 2, PG&E is in the

contracting phase with SLAC and the contract is waiting for approval from DOE.

## V. Budget

The following is a breakdown of the total expenditures for PG&E's 2017 DRET budget. These values are based on accruals made each month. Values do not reflect commitments for projects, including those described in this report, which have been scoped and contracted, but not yet executed.

Approved 2017 Budget <sup>6</sup>	\$1,350,051
Budget Spent in 2017 <sup>7</sup>	\$357,508
2017 Budget Remaining <sup>8</sup>	\$992,543

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<sup>6</sup> As approved in D.16-06-029, less \$40,000 that was fund shifted to the Auto DR program.

<sup>7</sup> Through June 30, 2017

<sup>8</sup> As of June 30, 2017