Pacific Gas and Electric Company®

Emerging Markets & Technology
Demand Response Projects
2022 Q2 – 2022 Q3 Semi-Annual Report

September 30, 2022

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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*, Decision (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. The Demand Response Emerging Technologies (DRET) Program was also approved in the *Decision Adopting Demand Response Activities and Budgets for 2018 through 2022*, D.17-12-003.

PG&E's 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 in 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 Q2 2022 and Q3 2022

There were no projects completed in Q2 2022 and Q3 2022

III. Project Initiated in Q2 2022 and Q3 2022

A. Smart Electric Panel Lab/Field Test

1. Overview

In recent years, electric panel manufacturers have started to add connected technologies to traditional electric panels. These technologies include

integrated or add-on software controls that provide customers with additional information and capabilities beyond a traditional panel.

There are two phases of this study:

Lab test –

- Evaluate smart panel installation difficulty
- Evaluate smart panel customer app functions
- Evaluate smart panel utility app functions
- Validate that the smart panel is safe to operate for field demonstrations

Field test –

- Demonstrate the ability of smart electrical panels to deliver targeted, firm reductions in residential demand during critical tested DR events via a whole-home load limiting capability
- Demonstrate the capability for smart electrical panels to provide a platform for residential demand response that does not require direct control of end-use devices

2. Collaboration

PG&E's DR Emerging Technology and PG&E's Applied Technology Service (ATS) teams jointly designed and will implement the test cases and procedures for the lab tests.

3. Results/Status

The ATS team installed two smart panels at its San Ramon location. The panels are connected to a load simulator, which may expand to real residential electric loads such as air conditioning, electric vehicles, and water heaters in the future. The team is currently developing test cases for the customer and utility apps.

4. Next Steps

The ATS team will start testing the customer and utility apps starting October 2022 and expects this process to last 4-6 weeks.

IV. Ongoing DRET Projects

A. Evaluate Third Party Aggregator and Vendor Interest in Residential Digital Rates

1. Overview

The objective of this study is to evaluate third-party (example: integrated demand side management aggregators and smart energy vendors/manufacturers) interest in using residential digital rates to help customers be successful when they are already enrolled in a dynamic rate such as time of use (TOU), electric vehicle (EV) and SmartRate. Below are the proposed scoping topics for this study:

- Defining a digital rate
- Determining the format of the dynamic rate
- Scoping information technology (IT) architecture design that can be scaled in the future
- Documenting third parties' preferences on the channels and different type of rates
- Testing different channels that can provide digital rates to third parties
- Testing the elasticity of different type of rates (dynamic, tier and non-tier, etc.)

2. Collaboration

PG&E's DR Emerging Technology and Share My Data teams jointly designed and will implement this Emerging Technology assessment. Internal stakeholders would include the Pricing Products and IT teams. PG&E hired a consultant to lead the digital rate development.

3. Results/Status

CPUC Energy Division Staff suggested that PG&E put this DRET study on hold due other priorities, such as the Reliability Order Instituting Rulemaking (OIR). PG&E delayed the deployment of this DRET study until the end of second quarter 2021 and is restarting the study in the 3rd quarter of 2021.

4. Next Steps

PG&E hosted three webinars to enroll third parties into the study and three parties submitted a registration form to show interest in participating in the study. PG&E signed a participation agreement with one vendor in the 3rd

quarter of 2022 and will start engaging with this vendor in the 4th quarter of 2022.

B. Voice Automation Technology for Load Management Study

1. Overview

PG&E started to default residential customers to TOU rates in April 2021. Therefore, PG&E will expand the existing tools and technologies offered on its website to help customers understand new time varying rates. The objective of this DRET study is to leverage residential voice assistant technology (such as Amazon Alexa) to educate residential customers on energy usage and bill forecasts, rates, TOU automation/optimization, and notification of utility events.

Customer engagement through Voice Assistants require the customer to have access to Amazon Alexa via speakers, display, and/or mobile app. Information is collected and processed from PG&E's internal rate engine and Share My Data (SMD) to a third-party system. The customer would then interact with a third-party system (Energy Expert) through their smart speakers, smart display, and mobile devices. The Energy Expert will advise the customers to optimize their energy use based on the customer's rate schedule. In addition, the app will provide customer notification such as Smart Days and PSPS events.

This study has two phases. Phase 1 of this program will target 5-10 employees (combination of PG&E employees and friends of PG&E employees). Phase 2 will target up to 200 customers.

2. Collaboration

The DRET team is partnering with the internal customer care Pricing Pilot and Marketing teams to develop frequently asked questions (FAQs) that relate to TOU and load management. PG&E hired a third party to develop a smart speaker application (a voice automation skill named Energy Expert) for this study.

3. Results/Status

The DRET team completed performing small scale User Acceptance Test on the Energy Expert skill. Below is list of sample questions that were supported by the Energy Expert skill in Phase I:

- What's my bill? (As of yesterday)
- What's my energy usage? (As of yesterday)

- What is my current rate?
- What other rates are available?
- Am I on the right rate?
- What's a good time for to run appliances?
- When are prices the lowest? (For both Smart Rate and non-SR customers)

4. Next Steps

The DRET team worked with Amazon to leverage the notification function for Smart Days and PSPS and successfully completed Phase 1 of the study. This study this product to residential customers through the Apple app stores and have enrolled close to 130 participants as of the 3rd quarter of 2022.

C. Heat Pump Water Heater Barriers and Mid-Stream Solution Study

1. Overview

The majority of existing single family and low-rise multifamily buildings use natural gas for some or all of the following end-uses: space heating, water heating, cooking, clothes drying, fireplace and pool heating. The State of California has allocated funding from several different sources for residential electrification efforts targeting space and water heating equipment. Following the launch of new programs to support these efforts, several challenges have been identified that could significantly delay market transformation.

For example, converting existing gas water heaters to heat pump water heating (HPWH) equipment across the state will require a comprehensive effort across the entire industry, including education for homeowners and equipment manufacturers, enforcement personnel, distributors, and installers. Initial efforts have identified several challenges that inhibit selection and installation of HPWH, including, but not limited to:

- Insufficient panel capacity
- Location of existing equipment (e.g., most HPWH require 240V supply, no electricity (or only 120V) at equipment location)
- Permitting (both electrical and plumbing)
- Familiarity with technology (both for homeowners and contractors)
- Equipment not locally stocked

As most water heater replacements are triggered by equipment failure with the majority resulting in emergency replacements, the objective of this DRET study is to identify potential solutions to these barriers, with a focus on leveraging mid-stream channels such as contractors, distributors, and retailers to increase adoption of this technology.

2. Collaboration

This study is a joint Energy Efficiency (EE)/DR Emerging Technology Study. PG&E is planning to hire a third party to lead this research project. The third party is responsible to partner with other initiatives that are related to heat pump water heater such as Technology and Equipment for Clean Heating (TECH) and Building Initiative for Low Emissions Development (BUILD).

3. Results/Status

The implementer developed a Midstream Heat Pump Water Heater Study and Field Test SharePoint extranet site. The extranet will provide contractors and distributors access to the Resource Library, which is a searchable catalog of materials on the study. The implementer developed different marketing materials and marketing plans. HPWH contractors and distributors were recruited for the study. In addition, the implementer also interacted with major HPWH manufacturers such as AO Smith, Bradford White, Rheem, and Nyle.

4. Next Steps

The study will continue to focus on the following tasks in the next two quarters:

- Completion of the PG&E Midstream HPWH Study and Field Test: Supply Chain Market Study
- Work with PG&E Workforce Education and Training team, PG&E Code Compliance, and BayREN Code Training on the best pathway for knowledge sharing from the Supply Chain Market Study to help support their existing efforts on HPWHs
- Recruit more distributor into the Field Test.

D. BTM Battery for Load Management Study

1. Overview

This study evaluates how behind the meter (BTM) residential battery system can be used to provide value to the customers and the grid when the battery is optimizing under different dynamic rates (e.g. TOU and real

time pricing (RTP)[1]) and DR events. The study will focus on two groups of customers: customers with an existing battery and customers purchasing a new battery.

PG&E will have collected data that informs the below program enhancement goals:

- Determine how best to leverage battery storage technologies for TOU, DR, RTP, load following, and load shaping.
- Increase number of customers with DER technologies participating in DR programs
- Reliable load reduction: ability to deliver the amount of load reduction that is promised
- Meaningful load reduction: identify when and how DERs can provide value to the grid in DR programs
- Speed of response: measuring the speed of distributed battery storage response.
- Load building capability: the ability to increase minimum load and thus decrease ramping capacity needs and increase hosting capacity
- How to remove significant barriers for battery storage aggregators and their customers to use DER technologies when participating in DR programs
- How to ensure DR programs remain cost effective with these enhancements

This study will collect data, such as customer load performance and effectiveness of different algorithms during 2021 and 2022, to inform optimal program design for aggregators and customers with a BTM battery, which could then inform future DR funding applications.

2. Collaboration

The DRET team is collaborating with the internal Distributed Generation and Pricing Products team to implement this study. PG&E hired one consultant to manage the implementation and Evaluation, Measurement and Verification (EM&V) for this DRET study, and another consultant for TOU, DR and RTP signals dispatch.

3. Results/Status

PG&E completed the scope for the study and contracted with one battery manufacturer and two energy platform implementers for the study. The

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[1] RTP as represented by the CAISO IFM Day Ahead LMP PGAE DLAP price

study also developed a customer participation agreement and websites for customer recruitment. As of September 2022, the DRET study recruited 110 customers to participate in the study.

4. Next Steps

The study completed customers recruitment and will continue to send TOU, DR and RTP signals to customers' battery until the end of October. The M&E consultant will start to develop the final report on November 2022.

V. Budget

The following is a breakdown of the total expenditures for PG&E's 2018-2022 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 for, but not yet executed.

At the time of filing this report, PG&E has over committed its DRET budget. In response, PG&E is planning to fund shift a portion of ADR funds to the DRET Program in 2022. Because the fund shifting amount will be less than 50% of the ADR budget, it will be reported in the monthly DR ILP report.

Approved 2018-2022 Budget	$7,230,000
Budget Spent as of August 31st, 2022	$6,822,574
Budget Committed as of August 31st, 2022	$407,426
2018-2022 Budget Remaining (estimated)	$0