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September 27, 2019

Ed Randolph
Director, Energy Division
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Re: A.11-03-001 et al- Southern California Edison Company's 2019 Semi-Annual Report on Demand Response Emerging Technologies Program

Dear Mr. Randolph:

In accordance with Decision 12-04-045, Ordering Paragraph 59, attached please find Southern California Edison (SCE) Company's semi-annual report. This report is also being served on the most recent service lists in Application 11-03-001 et al. and Rulemaking 13-09-011, and has been made available on SCE's website. The URL for the website is:

Go to www.sce.com;

- Click on the "Regulatory" Information link at the bottom of the page;
- Select "CPUC Open Proceedings";
- Enter "A.11-03-001" in the search box;
- Locate and select the "SCE Emerging Markets & Technology DR Projects 2019 Q1-Q2 Semi-Annual Report" link to access associated document.

If you have any questions, please feel free to contact me.

Sincerely,

/s/ Adenna Lee

Adenna Lee

cc: A.11-03-001 et al. Service List
R.13-09-011 Service List

Enclosure

Demand Response Emerging Markets and Technologies Program

Semi-Annual Report: Q1 – Q2 2019

Prepared by:
Southern California Edison (U-338-E)

September 2019

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Contents

Abbreviations and Acronyms

AC	Air Conditioning
ACEEE	American Council for an Energy-Efficient Economy
ADR	Automated Demand Response (aka Auto-DR)
AHRI	Air Conditioning, Heating, and Refrigeration Institute
AHU	Air-Handling Unit
AMI	Advanced Metering Infrastructure
API	Application Program Interface
ASHRAE	American Society of Heating and Air Conditioning Engineers
AT	Advanced Technology
AutoDR	Automated Demand Response
BAN	Building Area Network
BBI	Better Buildings Initiative
BCD	Business Customer Division
BEMS	Building Energy Management System
BESS	Battery Energy Storage System
BOD	Biochemical Oxygen Demand
C&S	Codes and Standards
CAISO	California Independent System Operator
CALTCP	California Lighting Contractors Training Program
CASE	Codes and Standards Enhancement
CCS	Conditioned Crawl Spaces
CEC	California Energy Commission
CPUC	California Public Utilities Commission
CSI	California Solar Initiative
CZ	Climate Zone
D.	Decision (CPUC)
DAC	Disadvantaged Community
DER	Distributed Energy Resource
DOE	Department of Energy
DR	Demand Response
DRAS	Demand Response Automated Server
DRLIMFH	Deep Retrofits in Low-Income Multi-Family Housing
DRMEC	Demand Response Measurement and Evaluation Committee
DRMS	Demand Response Management System
DRRC	Demand Response Research Center
DSM	Demand-Side Management
EDF	Environmental Defense Fund
EE	Energy Efficiency
EEC	Energy Education Center
EERP	Energy Efficient Retrofit Packages
EM&T	Emerging Markets & Technologies
EMCB	Energy Management Circuit Breaker
EMS	Energy Management System
EPA	Environmental Protection Agency
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
ET	Emerging Technologies
ETCC	Emerging Technologies Coordinating Council
EVSE	Electric Vehicle Supply Equipment
EVTC	Electric Vehicle Test Center

EWH	Electric Water Heater
FDD	Fault Detection and Diagnostics
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
GIWH	Grid Integrated Water Heater
GWP	Global Warming Potential
HAN	Home Area Network
HEMS	Home Energy Management System
HFC	Hydrofluorocarbons
HVAC	Heating, Ventilation, and Air Conditioning
IALD	International Association of Lighting Designers
IAQ	Indoor Air Quality
IDSM	Integrated Demand-Side Management
IESNA	Illuminating Engineering Society of North America
IoT	Internet of Things
IOU	Investor-Owned Utility
kW	kilowatt
kWh	kilowatt-hour
LADWP	Los Angeles Department of Water and Power
LBNL	Lawrence Berkeley National Laboratory
LEED	Leadership in Energy and Environmental Design
LIMF	Low-Income Multi-Family
M&V	Measurement and Verification
MF	Multi-Family
MSO	Meter Services Organization
MW	megawatt
NEEA	Northwest Energy Efficiency Alliance
NEM	Net Energy Metering
NG	Natural Gas
NPDL	New Product Development & Launch
NREL	National Renewables Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
OCST	Occupant-Controlled Smart Thermostat
OEMs	Original Equipment Manufacturers
OP	Ordering Paragraph
OpenADR	Open Automated Demand Response
OTE	Oxygen Transfer Efficiency
PC	Personal Computer
PCT	Programmable Communicating Thermostat
PDR	Proxy Demand Response
PEV	Plug-In Electric Vehicle
PG&E	Pacific Gas and Electric
PLMA	Peak Load Management Alliance
PLS	Permanent Load Shift
PMS	Property Management System
PTR	Peak Time Rebate
PV	Photovoltaic
QI/QM	Quality Installation/Quality Maintenance
RESU	Residential Energy Storage Unit
RFI	Request for Information
RPS	Renewable Portfolio Standard
RSO	Revenue Services Organization
RTU	Rooftop Unit (air conditioning)
SCE	Southern California Edison

SDG&E	San Diego Gas and Electric
SEER	Seasonal Energy Efficiency Ratio
SEPA	Smart Electric Power Alliance
SGIP	Self-Generation Incentive Program
SME	Subject Matter Expert
SMUD	Sacramento Municipal Utility District
SoCalGas	Southern California Gas Company
SONGS	San Onofre Nuclear Generating Station
T-24	Title 24 (California building energy efficiency code)
TES	Thermal Energy Storage
TOU	Time of Use
TTC	Technology Test Center
UCOP	University of California – Office of the President
UL	Underwriters Laboratories
USGBC	U.S. Green Building Council
VCAC	Variable-Capacity Air Conditioning
VCHP	Variable-Capacity Heat Pump
VCRTU	Variable-Capacity Roof Top Unit
VNEM	Virtual Net Energy Metering
VRF	Variable Refrigerant Flow
WW	Wastewater
WWTP	Wastewater Treatment Plant
ZNE	Zero Net Energy

1. Summary

Southern California Edison (SCE) submits this 2019 Q1-Q2 semi-annual report in compliance with Ordering Paragraph (OP) 59 of the California Public Utilities Commission (CPUC) Demand Response Decision (D.) 12-04-045,[1] dated April 30, 2012. The subject Decision directed SCE to submit a semi-annual report regarding its demand response (DR) Emerging Markets and Technology (EM&T) projects by March 31 and September 30 of each program year.

As described in SCE's 2018-2022 DR program application (A.17.01.012, et al), and ultimately approved in D.17-12-003, the SCE DR EM&T program facilitates the deployment of innovative new DR technologies, software, and system applications that may enable cost-effective customer participation and performance in SCE's DR rates, programs, and wholesale market resources.

SCE works collaboratively with other California Investor-Owned Utilities (IOUs), as well as with other DR research organizations, national laboratories, trade allies, and state agencies, to investigate innovative applications and software that could enable increased customer participation in SCE's DR program portfolio. Reports from previous EM&T studies can be found at the Emerging Technology Coordinating Council (ETCC) website at www.etcc-ca.com.

In accordance with the CPUC direction for the reporting of the DR EM&T program, this report covers SCE DR EM&T project activities during the timeframes between January 1, 2019 and June 30, 2019, for Q1 and Q2 of program year 2019.

[1] D.12-04-045, Decision Adopting Demand Response Activities and Budgets for 2012 through 2014, Ordering Paragraph 59, *available at*: http://docs.cpuc.ca.gov/PublishedDocs/PUBLISHED/GRAPHICS/165317.PDF].

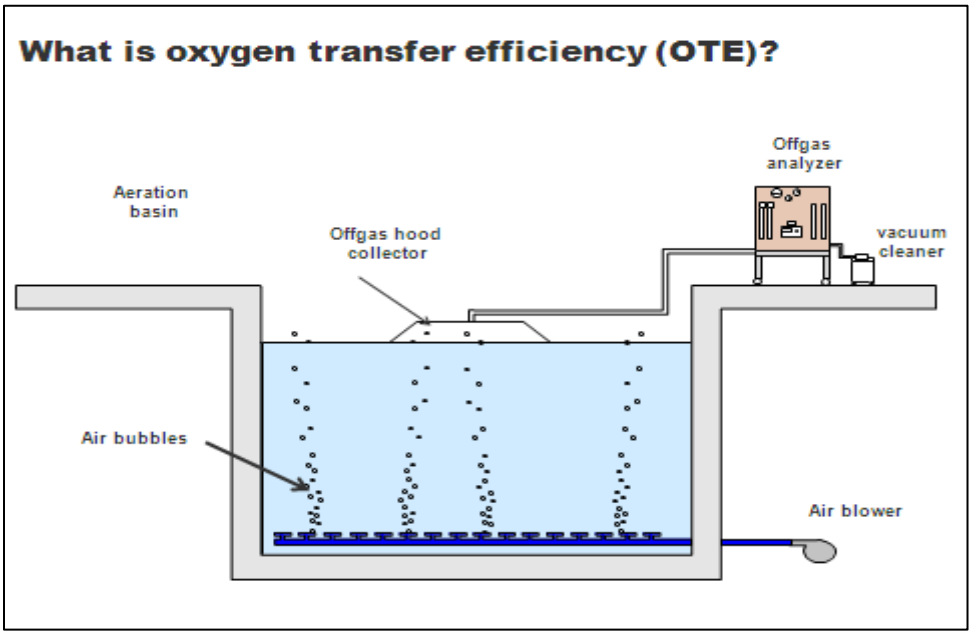
2. Projects Completed Q1 – Q2 2019

DR15.18 Wastewater Treatment Plant Demand Response

Overview

Wastewater (WW) processing in the water industry is a critical process that is an energy-intensive and continuous industrial operation, subject to varying hourly surges that must be met in real time. Typical WW Treatment Plants (WWTPs) have limited capacity to delay or shift operations, and often cannot store incoming WW, which prohibits effective DR strategies that could otherwise be deployed.

Recent technological developments have shown a significant reduction in electrical power consumption may be possible for WWTPs, that would improve their energy efficiency and present an opportunity for DR. Aeration blowers that can effectuate the process of oxygen transfer efficiency (OTE) are used as part of the secondary treatment stage (activated sludge). They may account for 50% of a plant's energy demand and usage and can be controlled through new technology to significantly reduce power requirements, thereby making effective DR event responses possible.



Wastewater Aeration System

This project tested several changes to a WW treatment facility's aeration operation to facilitate DR adoption capabilities and assess load impacts. The goal of the testing was to find the optimum configuration that meets DR objectives without compromising the process operations.

Project deliverables included:

- A report including methods, site data logs, results of DR effectiveness, and recommendations for future development and application.
- A permanent advanced OTE analyzer installed at the Chino, California site.

Collaboration

Multiple stakeholders came together to design the project, provide technical support, and helped to ensure project success though meaningful engagement:

- DrH2O, the prime contractor which developed the OTE Analyzer, was responsible for all field work and technical expertise
- University of California (UC) Irvine supported DrH2O as a subcontractor
- SCE's field engineering staff worked with the DrH2O team to support the field and technical work
- A WW facility in Chino, California, provided the installation site

Results/Status

By considering the specific energy pricing structures (e.g., time-of-use rates) and charges (e.g., energy usage, peak power demand charges), the project team found it is possible to optimize and reduce or shift peak power demands. Intermittent aeration is a strategy that refers to operating aeration with on and off cycles during peak hours to enhance mixing and increase aeration savings. The simulations of this strategy resulted in cost savings improvements close to 18% for almost all the seasonal periods.

Next Steps

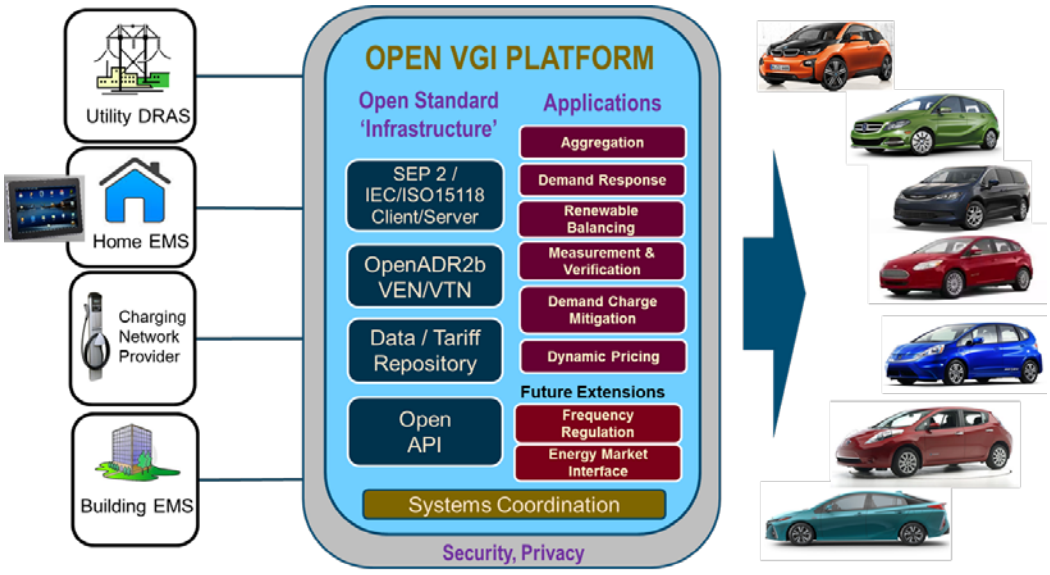
The results will be shared by SCE field staff with other customers. However, further studies would be required to better define and understand how the specific aeration strategies could be optimized for both effective demand management and shifting of operations to allow for maximum DR flexibility. The report can be found at:

https://www.etcc-ca.com/reports/demandresponse-system-wastewater-aeration-using-line-offgas

DR16.02 Open Vehicle Grid Integration Platform (OVGIP)

Overview

Plug-in Electric Vehicles (PEVs) and Electric Vehicles (EVs) represent a rapidly growing class of smart, connected loads with increasing nationwide adoption. Utilities have an opportunity to manage PEV charging in a manner consistent with DR and DSM objectives. Over the last two years, Electric Power Research Institute's (EPRI) Electric Transportation program has engaged with eight leading global PEV manufacturers to develop a proof-of-concept for an Open Vehicle Grid Integration Platform (OVGIP) to streamline PEV charging. This platform may enable access to data on vehicle energy use, charging profiles, and consumer responses to various signals or inducements to affect charging. With these capabilities, utilities will be able to integrate all PEVs in their service territories into DR and DSM programs.



EPRI OVGIP Project Architecture

The OVGIP project objective was to advance the open platform concept into the product development and testing stages. This project assessed the effectiveness of an open standards-based platform to seamlessly integrate PEV charging with grid objectives through DR and DSM mechanisms.

The project included the following research objectives:

1. Create requirements and use cases for a unified grid services platform that is secure, low-cost, open, and extensible.

2. Develop an architecture and functional representation of a platform that enables PEV integration into DR and DSM use cases.
3. Assess the OVGIP platform performance against industry requirements through field trials at utility host sites.
4. Enable utilities to use one platform to reach out to multiple Original Equipment Manufacturers (OEMs) and receive an aggregated capacity.

Project deliverables were:

- A report describing the technical requirements, architecture, design, and open-interface specifications
- Open-grid services platform software to integrate and apply to future extensions of other end-use devices and additional grid services
- An EPRI final report, with specific recommendations for next steps

Collaboration

The project is in collaboration with EPRI, multiple industry vehicle OEMs, and utilities. EPRI coordinated the participating utilities and prepared the final report. Automotive industry participants included BMW, Daimler, Fiat Chrysler, Ford, Honda, Nissan, and Toyota (observers were GM, Tesla and VW Group). These utilities formed the development team: Pacific Gas and Electric (PG&E), San Diego Gas and Electric (SDG&E), Sacramento Municipal Utility District (SMUD), Puget Sound Energy, Hawaiian Electric, New York Power Authority, Southern Company, Duke Energy, American Electric Power, and Con Edison.

Results/Status

The project has been completed, with the OVGIP validating the presupposed need for direct PEV communications connectivity. The OVGIP would provide both excess supply side (add charging load) and supply side (reduce charging load) the ability to exercise PEVs as a controllable dispatchable load for utilization as a load modifier resource. A significant outcome of the project was that the OVGIP successfully provided a viable interface and communications connection between the utility and the customer PEVs for managing charging loads. The OVGIP validated the research concept for DR aggregation of PEV charging load using the Original Equipment Manufacturer (OEM) telematics vehicle connection and the ability to collect individual customer charging profiles.

Next Steps

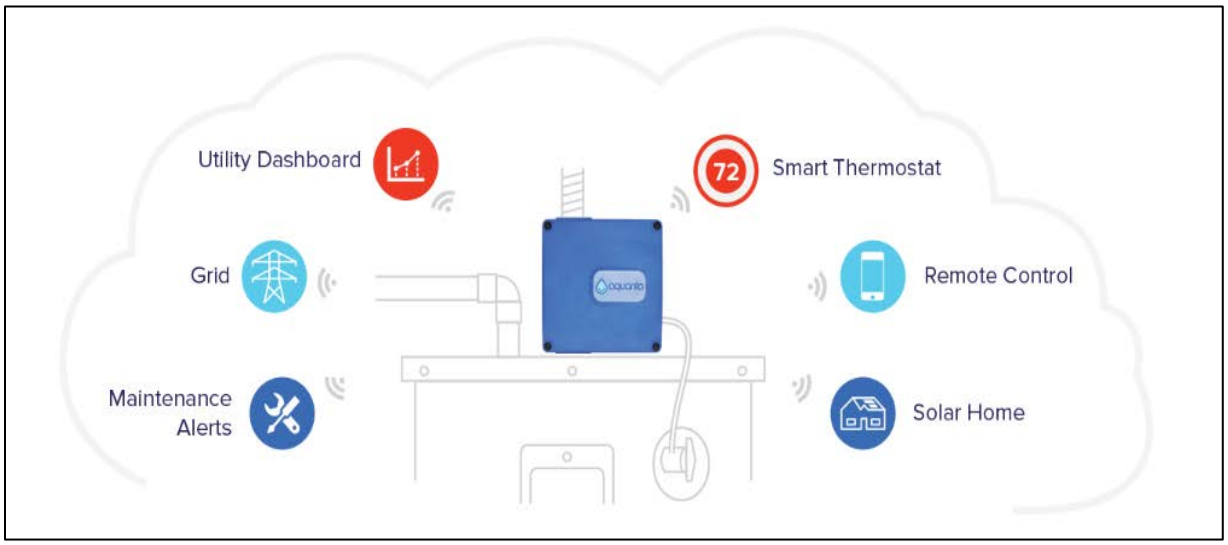
EPRI is expected to provide a public version of the report that will ultimately be posted on the ETTC-CA website, but for now the report is considered internal-only and is limited to EPRI members. No publication date has been given.

DR17.06 Aquanta Smart Water Heater Controller

Overview

SCE was interested in examining the capabilities of advanced load management and dispatchable DR strategies for future GHG-mitigating consumer technologies, such as non-gas water heater systems. To advance research and learn more about advanced Electric Water Heater (EWH) control systems, SCE selected Aquanta, a "smart" water heater controller, for initial evaluation and assessment.

SCE conducted laboratory testing in Phase 1 and field testing in Phase 2. This testing helped SCE understand the controller's communication technology, how the device gives customers better energy management of the water heater systems, and how SCE may explore strategic flexible DR initiatives with electric water heaters that have improved GHG benefits.



Smart Water Heater Controller Features

Aquanta is usable with both electric and gas water heaters. Utility use cases for this technology include energy savings and cost reduction optimization, demand response through the application of "shift," Time-of-Use (TOU) pricing enablement, and opportunities for "absorbing" low-carbon energy from excess renewable generation. This SCE project assessed the device's DR control strategies for local "learning" control algorithms, as well as advanced capabilities for DR flexibility for electric resistance water heaters.

Collaboration

This project was initiated by ETCC, with stakeholders from PG&E, SCE, Southern California Gas Company (SoCalGas), SDG&E, the California Energy Commission (CEC), SMUD, and the Los Angeles Department of Water and Power (LADWP). SCE's Emerging Technologies (ET) division was selected to investigate OpenADR compliance with Aquanta's cloud-based system. The SCE Technology Test Center (TTC) developed a laboratory test bed to evaluate Aquanta's controller with other water heaters.

Results/Status

The project has been completed. This laboratory study offered detailed insights into the complex interactions that can occur in a water heater for demand management. Outcomes identified included that the technology worked as planned in the laboratory, but for field deployment, a continuous balance must be maintained for meeting hot water needs, mitigating safety concerns for scalding and pathogen development, and managing energy use and peak demand. This investigation also confirmed that this technology shows promise to enable utility programs to implement the three main DR strategies identified, with some given nuances that can be addressed such as Load Curtailment, TOU Controls, and Grid-Integrated Water Heating (GIWH).

The project report recommends that further studies should be pursued to better understand how to characterize broader market offerings for retrofit and on-board controls for GIWH. In addition, classifications of control product families should be defined and pursued for DR program development. DR program requirements and specifications related to communications and DR scheme capabilities should also be established. Additional research should be pursued to develop an acceptable tool for predicting hot water usage, which would enable future water heater DR program use. Resources for T-24 energy modeling purposes, and the tool established for the Department of Energy (DOE) Building America program should also be considered.

Next Steps

The report has been posted to the ETTC website and the outcomes of the work have been shared with internal SCE stakeholders for review and possible investigation for additional program development. The report can be found here:

https://www.etcc-ca.com/reports/smart-water-heater-controller-study

3. Projects Continued Q1 – Q2 2019

DR15.21 Mosaic Gardens Low-Income Multi-Family Housing

Overview

A large percentage of new construction in California is now Multi-Family (MF) residential. Much of this housing stock is targeting a long-overlooked segment: Low Income. As a result, government programs are providing incentives to encourage the development of new Low-Income Multi-Family (LIMF) residential construction projects.

Co-funded by the Emerging Technologies Program, the Mosaic Gardens project provides SCE an in-situ opportunity to demonstrate Zero Net Energy (ZNE) measures in new LIMF construction. The knowledge gained will assist in understanding implementation barriers that can inhibit greater adoption of ZNE in this sector. The goal is to conduct a field test to evaluate the installation and operation of viable measures that could provide EE and DR capabilities in individual residential units and communities.

Mosaic Gardens complex

Located in Pomona, California, Mosaic Gardens is a new, three-story LIMF residential development consisting of 46 apartment units constructed on an infill lot. The apartment units vary in size from one to three bedrooms. The community serves tenants that are low-income; half the units are designated for displaced residents. This project is a demonstration of ZNE in Multi-Family residential construction and includes renewable energy generation technology implemented at this development, with a 34-kW rooftop photovoltaic (PV) array serving the common areas. The interaction of these systems is fundamental to attaining ZNE goals. As part of this unique field assessment, the project evaluation will cover the performance, customer acceptance, operational viability, EE, DR, and cost-effectiveness of the applied technologies. From this test, SCE expects to gain a comprehensive understanding of installation costs and barriers to ZNE in new construction.

The EM&T portion of the project includes the demonstration of key DR features, including smart communicating thermostats to reduce electricity demand in response to an OpenADR signal. The thermostats are expected to provide improvements to LIMF community management, operations, commissioning, and improved tenant comfort, while supporting low-energy usage and costs.

Commercial mesh-network thermostat system

Collaboration

Many stakeholders are collaborating in this multi-faceted project to ensure success towards the project goals. The facility owner, LINC Housing, is a key stakeholder,

demonstrating support as an early adopter of new technologies to the LIMF segment. The CEC is another important stakeholder, and EPRI is providing support to collect and analyze energy usage data that demonstrate the building system's performance.

SCE's stakeholders include the Emerging Technologies Program, the Savings by Design group, and the Codes and Standards group. Together, these stakeholders provide much support which includes leveraging resources to investigate DR and Distributed Energy Resource (DER) opportunities, providing SMEs, helping the owner identify measures that qualify for incentive payments, and providing SMEs to support the project throughout the design and construction process.

Results/Status

The ZNE aspects of construction for the project are complete with all building systems operational. Final field data are being collected to support research objectives with occupancy, and the results will be transferred for a potential new multi-family building code. The data will also serve to support similar ZNE projects that LINC and SCE are engaged in through the CEC and EPRI. Additional predictive outcomes from this project are expected to provide insights into how and when energy is used in a LIMF development. The detailed real-world data collected on the interaction of building technologies with residents shall provide insights to the high-performance building industry in planning future LIMF developments.

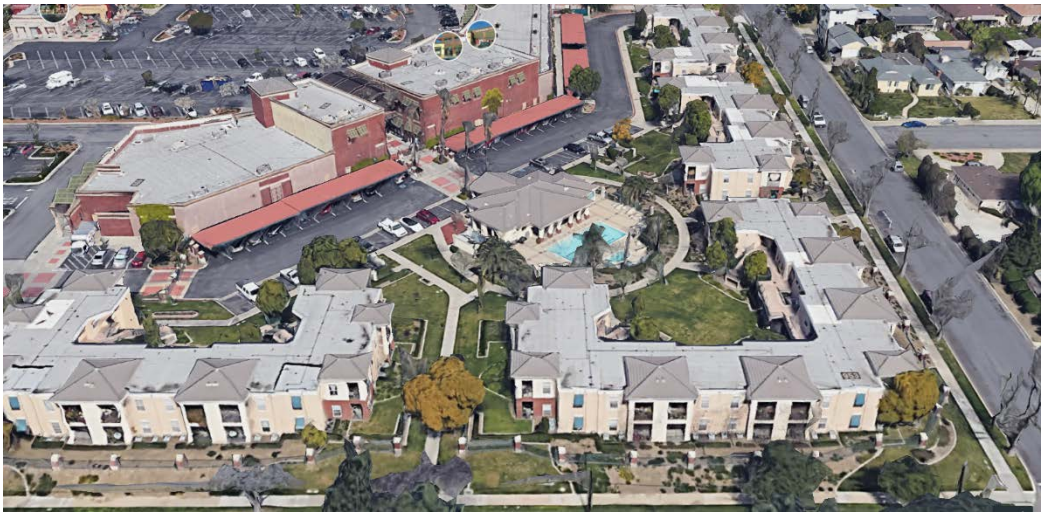
Next Steps

The ZNE work will continue for another six months for post-occupancy data collection. The demand response aspects of this project include the operation of the smart thermostat mesh network system and overall HVAC management at the site. The final report for these results is being developed to provide design observations and recommendations for future program applications. Expected report delivery is scheduled for the end of second quarter 2020.

DR17.02 Customer-Centric Approach to Scaling IDSM Retrofits

Overview

California's Building Energy Efficiency Standards are moving the state closer to achieving its ZNE goals of all new low-rise residential buildings to be ZNE by 2020, and all new commercial buildings to be ZNE by 2030. Achieving these goals is a major improvement in energy efficiency in the construction industry's building practices and presents occupants with energy, cost, and Greenhouse Gas (GHG) reduction opportunities. Additionally, DR load management strategies can be tested to support ZNE. Co-funded by SCE Emerging Technologies, this project is a partnership through an Electric Program Investment Charge (EPIC) solicitation, with EPRI as the awardee. The EPIC solicitation is titled "Scaling Customer-Centric Energy Efficiency Retrofits with Integrated Demand Side Management (IDSM)."



Senior Apartments with IDSM Retrofits

This project's primary goal is to formulate, demonstrate, and evaluate an innovative retrofit methodology for designing IDSM/ZNE packages that could enable scaling EE and DR measures in existing low-income communities. This combined EE and DR project is intended to demonstrate IDSM and ZNE solutions in the MF sector category. An existing LIMF property will be used in the demonstration and will undergo retrofits to achieve the ZNE research objectives. The measures for DR assessment include smart thermostats in the units.

Project objectives are to:

- Formulate IDSM and ZNE solutions for MF residences.
- Create new resources for IDSM retrofit solutions to meet ZNE goals.
- Create IDSM retrofit guidelines for residences in low-income communities.
- Develop a list of technologies that create customer-centric packages for future retrofits that can enable and enhance DR strategies.

Collaboration

Many stakeholders are involved, starting with the CEC, which developed the EPIC solicitation. EPRI won the EPIC solicitation and is the overall project lead. Another key stakeholder is LINC Housing, an affordable housing owner and operator. SCE is the host utility, technology lead, grid-side lead, and is providing subject matter expert (SME) assistance. Sustainable engineering consulting is provided by BIRAenergy.

Results/Status

Construction work is complete for the retrofit measures, also known as the Energy Efficient Retrofit Package (EERP). As part of the EERP, the apartment units underwent HVAC retrofits. The data collection devices were installed and commissioned using circuit-level plug load data collection devices. The data is being collected by the EPRI team. For the EM&T program, the focus of data collection will be the operation of the smart thermostats and how they have provided optimization of the systems for load management.

Next Steps

Since the retrofit construction at the site is now complete, the post–retrofit occupancy data are being monitored. These data are on-track to provide information via active feedback to various project and industry stakeholders to demonstrate appropriate ZNE and IDSM technologies. The final report draft is scheduled for delivery in the third quarter of 2020. Following the final approval of the report filed with the CEC, the public version of the project report will be posted on the ETCC website.

DR17.03 Demonstration of Affordable, Comfortable, and Grid-Integrated ZNE Communities

Overview

A primary goal of this project is to demonstrate the technical and economic feasibility of advanced measures for all-electric ZNE homes within the MF housing sector. A secondary objective is to study how ZNE MF homes perform with solar and storage. The mission will be to develop the appropriate strategies for effective integration to the electric grid via load management and load modifying end-use operation, and by using appropriate technologies such as smart air-conditioning controls and other end-use measures.

Architectural Rendering of ZNE MF housing

Project outcomes are expected to provide input to the development of the California Energy Code; help develop neighborhood planning tools for all-electric master communities; assist in cost-effective ZNE implementation and built-in DR features for developers and builders; and support utility distribution system planning to consider ZNE home electrical load performance.

Meritage will install a measure package consisting of the following ETs:

- Induction cooktops
- Open ADR-connected Application Program Interface (API)-controllable heat pump water heaters
- Heat pump clothes dryers
- Electric barbeque grills
- High-performance windows

- Variable refrigerant-flow heat pumps
- Network-connected smart thermostats with DR capabilities
- Ducts located in conditioned attic spaces
- Voice assistant-driven smart home energy management systems
- Smart intermittent ventilation systems
- Integrated smart electric load panels, with built-in circuit energy monitoring
- Integrated grid distribution planning for ZNE
- Integrated DR controls to improve electric load shaping

This project will also provide feedback on the implementation of voice-activated smart-speaker DR control of the in-home technologies (if applied), and grid-interactive heat pump water heaters.

Collaboration

This project includes collaboration with EPRI as the overall project lead with Meritage Homes as the builder and seller of the MF units. SCE is providing technical assistance with design, construction management and DR innovation review.

Results/Status

Construction of the housing units are underway. The model homes were completed in April 2019 and are open for viewing by prospective customers.

Next Steps

Performance data monitoring will begin and continue for a year after the housing units are occupied. The final report is expected by December 31, 2020. After review and approval, the report will be posted to the ETCC website.

DR17.14 Packaged Ultra Low Charge NH3 Refrigeration Field Monitoring

Overview

According to the International Institute of Ammonia Refrigeration (IIAR), ammonia is 3% to 20% more thermodynamically efficient than competitive synthetic refrigerants. This allows ammonia-based refrigeration systems to use less power to maintain a specific refrigeration load. This assessment will demonstrate whether replacement of hydrofluorocarbons (HFC) refrigerants with zero Global Warming Potential (GWP) ammonia will provide EE and flexible DR benefits to California cold storage users who have facilities that contain various refrigeration applications. SCE has provided incentives via the Savings by Design program for these facilities.

Findings from a Port of Long Beach study will determine the site equipment control strategies to be demonstrated at two facilities: one, a 240,000 square foot Long Beach, CA plant and another, a 70,000 square foot facility at a South Gate, CA plant. The goal is to achieve at least 20% demand reduction by taking advantage of the NXTCOLD equipment manufacturer's design features and inherent (built-in) site storage capabilities.

Refrigeration Facility Field Test Site

This assessment will also demonstrate that replacing HFC-based refrigerants with refrigerants yielding a global warming potential of less than 150 (e.g. ammonia) can result in refrigeration systems which are more energy efficient and responsive to DR events. These integrated systems can provide cost-effective solutions for cold storage applications while providing flexible DR benefits to California cold storage

users in various refrigeration applications. This field demonstration is examining both EE and DR integrated demand side management (IDSM) opportunities.

The load shifting strategy for the flexible DR opportunities is based on the thermal mass of frozen or refrigerated food, which will allow customers to temporarily shed electrical load and meet permanent peak shift requirements. Ongoing performance monitoring of all energy and demand metrics will enable real-time data acquisition and analytics, metering, and DR controls. These activities will verify usage and flexible DR abilities (to add load, reduce load, and shift load) and will help build a calculation tool to support the technology's market adoption and knowledge transfer. This information will then be extrapolated to other facilities within SCE's service territory and throughout California.

Collaboration

Project stakeholders include NXTCOLD/Hillphoenix, General Cold Storage, Lineage Logistics, Cypress Ltd., AAIM Controls (division of Danfoss), and SCE's Emerging Products and Technologies team.

Stakeholders' levels of engagement are:

- NXTCOLD/Hillphoenix: equipment manufacturer
- General Cold Storage, Lineage Logistics: field test sites, customers
- SCE Emerging Products: Project Lead/Designer
- Cypress Ltd.: M&V, Project Consultant

Results/Status

The beginning stages of the project started the first half of 2018. Instrumentation for monitoring DR process performance has been installed at the Port of Long Beach site. Based on the South Gate new construction site's cold storage and blast freeze operational requirements, this project was set to demonstrate flexible DR control options and strategies, including testing and measuring results. These results were intended to inform the team of opportunities for the development of cost-effective measures for the Automated Demand Response (AutoDR) incentive program, as well as other opportunities discussed in this report.

Opportunities to optimize performance of these new systems were identified as part of the efforts during the first half of 2018. The decision was made to take this opportunity to demonstrate how to further optimize this equipment. Scope was added to the project to modify systems at both the Long Beach and South Gate sites, confirm the improvements, and then proceed with DR efforts during the first

half of 2019. These controls were modified further with the addition of energy management controls, which resulted in delaying the project.

Next Steps

The advanced controls installed to increase the operational efficiency of the system have delayed the final analysis and final report for this project. Both the Long Beach and South Gate facilities have shown increased energy efficiency from the modifications, and the advanced controls have also provided additional capacity to be available for DR strategies that include shed and possible shift events.

The final project report will include the results of energy, demand, temperature, performance improvements and benefits, and power metering resulting from DR testing strategies. The final report will also include calculation tool requirements, with a draft to be available for review in the 3rd quarter of 2019.

DR18.06 Willowbrook Low-Income Multi-Family DER: Energy Storage with PV

Overview

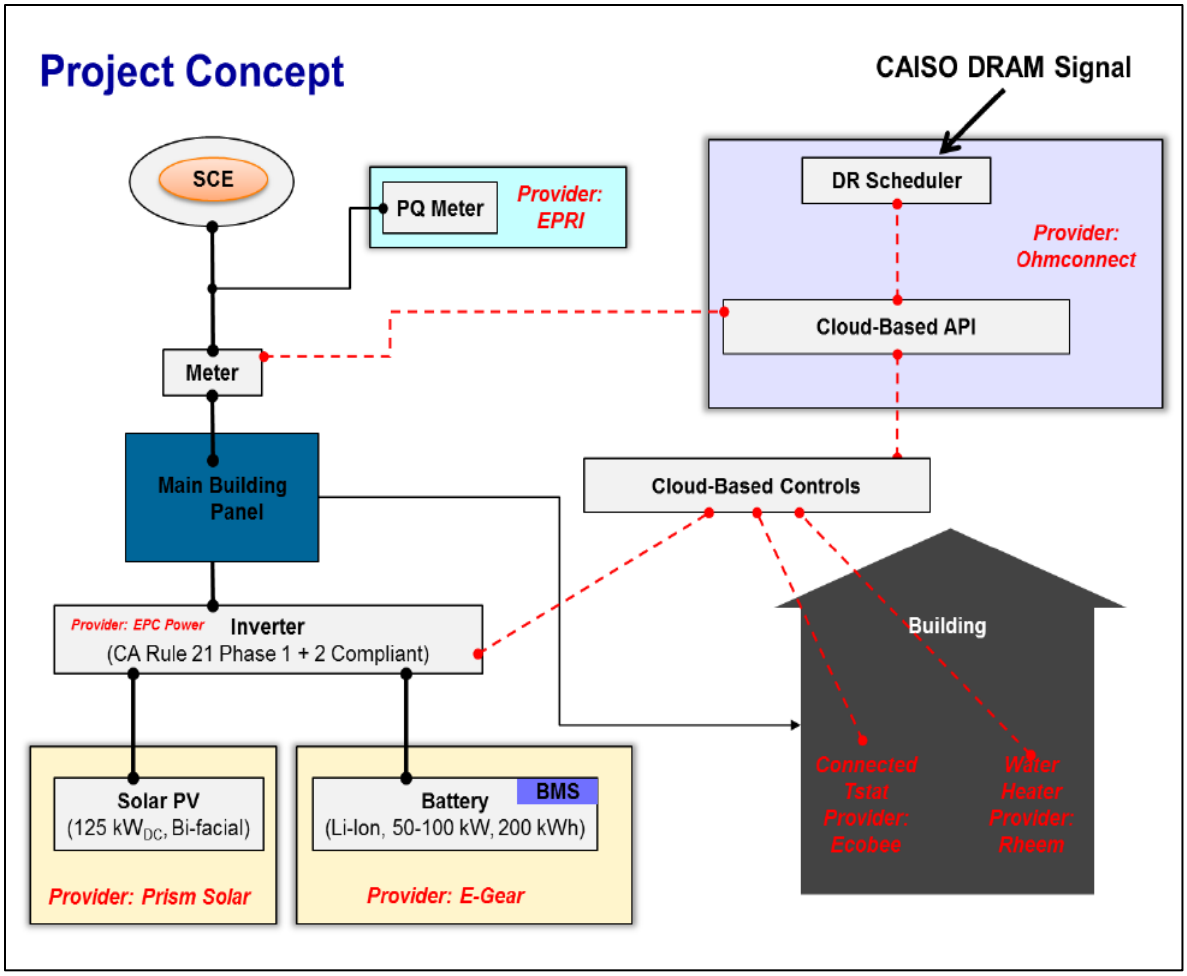
This project is a new, advanced residential community being developed by LINC Housing in the Willowbrook neighborhood (Compton, CA) called Mosaic Gardens at Willowbrook. Willowbrook consists of 61 apartment homes with 1, 2, and 3 bedrooms, of which half are family housing, and the other half are reserved for formerly homeless and regular users of the county services. The community also has a common area with a fitness center, a community kitchen, a computer lab, and a children's play area.

This project showcases a host of technology advances that individually and together can contribute substantially to meeting the state's energy goals. The barriers to meeting the state's energy goals are multi-fold. Of specific relevance, this project will address:

- Efficiency, cost, and space constraints that are barriers to meeting the Zero Net Energy goals in both residential and commercial buildings with advanced bifacial PV
- A Distributed Energy Resource (DER) integration platform that is communications-agnostic for coordinated DER operation at the community scale to better enable management of high-penetration distribution circuits
- Multi-port storage — Smart inverter configuration that enables a "shared savings" model between customers and utilities
- Coordinated ISO and utility load shaping and demand management needs through integration of solar, storage, and demand response, including behavioral demand response
- Development and implementation of innovative testing techniques to evaluate new configurations for solar and optimization

Collaboration

The project is being designed and operated by EPRI under a contract with the California Energy Commission's EPIC program. SCE is co-funding the project through a supplemental program agreement. Other partners include LINC Housing, Prism Solar, E-Gear, EPC Power, and OhmConnect.



Willowbrook Multi-Family System Overview

Results/Status

The contractor completed drawings in mid-2019 and applied for local building permits. The overall scope of work is now being initiated to drive milestones to complete the installation of the solar PV and battery energy storage systems. The estimated completion date of the installation is the last quarter of 2019.

Next Steps

The following stages of the project are in progress and will include:

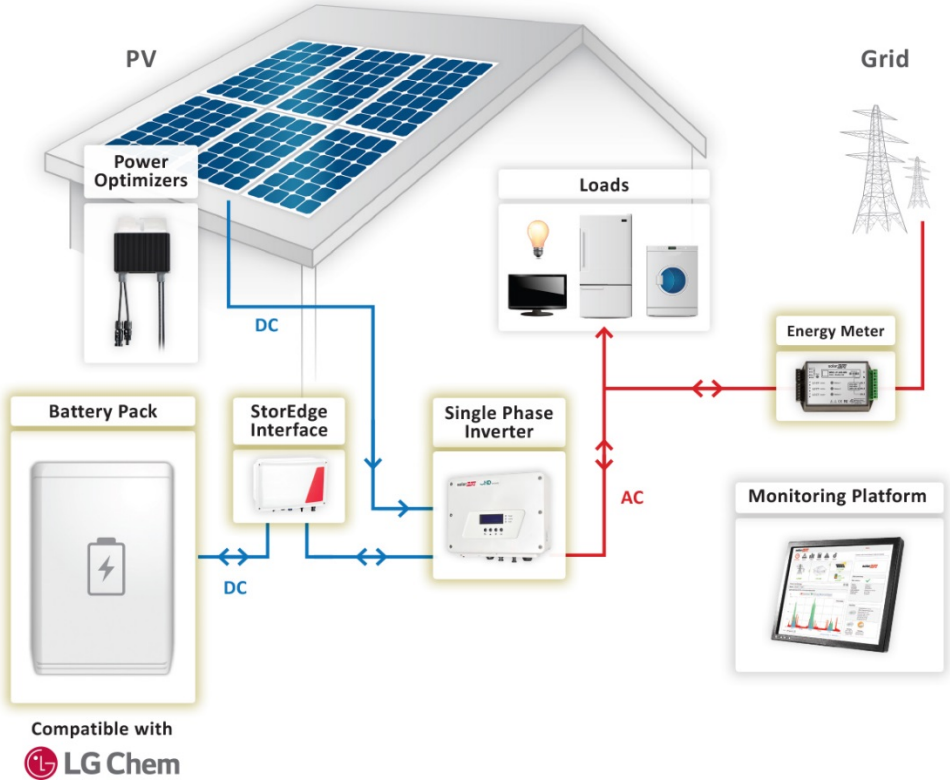
- Installation of Solar PV and Battery Storage Systems
- Finalization of testing strategies and customer schedules
- Facilitation of team's milestone objectives to support a project completion
- Development of the Final Report in first quarter of 2021

4. Projects Initiated Q1 – Q2 2019

DR18.05 Residential Energy Storage Study

Overview

The overall goal of the project is to demonstrate the monitoring and automated control of behind-the-meter residential batteries for grid support, demand response, and price elasticity to dynamic tariffs. This project will leverage SCE's investment in three Li-ion Batteries with Solar Edge smart inverters that have been purchased by SCE and are in the final stages of installation and commissioning at three homes in the Moorpark area.



Typical Residential Storage System

Distributed energy storage is regarded as one important solution to support increased distributed solar while minimizing operations stress on the distribution grid. SCE and other IOUs, the California Independent System Operator (CAISO),

and the CPUC are exploring various approaches to dispatching and compensating behind-the-meter customers. The flexibility of the battery to either charge or discharge on short notice and to store energy for later discharge can be harnessed to accommodate more distributed, variable solar generation. This project will demonstrate the application of retail tariffs with highly dynamic prices for energy storage and will explore automated dispatch of storage to address customer economics and grid operational issues.

Results/Status

The project team has completed the installation of the storage systems and has selected an Aggregation API (Application Programming Interface) that enables the management of inverters with the battery systems and home automation devices.

Next Steps

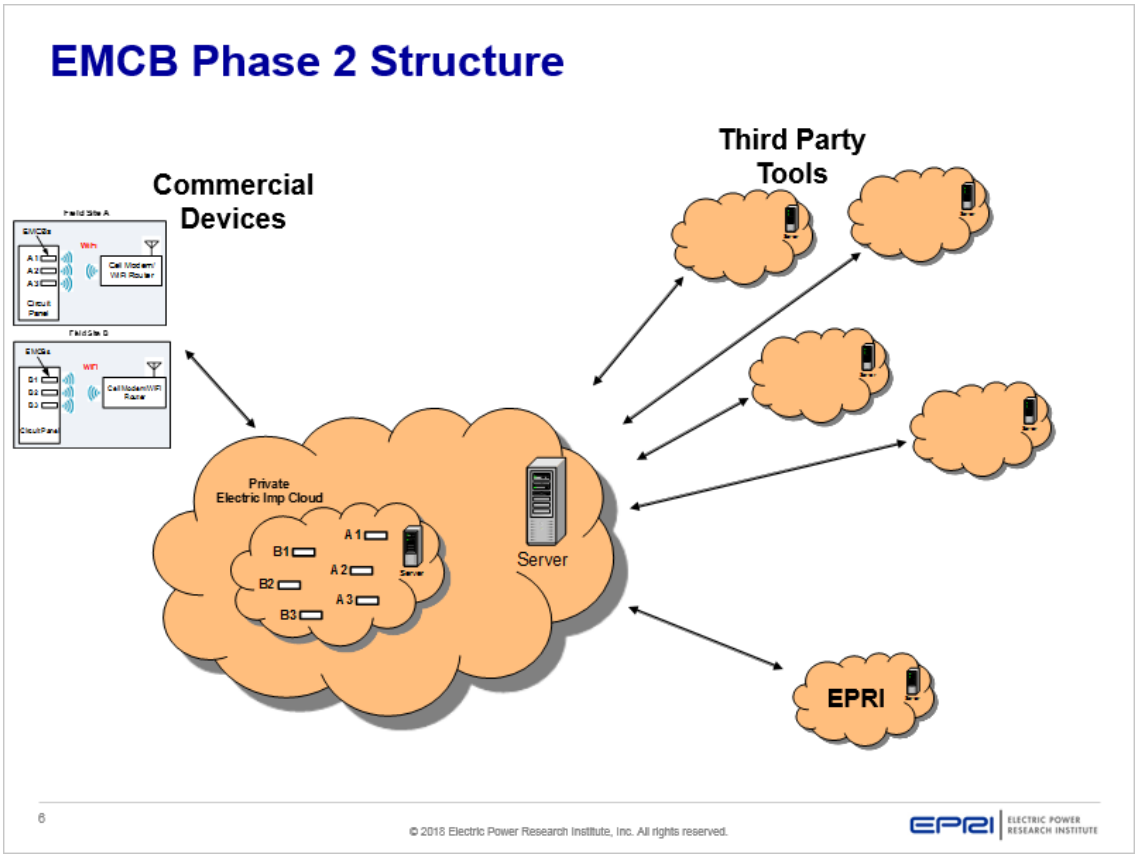
The project team is securing the licensing of the enhanced version of the API to initiate the customer response to the dynamic tariff design and will then proceed with the following project tasks through the end of 2020:

1. Commission the price schedules for the three residential batteries systems and smart inverters
2. Implement monitoring of batteries by the project team for charge up/charge down responsiveness to the transactive price signal
3. Investigate flexibility control options for the batteries
4. Monitor the customer cost impacts of the automated response of the batteries to the dynamic tariff and improve storage operations as needed

DR19.01 Energy Management Circuit Breaker - Phase 2

Overview

The Phase 2 project is a follow-up to the original Energy Management Circuit Breaker (EMCB) project that SCE participated in with EPRI in 2018. The main objective of the project was to develop third-party tools to be able to connect with the EMCB devices. This phase will expand on the improved EMCB technology that will capture more DR capability, as well as evaluate revised EV EMCBs that can work with the latest EV charging networks.



EMCB Phase 2 System Architecture

The objectives for Phase 2 include providing a more detailed set of preliminary support documentation on the Eaton API that can interconnect with other interface architectures and develop simple device management tools to commission and decommission EMCBs (Phase 1 toolset).

Collaboration

This project is being conducted by the Electric Power Research Institute, and SCE is participating as a supplemental project funder along with other utilities, including Arizona Public Service, CPS Energy, FirstEnergy, and New York Power Authority.

Results/Status

The project is currently in the stage of developing the Data Analytics Tool and awaiting the completion of UL approval for the EV EMCB devices. Deployment of the standard EMCB devices is in the planning process with the project participants.

Next Steps

Once all the standard EMCB devices are deployed, the data collection will commence and the UL-approved EV EMCB devices are expected to be ready to deploy by Q4 2019. Final report drafts are expected by the end of 2020 after the usage and operational data are collected from all the project sites.

DR19.02 Low-Income Multi-Family Battery Storage PV and Data Collection

Overview

Battery Energy Storage Systems (BESS) and PVs are being integrated into Multi-Family owner portfolios at a growing number of sites across California. This project is designed to assess how the BESS, PV, and demand response operations can interact, along with the potential impact on the local distribution transformers, the distribution infrastructure, and the customer electric bills. These interactive effects need to be better understood so SCE can provide better customer support for future DER installations, improve the models for grid infrastructure design and planning, and gain experiential data from these customer assets.

Battery Energy Storage System in Multifamily

The project will provide a better understanding on how the various BESS, PV, smart inverters, and related components working as a system in the context of Low-Income or other Multi-Family housing can act both as a Distributed Energy Resource (DER) as well as provide grid-responsive services.

Collaboration

The SCE Project Team is conducting this project with the coordination and cooperation of the building owner LINC Housing Corporation, the SCE T&D strategy teams, and researchers from the Electric Power Research Institute (EPRI).

Results/Status

The battery system, smart inverters, and PV solar optimizers have been installed and commissioned in coordination with the existing solar system that supports the common area of the building. Project kick-off meetings have taken place to define the project research objectives and several internal stakeholder groups have been engaged. Inspection and review of the equipment is taking place, and the design specifications have been stipulated to align with best practices for installation procedures that support the request for operation.

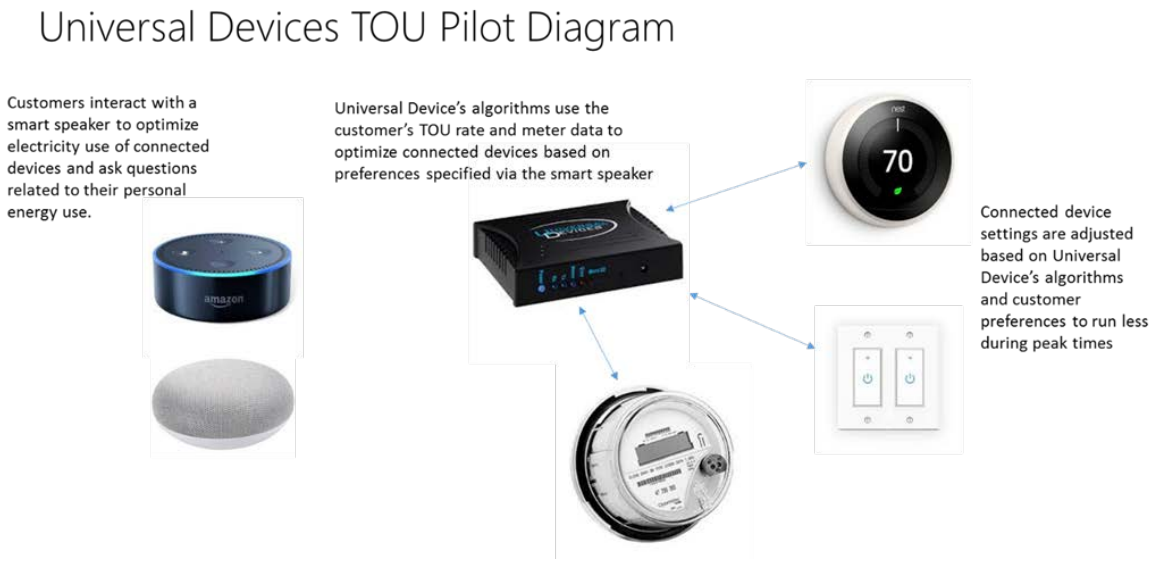
Next Steps

The project team is working with the BESS vendor and electrical inspectors to receive final approval and to complete the next set of tasks of the project scope that are scheduled through 2020. The team will next meet with project stakeholders to affirm the methods for collection of data, identify research outcomes and metrics for test results, and document contextual information identified during the project.

DR19.03 Smart Speakers

Overview

This project's goals are to test optimization of connected thermostats and other loads via voice commands based on TOU rate peak times and customer preferences. Voice interactions related to energy (usage, estimated bills, best times to use appliances, etc.) will undergo evaluation to determine the most common and additional desired interactions. The system will use a meter-based home-by-home assessment to understand energy usage impacts and potentially develop a deemed measure for both the EE and DR residential programs.



Smart Speaker System Overview

This project is intended to demonstrate the smart speaker's interactive capabilities to enable customers to manage their energy use and costs by optimizing when connected devices are used. This effort leverages previous Universal Devices work funded by the CEC and supported by SCE to develop optimization algorithms and voice interactions "skills" specific for time-of-use rate response.

Collaboration

This project includes collaboration with internal SCE groups. The SCE transmission and distribution (T&D) stakeholders have an interest in defining additional grid benefits available from customers with Universal Devices gateway. SCE Customer

Service is interested in assessing the plug load energy efficiency opportunities by optimizing the network of connected devices, and Universal Devices is leveraging their previous work with the CEC from a transactive energy project that helped develop the software and smart speaker skills.

Results/Status

This project was recently initiated in June 2019, and final scope and vendor proposals are in the review stages. Contracts are in negotiation and the installations are expected to begin in the fourth quarter of 2019, after customer recruitment is completed.

Next Steps

Finalizing the scope, M&V plan, and completing the contracts are forthcoming. Recruitment of customer sites is planned to begin by late third quarter 2019, and a final report is expected by the end of 2020.

5. Budget

The following is a breakdown of the total expenditures for SCE's 2018-2022 EM&T budget. These values are based on the authorized funding and expenditures as reported in SCE's Monthly Report on Interruptible Load Programs and Demand Response Programs, Table I2, SCE Demand Response Programs and Activities Expenditures and Funding, dated July 22, 2019. Values do not reflect commitments for projects, including those described in this report, which have been scoped and contracted, but not yet executed or monies spent.

Southern California Edison's Emerging Markets and Technology Program (D.17-12-003)	
Approved 2018-2022 Budget	$14,610,000
Budget Spent to date[2]	$ 4,614,342
2018-2022 Budget Remaining	$ 9,995,658

[2] As of June 30, 2019