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October 2, 2017

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 Q1-Q2 2017 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 being served on the service list in Rulemaking R.13-09-011 since A.11-03-001 et al., is now closed. This report has been made available on SCE's website.

Please use the following instructions to access the report on SCE's website:

- Directly access the documents at: http://on.sce.com/2khjZ0v
- Click the icon in the "Attachment" column for the "SCE Semi-Annual DR EMT Report 2017 Q1-Q2."

OR

- Go to www.sce.com/applications
- Enter "A.11-03-001"[1] in the search box and click "Go";
- Click the icon in the "Attachment" column for the "SCE Semi-Annual DR EMT Report 2017 Q1-Q2."

The report is presented in Portable Document (.pdf) format, and can be viewed online, printed, or saved to your own device. Please contact me if you experience technical difficulties accessing the documents via the instructions outlined above.

[1] Although the A.11-03-001 Proceeding is closed, SCE is continuing to post the reports together for ease of access.

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

Very truly yours,

/s/ Nathanael Gonzalez

Nathanael Gonzalez

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Emerging Markets & Technology Demand Response Projects Semi-Annual Report: Q1–Q2 2017

Submitted in Compliance with D.12-04-045
Decision Adopting Demand Response
Activities and Budgets for 2012 through 2014

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

September 2017

Table of Contents

Acronyms

AC	Air Conditioning
ACEEE	American Council for an Energy-Efficient Economy
ADR	Automated Demand Response (also seen as Auto-DR)
AHRI	Air Conditioning, Heating, and Refrigeration Institute
AMI	Advanced Metering Infrastructure
ASHRAE	American Society of Heating and Air Conditioning Engineers
AT	Advanced Technology
BAN	Building Area Network
BCD	Business Customer Division
BESS	Battery Energy Storage System
BOD	Biochemical Oxygen Demand
BEMS	Building Energy Management System
CALTCP	California Lighting Contractors Training Program
CAISO	California Independent System Operator
CASE	Codes and Standards Enhancement
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CES	Community Energy Storage
C&S	Codes and Standards
CSI	Customer Solar Initiative
CPUC	California Public Utilities Commission
CZ	Climate Zone
D	Decision (CPUC-related)
DAC	Disadvantaged Community
DER	Distributed Energy Resource
DOE	Department of Energy
DR	Demand Response
DRAS	Demand Response Automated Server
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
EM&T	Emerging Markets & Technology
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ET	Emerging Technologies
ETCC	Emerging Technologies Coordinating Council
EVTC	Electric Vehicle Test Center
FDD	Fault Detection and Diagnostics

GHG	Greenhouse Gas
HAN	Home Area Network
HVAC	Heating, Ventilation, and Air Conditioning
IALD	International Association of Lighting Designers
IDSM	Integrated Demand-Side Management
IESNA	Illuminating Engineering Society of North America
IOU	Investor-Owned utility
kW	Kilowatt
kWh	Kilowatt-hour
LBNL	Lawrence Berkeley National Laboratory
LEED	Leadership in Energy and Environmental Design
LIMF	Low-Income Multifamily
MF	Multifamily
MSO	Meter Services Organization
MW	Megawatt
NEEA	Northwest Energy Efficiency Alliance
NPDL	New Product Development & Launch
NREL	National Renewables Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
OCST	Occupant-Controlled Smart Thermostat
OP	Ordering Paragraph
OpenADR	Open Automated Demand Response
PC	Personal Computer
PCT	Programmable Communicating Thermostat
PLMA	Peak Load Management Alliance
PLS	Permanent Load Shift
PTR	Peak Time Rebate
QI/QM	Quality Installation/Quality Maintenance
RESU	Residential Energy Storage Unit
RSO	Revenue Services Organization
RFI	Request for Information
SCE	Southern California Edison
SGIP	Self-Generation Incentive Program
SONGS	San Onofre Nuclear Generating Station
TES	Thermal Energy System
TOU	Time of Use
TTC	Technology Test Centers
UCOP	University of California – Office of the President
UL	Underwriters Laboratories
USGBC	U.S. Green Building Council
VCHP	Variable Capacity Heat Pump
VNEM	Virtual Net Energy Metering
VRF	Variable Refrigerant Flow
ZNE	Zero Net Energy

1. Background

The *Emerging Markets & Technology Demand Response (DR) Projects Semi-Annual Report: Q1–Q2 2017* is provided 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 Decision directed Southern California Edison Company (SCE) to submit a semi-annual report regarding its DR Emerging Markets and Technology projects by March 31 and September 30 of each year.

Prior to D.12-04-045, the *Emerging Markets and Technology Report* was submitted annually, consistent with OP 14 of CPUC D.09-08-027. In that decision, SCE was ordered to provide reports on the previous year's Emerging Markets and Technology (EM&T) activities to the director of the Commission's Energy Division, and provide copies to the most recent service list in this proceeding.

2. Summary

To help realize the benefits of DR—greater grid security, modernization of the grid, and improved use of in-home smart technologies as well as large scale distributed energy resources—the EM&T program at SCE develops and delivers technology-driven DR standards advocacy, innovative demonstration projects, and market research studies that facilitate customer acceptance of cost-effective DR and facilitate wholesale market integration of supply side DR measures. The EM&T program also works to enable California DR renewable integration policies by providing T-24 Codes and Standards DR advocacy for Zero Net Energy homes, and encouraging retail and wholesale market participants to adopt OpenADR protocols for enhancing participation on future models of DR.

This report on SCE's EM&T Program activities over the first half of 2017 is submitted as directed in D.12-04-045, cited above.

SCE works closely with industry groups, academic institutions, and other investor-owned and municipal utilities to develop a vision for effective DR markets and programs, identify technologies that can be leveraged for new models of DR enablement, and establish standards for interoperability of DR technologies. Emerging Technology (ET) stakeholders from each of the California Investor-Owned Utilities (IOUs) and municipal utilities meet periodically to coordinate, collaborate, and share results from each utility's portfolio of EM&T projects. In addition, to further enable and expand DR in California, SCE is involved in ongoing collaborations and research with other statewide agencies and third-party stakeholders interested in DR, such as those found in the list at the end of this report.

Further, to advance acceptance and use of DR in the California wholesale markets, SCE communicates results from the EM&T program to a broad range of stakeholders, via a communications strategy

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

that includes providing reports and presentations at DR industry workshops and seminars, and facilitating market outreach and education via trade allies and membership in DR advocacy groups. Organizations such as the Peak Load Management Alliance (PLMA) and the Smart Electric Power Alliance (SEPA) can educate and influence non-participating customers to enroll in DR programs, and can enable technology firms and other market actors to adopt DR technologies and strategies.

The following is a sampling of some of the EM&T partnership affiliations and strategic communications approaches implemented by SCE:

- Active participation in several DR technology advocacy groups, such as the Open ADR Alliance and the MESA Standards Alliance, to promote the continuous improvement of communications standards for DR technologies and strategies developed by the EM&T program.
- Partnership with the Electric Power Research Institute (EPRI) to test and execute DR projects through participation in the core Power Delivery and Utilization program, as well as supplemental projects focused on specific DR technology assessments.
- Participation and engagement in presentations on EM&T activities at periodic DR Forums throughout California and workshops at SCE, to communicate and coordinate DR information across the state and with internal stakeholders.
- Publication of full reports on EM&T projects on the Emerging Technologies Coordinating Council (ETCC) website[2] to provide them to the public. The ETCC coordinates among its members, which include the California IOUs, Sacramento Municipal Utility District (SMUD), California Energy Commission (CEC), and the CPUC, to facilitate the assessment of promising Energy Efficiency (EE) and DR ETs that benefit California customers and respond to the initiatives outlined in the California Long Term Energy Efficiency Strategic Plan[3].
- Assistance in organizing the ETCC Summit, an event held every two years by the joint IOUs in California, to promote emerging energy technologies by planning the DR tracks and organizing joint presentations with the CEC and other IOUs and emerging DR activities and research.
- Assistance in organizing the PLMA and other DR-related conferences, events intended to promote and support DR technologies, markets, and programs and services. This includes hosting events when held in California, to encourage both customers and stakeholders to attend trainings and presentations.

In the first half of 2017, SCE initiated, completed, and continued the EM&T projects listed in this report. This report summarizes the results and status of all individual DR projects undertaken by SCE. The DR project numbers assigned to each project are listed for internal tracking, and to allow their identification in the ETCC website.

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[2] Emerging Technologies Coordination Council (ETCC) website [*available at*: www.etcc-ca.com].

[3] California Long Term Energy Efficiency Strategic Plan [*available at*: http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf].

3. Projects Completed Q1 - Q2 2017

DR12.17 Field Testing of Climate-Appropriate Air Conditioning Systems

Overview

This field study evaluated the current and potential DR capabilities of climate-appropriate AC systems, such as evaporative cooling and VCHP. Targeted DR and EE programs can help reduce high peak demand caused by increased AC, use and address uncertainties about generation and consumption caused by extreme weather conditions. This field study analyzed how automated and optimized DR technology, combined with understanding a building's heating, ventilation, and air conditioning (HVAC) capacity and thermal characteristics, can build and implement accurate relationships between DR lead time, customer incentives, DR duration, external environmental conditions, and building occupancy.

Collaboration

This project was executed in collaboration with a third-party vendor, which conducts research on issues related to the electric power industry.

Status

The data collection delays have been resolved and the demand response portion of this collaborative project is now complete. The functionality tests that were pending technology installation have now been finalized and the data needed for analysis has been collected.

Next Steps

The final report is in peer review, and will be posted to the ETCC website.

DR12.21 Field Testing of DR-Ready End-Use Devices

Overview

Manufacturers are introducing new DR-ready end-use devices, including appliances, into the market. This project, a part of EPRI Subproject G, selected one of these technologies for testing, both in the lab and in the field, to determine its ability to meet SCE's demand-reduction objectives.

Collaboration

This project was co-funded by SCE's Emerging Technologies Program as part of an EE/DR buildings contract with EPRI. The selection and testing was done in coordination with:

- EPRI Subproject C, on next-generation home and building energy management systems.
- EPRI Subproject D, on evaluation of networks that can provide HVAC fault detection and diagnostics.

Status

The schedule delays from the contractor on the overall EE/DR buildings contract have now been resolved and the supplemental data requested by SCE have been delivered. The demand response portion of the overall EPRI EE/DR project is now complete. That section included a description of the advances in the development of DR-Ready devices and programs for mass market customers, and has been included in other EPRI interim reports during the term of this activity.

Next Steps

The final report is in peer review, and will be posted to the ETCC website in Q4 of 2017.

DR12.40 Field Testing of Occupancy-Based Guest Room Controls

Overview

An occupancy-based guestroom energy management system senses when a hotel room is occupied and adjusts the energy systems—such as HVAC, lighting, and outlets—accordingly, to save energy. The control capabilities of these occupancy-based control products could be used for DR. However, implementing this capability requires additional investment in software and communications, and hotels and motels have been reluctant to implement DR measures in guestrooms, due to concerns about inconveniencing guests.

Collaboration

This project was conducted in collaboration with SCE's Advanced Technologies organization, to leverage their expertise. It also involved partnering with several third-party vendors, who provided the guest room control equipment and installation.

Status

The field data from the project have now all been collected and the draft report was updated with this information. The analysis was also developed for the draft report, and the project is now complete.

Next Steps

The final report is in peer review, and will be posted to the ETCC website in Q4 2017.

DR13.06 EPRI EB III A – Variable-Capacity Space Conditioning Systems for Residential

Overview

This project evaluated the DR capability of Variable-Capacity Heat Pump (VCHP) systems. The tested products included traditional "American-style" high-static ducted systems. Testing focused on three products. The project team leveraged lab and field testing, to evaluate the response of the VCHP system to demand control signals. An appropriate signaling/controlling method (OpenADR 2.0) was selected, to enable DR testing under varying operating conditions.

Project plans included conducting a survey of technologies, followed by developing and executing lab and field test plans. Steps for the field tests included generating and applying site selection criteria, creating site monitoring plans, and installing, commissioning, and testing the systems. Deliverables from the project include documentation of the steps, test plans and results, and a final report.

Collaboration

The program manager for the Summer Discount Program was continually engaged, to ensure the results were in line with program needs. Further, the project team collaborated with the program manager and a certified contractor in the Residential HVAC Quality Installation/Quality Maintenance (QI/QM) program, to ensure HVAC technologies were installed and maintained properly.

Status

The vendor has now provided all of the data required for a final analysis, which was quality reviewed by the project manager. The summary data analysis and the commercialization assessment are now completed, and the demand response portion of this collaborative project which will identify the DR capabilities and functionality of the VCHP systems is complete.

Next Steps

The final report is in peer review, and will be posted to the ETCC website in Q4 of 2017.

DR13.07 EPRI EB III B – HVAC & Refrigeration Systems Using Advanced Refrigerants

Overview

In response to the continuing phase-out of halogen-based refrigerants, the industry is seriously examining ultimate replacements, focusing on ammonia and hydrocarbon refrigerants. Ammonia is receiving particular attention, thanks to its exceptional thermodynamic characteristics, and ammonia systems are being developed for conventional applications. Such systems may increase efficiency over halogenated refrigerants, and the industry is working to mitigate the disadvantages of ammonia and hydrocarbon refrigerants—namely toxicity and flammability—by developing new configurations using small refrigerant charges in sealed systems and secondary hydronic loops.

Further, advanced product development engineering is creating ever more flexibility. Ammonia can now be used in smaller refrigeration systems, primarily due to the use of capacity variation and integrated controls. This engineering approach may allow these new systems to serve as tools for EE, DR, intermittent generation integration, and other utility load-management strategies.

This project explored and documented advances in product development for advanced refrigerants in applications fueled by natural gas and electricity, with the goal of identifying products for laboratory evaluation and field deployment. Once the appropriate systems were selected and laboratory tested, this project field-tested systems using advanced refrigerants in commercial and small industrial applications, at multiple sites in SCE's service area, to evaluate their effectiveness for EE and DR.

Collaboration

This project was initiated by the Customer Service New Product Development and Launch group, and was executed by EPRI, with project management from SCE's Technology Test Center.

Status

The technology changes that have occurred during this project have been accommodated by the project team and included in the final report. Data from the field demonstrations have also been included, with demand response information collected as a sub-project to the overall study of advanced refrigerants. The project has included all of the testing data and the report and final analysis are now complete.

Next Steps

The final report is in peer review, and will be posted to the ETCC website in Q4 2017.

DR13.08 EPRI EB III D – Automated Demand Response in Data Centers

Overview

The goal of this project is to conduct a field test of a software program that has the following characteristics and potential:

- A software program that reduces computer power demand in response to an OpenADR signal.
- Liquid cooling technology, for data center servers.
- Replacement of existing computer servers with more efficient equipment.

The evaluations will cover the performance, customer acceptance, operational viability, demand reduction, DR, and cost effectiveness of the technologies

Collaboration

The work will be done in collaboration with EPRI, which conducts research on issues related to the electric power industry.

Status

The project has been completed and the data collected to finalize the draft report, which was submitted for technical review by the SCE and EPRI research teams

Next Steps

The report is to be posted on the ETCC web site for public dissemination when the technical review is complete.

DR14.02 ZNE Retrofit Commercial Training Facility

Overview

This is a partnership with a large training facility (Electric Training Institute) in Commerce, California, to retrofit the existing 140,000 square foot commercial building toward achieving Zero Net Energy (ZNE). SCE will act as the project's expert and lead for emerging Demand-Side Management (DSM) technologies, including battery storage integration and post-monitoring. The main deliverable of this project will be a detailed report summarizing project findings and recommendations, to help overcome market barriers to ZNE commercial retrofits.

Collaboration

This project is in collaboration with the Electric Training Institute and many of their project affiliates, including Environmental Building Strategies, PDE Total Energy Solutions, GE, Lutron, and many others.

Status

SCE completed its assessment of the potential collaboration opportunities for demonstrating the demand response capabilities of commercial zero-net energy new construction. Due to current changes to the CEC's T-24 2019 guidelines for demand response and new developments in emerging technologies for ZNE, this activity will be re-assessed for future consideration using other ZNE buildings as tests beds. No current further demand response testing activity for this facility is planned at this time.

Next Steps

No project scope was developed for this facility for testing ZNE demand response capabilities, and so no project report was developed. SCE will continue to collaborate with the training facility on an as-needed basis and explore future ZNE demand response opportunities with this and other sites.

DR15.09 Integrated Campus Energy Storage Project - CSUF

Overview

The project involves connecting 500 kW of Lithium Ion battery storage to the 480-volt system at California State University, Fullerton (CSUF). The energy storage system incorporates Green Charge Networks (GCN) control software, to minimize demand from the Edison system. The GCN software will manage generation from the co-generation and photovoltaic (PV) plants on campus.

The project is intended to create an understanding and methodology for incorporating energy storage with distributed generation, and/or co-generation capabilities, vehicle charging, and micro-grid capabilities.

Collaboration

This project was undertaken with cooperation from various stakeholders at SCE, P2S Engineering, and CSUF.

Status

The project has been cancelled, due to delays in developing the scope of work. Future scoping may be developed as SCE negotiates the Master Agreement with the University of California Office of the President (UCOP).

DR15.15 UC Deep Energy Efficiency Project Study

Overview

The University of California (UC) is a large and diverse energy user with facilities across the state, including ten campuses, five medical centers, and various other facilities that in total make up more than 130 million square feet, with a peak demand of 400 MW and annual usage of 1.8 billion kWh and 140 million therms. Facilities include more than 40 million square feet of energy-intensive research laboratory and hospital space, which gives the entire system an average energy intensity of 157 kBTU/sq ft, almost double that of an average office building. The project will involve evaluating deep energy retrofit, DR, energy storage, and distributed generation opportunities. This will include investigation of sustainable water savings opportunities and high-performance refrigerant technologies, with reduced or no global warming potential.

Collaboration

This project was undertaken with cooperation from various stakeholders at SCE and the UCOP.

Status

The current project has been cancelled, due to delays in developing a scope of work. Other opportunities will be assessed in the future, based on mutual agreements between SCE and the UCOP.

DR15.16 Electric Water Heater Study

Overview

Over the last five years, heat pump water heaters in the residential market have continued to be refined, and have shown increased market acceptance, especially outside California. Recently, several manufacturers have produced food-grade heat pump water heaters that may fit with small restaurants that need hot water, but do not have full-sized dishwashers. Additionally, the DR tactics and planning study identified over 100 MW of DR technical potential in the SCE service area from residential and commercial electric water heaters.

The project involves a field study of selected commercial and residential sites with electric water heaters (resistive and heat pump water heaters) to verify savings and DR potential, including load banks. If the project produces positive results, there will be a consideration to advocate adding the proven technologies and strategies to SCE's EE/DR portfolio of offerings.

Collaboration

This project was undertaken with cooperation from various stakeholders at SCE.

Status

The project has been cancelled and re-scoped as D17.06, Smart Water Heater Controller Retrofit Lab Assessment.

DR15.17 University Data Analytics Study

Overview

The Ecovox analytics platform at Welch Hall and Central Plant at California State University Dominguez Hills (CSDH) increases system visibility and improves the management of building mechanical systems through better detection of events that waste energy or adversely affect occupant comfort. Building efficiency monitoring services provide the basis of a continuous commissioning process, energy flow analysis, and distributed energy resources management. The project will evaluate this energy management tool for the campus, which will include determining the impacts of commissioning, interaction with grid and available distributed energy sources, and micro-grid capabilities. The project will also include data analytics, central plant process flow, and co-generation plant and distributed energy resources performance analysis.

Collaboration

Collaboration with be with the Southern California Gas Company.

Status

The project has been placed on hold due to delays in developing the scope of work, and may be re-scoped as a future project under the pending SCE-UCOP Master Agreement.

4. Projects Continued Q1–Q2 2017

DR13.05 Demonstrating Grid Integration of ZNE Communities

Overview

This is a partnership, through a CPUC/CSI solicitation, with EPRI as the awardee and other stakeholders, including a large production homebuilder (Meritage) to design, build, and monitor a new ZNE residential community of 20 new homes in Fontana. SCE will act as the project's lead on emerging DSM technologies, battery storage integration, electrical grid optimization, and post-monitoring. The main deliverable of this project will be a detailed report summarizing project findings and recommendations to help overcome market barriers to community-scale ZNE homes.

Collaboration

This project is in collaboration with EPRI, the CPUC, Itron, Meritage Homes, BIRAenergy, and several other private companies. EPRI is the overall project lead, Meritage Homes will build and sell the 20 ZNE homes, BIRAenergy will provide sustainability consulting, and SCE will act as the host utility, technology lead, and lead on grid-side matters. The community is called Sierra Crest in Fontana, where all 20 ZNE homes have been constructed, sold, and occupied for over one year.

Status

Currently, the project is still in the post-occupancy monitoring phase, in which circuit-level data monitoring is being collected for all 20 homes. This monitoring phase will continue as part of the overall EPRI contract to assess ZNE performance and effects on the local circuits, and the residential household demand response aspects of the project will also continue. The homes have now been occupied for over a year and the project team is well underway in the post-occupancy evaluation period. The project team plans release a post-occupancy evaluation report with performance analysis early 2018.

Next Steps

The project is expected to continue through the end of 2017, to collect a full year of occupancy data. The report is to be provided by EPRI to the CPUC as part of their contract and is expected in mid-2018.

DR14.01 Deep Retrofits in Low-Income Multi-Family Housing

Overview

This ZNE Deep Energy Retrofit sub-project showcases a range of high-efficiency IDSM technologies within a 30-unit subset of a 100-unit, 1970s Low-Income Multi-Family (LIMF) development. These thirty units have been retrofitted to ZNE levels, with a 75kW PV array, thus reducing grid load. Battery storage is currently being considered, and in conjunction with smart thermostats, will be able to deliver even more energy savings during DR events.

Collaboration

EPRI is the project lead, with the CEC, SCE, Southern California Gas Company, BIRAEnergy, and the building complex owner (LINC Housing) acting as project partners.

Status

The field data collection for the demand response capabilities of the housing has been completed, allowing for a year of seasonal weather changes. The research team has completed analyzing the data for load impacts and efficiency trends, and the ZNE assessment of the units will continue after this phase of the project to examine the thermostat performance is completed.

Next Steps

The project results are in the draft final report, which is with EPRI awaiting final edits, peer review, and then final CEC approval.

DR14.07 Conditioned Crawl Space (CCS)

Overview

This DR project is being conducted within the larger CCS Field Study, which is endeavoring to discover if EE improves when the building envelope is modified by moving the pressure boundary (conditioned space) of the building envelope from the framed floor to the earth grade underneath the floor.

A second important element is to research the possibility of replicating these efficiency measures in modular housing. This housing sector is a significant segment of the housing/"relocatable" school building stock in SCE territory.

Finally, the project will help SCE drive new EE technologies by developing cost-effective/incentive-ready ET measures around the CCS area.

This project will break ground on existing and new construction with CCS, using a Programmable Communicating Thermostat (PCT) to signal DR events. The DR goal is to be able to shut off the AC compressors, but still run the fan to circulate the cool air from beneath the house, thus keeping the house cool through the DR event.

Collaboration

This project was initiated by the EM&T NPDL group, and is being executed by one of its project managers. EM&T is collaborating with the Codes and Standards program, to maximize the data derived from this field test research for the 2022 Building Energy Code Cycle.

Status

The measures have been installed in four homes in four Climate Zones (CZs). Data collection is underway. DR tests were performed on several different days on all the homes. The results will be analyzed and included in the project report.

Next Steps

Phase I of the assessment (data analysis) has been completed. Phase Two has been initiated, to study high-performance attics on the same homes in the CCS study, which has revised the completion date to Q3 2018. Data collection will be ongoing to collect performance data through at least one more weather season until final project completion.

DR15.14 Real Estate/Transportation Proof of Concept Study

Overview

The demonstration project objective is to link building energy retrofits with electric transportation systems, linking buildings to public transportation to scale adoption of key technologies, including EE, energy storage, distributed generation, charging stations, and Electric Vehicles (EVs).

The proof of concept includes SCE commercial customers and local business improvement districts, with city and constituents as benefactors. Advanced technologies are available, but packaging them with tax credits and financing in a project has had limited traction.

Collaboration

This project was undertaken in collaboration with SCE's ET program and various other internal stakeholders at SCE, Silicon Beach cities, Los Angeles Metro County Metropolitan Transportation Authority (Metro), and business improvement districts.

Status

The project scope has been narrowed to three project partners in the West Los Angeles area who have agreed to participate in developing a broader scope for this joint opportunity. Various partners have been approached in the past and efforts to secure commitments have met with partial success. Given recent interest in Transportation Electrification and GHG reduction initiatives at the State level, a clearer path to collaboration has been developed for the initial project scope.

Next Steps

The project team is developing a scope of work for several different opportunities involving Metro's first-last mile strategy. The team is also preparing to move to Phase II of the project, once the joint parties have agreed to the Letter of Intent, which is still under review.

DR15.18 Wastewater Treatment Plant Demand Response

Overview

Wastewater processing is a continuous activity, since it is typically not possible to store the incoming wastewater to be treated. Although the wastewater entering the treatment plant and the ongoing process cannot be shut down for a DR event, recent development work has shown a significant reduction in blowers used for aeration, which requires 50% of the plant's energy, is possible for a DR event. If only the aeration set points are curtailed, the DR event can span across consecutive hours. This modification to the plant's operation needs to be fully demonstrated, to verify that operations can be changed for one or more hours without jeopardizing the stability of the plant and the ability to meet the wastewater discharge permit. This project will explore and test several changes to the operation, finding the one that meets the DR objective with the least impact to the plant's operation, and with the highest impact on power demand reduction.

Collaboration

DrH2O is the prime contractor that will be responsible for all field work and technical expertise. SCE will work with the DrH2O team, supporting the field and technical work. The DrH2O team, along with SCE, developed the Oxygen Transfer Efficiency (OTE) Analyzer, the key technology for performing this groundbreaking work, to modify the operation of a wastewater plant to support a DR event.

Status

The OTE analyzer has been fabricated and tested at a lab, while waiting for the wastewater treatment plant to complete upgrades to the plant. Delays in the wastewater plant upgrades have continued well past the scheduled completion time, forcing the project to select another wastewater plant from the same wastewater utility (Inland Empire Utility Authority (IEUA) for the demonstration.

Next Steps

The electrical and mechanical support will be installed by IEUA shortly, at the new demonstration site, Plant 5 in Chino. The OTE equipment installation will follow immediately, along with equipment calibration and development of the OTE equipment interface with the wastewater plant control room.

DR15.20.00 Dispatchable Condenser Air Pre-Cooler

Overview

This project is to conduct laboratory and field studies to determine the transient response and load profile reduction of a Roof Top air conditioning Unit (RTU) after an evaporative pre-cooler is turned on. This data will be used to determine the potential of using pre-coolers as a dispatchable load balancing resource.

Collaboration

The project team consists of UC Davis' Western Cooling Efficiency Center and SCE Emerging Products.

Status

Lab testing has been completed and analyzed. The field test has been set up and is underway.

Next Steps

Completion of field testing is scheduled for Q3 2017. The final report is scheduled for Q1 2018.

DR15.21 LINC Housing – Low-Income Multi-Family ZNE New Construction

Overview

The goal of this project is to conduct a field test to evaluate viable measures that could provide EE and DR capabilities in individual residential units, and possibly in an entire residential complex. The project will include:

- Smart thermostats to reduce electricity demand in response to an OpenADR signal or other DR initiation.
- Battery storage and advanced controls for the entire building complex, using Virtual Net Energy Metering (VNEM) to support grid stabilization.
- Other possible DR options, as the design team and stakeholders agree to utilize.

The evaluations will cover the performance, customer acceptance, operational viability, EE, demand reduction, DR, and cost-effectiveness of the technologies chosen. Steps in the project will involve identifying technologies to be evaluated, develop an SOW, develop testing plans, installation of equipment and software, commissioning, conducting DR and other tests, and reporting results.

Collaboration

The work will be done in collaboration with LINC Housing, which designs, constructs, and manages many low-income building complexes throughout SCE's service territory and across California. EPRI will be involved as a stakeholder, fulfilling EPIC 309 project goals, including integration of Distributed Energy Resources (DERs) and energy storage.

Status

The project is under construction.

Next Steps

The project team will be collecting plug load and other data when the building begins to be occupied, estimated for Q4 2017. The final report is slated for completion five quarters after first occupancy, likely in Q1 2019.

DR15.23 EPIC PON 14-309 Building a Climate Change-Resilient Electrical System

Overview

In response to the subject Program Opportunity Notice, the University of California, Irvine (UCI) Advanced Power and Energy Program (APEP) proposes a project which determines climate change impacts for the electricity system and determines the steps necessary for building resilience against these impacts into the system. This project includes (1) identifying, characterizing, and quantifying the impacts of climate-change affected atmospheric and hydrological conditions on electricity system generation, renewable potential, and demand; (2) determining the implications for meeting Greenhouse Gas (GHG) reduction and renewable portfolio standard (RPS) targets; (3) developing solutions to mitigate these impacts; and (4) developing resource and technology planning roadmaps for use by IOUs and state policymakers for building resilience to climate change impacts into the system.

Collaboration

The project team consists of the Advanced Power and Energy Program and Center for Hydrometeorology and Remote Sensing at UCI, and SCE Emerging Products.

Status

The project contract has been awarded, and initial discussions are underway.

Next Steps

SCE's negotiations with the UCI/UCOP for the Master Agreement have not yet been finalized as of the end of Q2 2017, so the project is on hold.

DR16.02 Open Vehicle Grid Integration Platform (OVGIP)

Overview

The goal of this project is to evaluate the potential of EVs as a potential DR resource, while participating in DR programs via an aggregator. To achieve this goal, SCE will dispatch DR events to the Open Vehicle-Grid Integration Platform (OVGIP), which provides a single interface to receive OpenADR signals from utilities, and translates them into proprietary automakers' APIs. The automaker APIs will dispatch vehicles with available capacity, to provide the demand reduction.

Collaboration

The project will be done in collaboration with EPRI, multiple industry Original Equipment Manufacturers (OEMs), and other state utilities. Internal SCE stakeholders include Engineering Services and the Advanced Technologies Organization (ATO).

Status

The OVGIP functional testing (i.e., compatibility) is complete. The OEMs are making enhancements to their platforms to enable accurate demand response action when a dispatch event is received.

Next Steps

The next steps are to perform end-to-end live testing from the SCE DRAS to the OEM platform. Project has been delayed due to corporate re-structuring at the partner OEM firms. OEMs are expected to start customer enrollment beginning 2018. The report is expected to be drafted for review in 2018.

DR16.06 Market Characterization Study of Automated Demand Response Capabilities of Variable Refrigerant Flow (VRF)

Overview

The objectives of this study are to understand the status of Automated Demand Response (ADR)-capable controls across VRF manufacturers, and to report on VRF controls compliance with DR requirements in California's existing building energy code, as well as DR requirements in ASHRAE.

This project helps make informed decisions about the ADR capabilities of VRF control systems and determine which are ready for accelerated commercialization in incentive programs. Specific objectives include:

- Research the status of ADR-capable VRF controls among different VRF manufacturers.
- Review whether VRF controls meet DR requirements in the California energy code.
- Report on available plans by VRF manufacturers to offer ADR-capable controls.

This project will provide findings, and includes recommendations for SCE to encourage the further development of ADR-capable control functions in VRF equipment.

Collaboration

The project team consists various stakeholders at SCE including Emerging Products.

Status

The project report is being revised to capture additional relevant market data.

Next Steps

The report is expected to be published in early Q3 2017.

DR16.08 Demand Response Clean Up for 2019 Title 24

Overview

The objective of this code change proposal is to clean up and clarify the existing DR requirements, so all sections of the standards use consistent terminology and approach. The goals are to improve comprehension of and compliance with the requirements, and to make it easier for occupants of compliant buildings to realize the economic benefits of their buildings' DR capabilities by enrolling in utility DR programs.

The scope of this project also initially included a look into the feasibility of adding demand flexibility to Title 24. However, the team decided to defer demand flexibility consideration for future code cycles.

Collaboration

This project was undertaken with cooperation from various stakeholders at SCE, the CEC, and the statewide Codes and Standards team, including consulting firms Energy Solutions and ASWB Engineering.

Status

The project is on target. An initial stakeholder workshop was held in Q4 2016. Recommendations and comments from this meeting are being used to develop the Codes and Standards Enhancement (CASE) Report for the 2019 Title 24 rulemaking process.

Next Steps

SCE continues to work with the CEC on the DR issues around Title 24, and has completed the Case Report in collaboration with other DR stakeholders during Q2 2017.

5. Projects Initiated Q1 - Q2 2017

DR16.04 Retrofit Zoning Enhancement and Balancing Controls Field Assessment

Overview

This project is a field assessment of retrofit zoning enhancements and balancing controls. The process follows these steps:

1. The wireless zone controllers monitor temperatures, damper position, and airflow temperatures (supply air).
2. The Central Control Unit (CCU) collects the information from all the zones and sends it to cloud servers, to be analyzed with the current weather to create a thermal model of the building and predict the zones' energy and damper position requirements.
3. The calculations are sent back to the CCU, which sends the required damper control points to the zone controllers.
4. The CCU then turns on the HVAC cooling or heating coil.

This technology enables these features:

1. Enhanced HVAC zoning and balancing with occupancy scheduling.
2. Enhanced HVAC zoning and balancing with occupancy detection control.
3. Support for a Variable-Frequency Drive (VFD) Induced Draft (ID) fan.
4. Support for demand-control ventilation.
5. Support for DR cycling control.

The main goal of the project will be to perform a field assessment, to characterize the efficiency benefits of the 75F DAB solution. The following deliverables are sought:

- Detailed field test plan.
- Final report.
- High-level summary reference materials - presentation slides and fact sheet.
- Summary data file and raw data files.

Collaboration

The project will be done in collaboration with other California utilities. Internal SCE stakeholders include Engineering Services and ATO.

Status

The manufacture of OpenADR capabilities has been delayed until March 2018.

Next Steps

The next step is to re-initiate project in 2018, pending product availability.

DR16.05 Laboratory Assessment of Demand Response RTU Controller

Overview

This is a project to conduct a laboratory assessment of a DR-capable controller for RTUs. The controller is an add-on retrofit for RTU units, and is capable of receiving DR signals and accordingly limiting the speed of the indoor fan and compressor simultaneously, or shutting off the unit. The gathered data will be used to evaluate the controller's capability to respond to DR signals.

Collaboration

This project was initiated by SCE's TTC, and will be conducted in the TTC's controlled-environment test chambers. A contractor, certified by the manufacturer, will install and set up the controller for a five-ton RTU.

Status

The instrumentation of the five-ton RTU is completed, and all sensors have been calibrated and installed. The manufacturer's certified contractor has installed the variable-speed drives and the controller. Testing will start in Q3 2017, and a draft report will be completed by the end of Q4 2017.

Next Steps

The manufacturer's certified contractor is scheduled to install software to communicate with the controller. Then, initial setup and preliminary test runs will be conducted, to ensure the unit operates properly. Once the unit's proper operation is confirmed, testing will start.

DR16.09 Predicative Energy Optimization

Overview

As a subset of another EE study within Emerging Technologies, this project is designed to conduct a field assessment of the DR capabilities of a predictive energy optimization system. This system acts as an automated supervisory control system for HVAC systems in commercial buildings, designed to reduce energy consumption, operating costs, and CO2 emissions. It connects to most existing Building Management and Control Systems (BMCS) using industry-standard interfaces, and is compatible with both new and existing building stock.

Collaboration

This project will be conducted in collaboration with SCE's ET program.

Status

The project has been initiated.

Next Steps

The next step is to identify a site for evaluating the DR potential of this system.

DR17.04 Energy Management Circuit Break (EPRI)

Overview

This project will assess a novel approach to end-use energy management through a low-cost, simple-to-install, and familiar type of device – a circuit breaker. The Energy Management Circuit Breaker (EMCB) could bring together both control and energy measurement capabilities across diverse end uses, to enable such applications as low-cost DR, low-cost monitoring and integration of DERs, and low-cost and more streamlined facility energy management and Plug-In Electric Vehicle (PEV) fast charging. Project benefits include guiding the design of a low-cost, easy-to-install device for end-use management via the service panel. This project will validate the EMCB's capabilities of DR, and meter-grade monitoring of end-use loads.

Collaboration

SCE is participating in this project with EPRI as the lead project coordinator. There are 11 other nationwide utilities participating in this research project.

Status

The circuit breakers have been installed at the identified test locations. The breakers are currently collecting data through the end of 2017.

Next Steps

After the data collection activity is complete, consolidated data will be analyzed, and a final report will be published in 2018.

DR17.06 Smart Water Heater Controller Retrofit Lab Assessment

Overview

Increased electrification of residential end-use fuel types are expected as a result of activities promoting the achievement of ZNE buildings. Because of this, there is much interest in the opportunities associated with electric water heaters. Retrofit controls are available for water heaters, to reduce demand and energy consumption. These controls learn and adapt to the unique usage patterns of water heaters, to reduce standing losses and ensure water heating is only operational when needed, ideally at low electricity-cost periods. These controls are applicable to electric and gas tank/storage water heaters (not tankless or heat pump).

Three DR control schemes are identified as applicable to these residential water heater controls:

- Time-of-Use (TOU)-driven controls: The water heater adjusts its operation (setpoint and operating times) based on the real-time TOU pricing of electricity. Operating times will be shifted to occur during periods of lower electricity prices. The water heater controls may take advantage of elevated setpoint temperatures, to ensure sufficient thermal capacity for water heating needs.
- Thermal storage / Grid-Interactive Water Heater (GIWH) controls: The water heater responds as part of an aggregated fleet, to shift operating times and influence the end-use load shape (flatten the "duck curve").
- Load Curtailment Controls: The water heater responds to temporary DR event signals, to reduce electrical demand by cycling off for the duration of the DR event.

Collaboration

The project will be done in collaboration with the vendor and other California utilities. Internal stakeholders include Engineering Services and ATO.

Status

OpenADR not currently available. DR is initiated through an internet-based portal and control modes. Solicitation of test plan comments is complete. The lab test setup is ongoing.

Next Steps

The next steps are to complete the lab test setup and hold a project kickoff meeting.

6. Budget

Emerging Markets and Technology Program
2017 Authorized Funding[1]
$2,922,000

[1] Funding for DR programs and activities are approved in D.16-06-029

7. SCE's Third-Party Collaborative DR Stakeholders

- American Council for an Energy-Efficient Economy (ACEEE)
- Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
- Association of Energy Services Professionals (AESP)
- California Energy Commission (CEC)
- California Lighting Technology Center (CLTC)
- California Public Utilities Commission (CPUC)
- Consortium for Energy Efficiency (CEE)
- Consumer Electronics Association (CEA)
- Lawrence Berkeley National Laboratory (LBNL)
- Electric Power Research Institute (EPRI)
- Emerging Technologies Coordinating Council (ETCC)
- New York State Energy Research and Development Authority (NYSERDA)
- Northwest Energy Efficiency Alliance (NEEA)
- Open Automated Demand Response (OpenADR) Alliance
- Pacific Gas & Electric (PG&E)
- Peak Load Management Alliance (PLMA)
- Sacramento Municipal Utility District (SMUD)
- San Diego Gas & Electric (SDG&E)
- University of California Office of the President (UCOP)
- U.S. Green Building Council (USGBC)