

April 3, 2017¹

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 Q3-Q4 2016
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/2nPYEJA>
- Click the icon in the "Attachment" column for the "SCE Semi-Annual EMT Report 2016 Q3-Q4."

OR

- Go to www.sce.com/applications
- Enter "A.11-03-001"² in the search box and click "Go";
- Click the icon in the "Attachment" column for the "SCE Semi-Annual EMT Report 2016 Q3-Q4."

¹ Because the Commission recognizes the state holiday of Cesar Chavez Day on Friday, March 31, 2017, SCE is filing this on the next business day of Monday, April 3, 2017.

² Although the A.11-03-001 Proceeding is closed, SCE is continuing to post the reports together for ease of access.

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.

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

Very truly yours,

/s/ Nathanael Gonzalez

Nathanael Gonzalez



Emerging Markets & Technology Demand Response Projects Semi-Annual Report: Q3–Q4 2016

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)

March 2017

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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	SCE's Advanced Technology group
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	Dis-Advantaged 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
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
IDSMM	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 Products 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 Company
SGIP	Self-Generation Incentive Program
SONGS	San Onofre Nuclear Generating Station
TES	Thermal energy system
TOU	Time of Use
TTC	Technology Test Centers
UC	University of California
USGBC	U.S. Green Building Council
VCHP	Variable capacity system heat pump
UL	Underwriters Laboratories
VRF	Variable refrigerant flow
ZNE	Zero net energy

1. Background

The *Emerging Markets & Technology Demand Response (DR) Projects Semi-Annual Report: Q3–Q4 2016* is provided in compliance with Ordering Paragraph (OP) 59 of the California Public Utilities Commission (CPUC) Demand Response (DR) Decision (D.) 12-04-045¹ dated April 30, 2012. The Decision directed Southern California Edison Company (SCE) to submit a semi-annual report regarding its DR Emerging 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 generating resources, including distributed resources—the EM&T program at SCE develops and delivers emerging, technology-driven DR initiatives, projects, and studies that facilitate customer acceptance of cost-effective DR and promote behavioral change. The EM&T program also works to enable customer participation in SCE's DR programs by providing input to the Codes and Standards (C&S) program, which draws on research into customer preferences and the market potential for DR in California's new construction markets.

This report on SCE's EM&T Program activities over the second half of 2016 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 DR enablement, and establish standards for interoperability of DR technologies. Emerging technology employees from each of the California investor-owned utilities (IOUs) and municipal utilities meet periodically to coordinate, collaborate, and share results from each utilities' 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 wholesale markets, SCE communicates results from the EM&T program to our customers, external stakeholders, and internal stakeholders, such

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.]

as the account managers within the Business Customer Division (BCD), who educate and influence non-participating customers to enroll in DR programs and adopt DR technologies and strategies.

Following is a sampling of some of the EM&T partnership and communications approaches implemented by SCE:

- Development of customer information sheets to aid account managers in communicating the opportunities associated with DR technologies and strategies developed by the EM&T program.
- Exploration of Integrated Demand-Side Management (IDSM) opportunities through coordination and collaboration among EM&T, engineering, and other staff throughout SCE's Customer Service (CS) organization.
- Partnerships with SCE's Technology Test Centers (TTC) to test EM&T products and execute projects.
- Partnership with the Electric Power Research Institute (EPRI) to test and execute DR projects.
- Maintenance of an internal SCE EM&T Wiki with information on industry trade events attended and current projects to keep interested SCE stakeholders current.
- Periodic DR Forums & Training at SCE to communicate and coordinate DR information across the company.
- Publication of full reports on EM&T projects on the Emerging Technologies Coordinating Council (ETCC) website² 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 emerging technologies that benefit California customers and respond to the initiatives outlined in the California Long Term Energy Efficiency Strategic Plan³.
- Assistance in organizing the ETCC Summit, an event held every two years to promote emerging energy technologies, by planning the DR tracks.
- Assistance in organizing the Peak Load Management Alliance (PLMA) spring and fall conferences, events intended to promote and support DR technologies, markets, and programs and services.

In the second half of 2016, 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.

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 Q3—Q4 2016

DR15.13 Commercial/Industrial Automated Demand Response Using Stationary Battery Storage

Overview

The purpose of this project is to test the potential of stationary battery storage systems for the Commercial and Industrial segment to provide the following identified objectives of this demonstration: fast & flexible DR, non-generation resource (as ancillary service), and distribution grid support.

With large battery capacities (1 MW & 2.8 MW) concentrated in only three locations the demo could explore the opportunity for a more cost-effective program in the commercial and industrial sector.

Evaluate performance issues with the batteries in place, validate demand response and load profile changes and identify and mitigate any power quality and voltage fluctuation issues.

Collaboration

This project is being delivered in collaboration within SCE's Engineering Services and DSM Operations Support.

Status

The final report has been published; the results show encouraging results to employ battery storage systems as a potential DR and grid support resource, given that it is utilized properly with precise instructions and a DR program designed to leverage such resources. The batteries have shown ability to respond within a short timeframe making them a good option for fast and flexible approach to acquire DR capacity.

Next Steps

The project is complete.

DR12.16 Field Testing of Commercial Variable Heat Pump Systems

Overview

This field study is evaluating the potential of variable capacity heat pump (VCHP) systems that can use smart integrated controls, variable-speed drives, refrigerant piping, and heat recovery. These capabilities provide products that can be controlled by a smart thermostat and that offer such attributes as high energy efficiency, flexible operation, ease of installation, low noise, zone control, and comfort using all-electric technology.

Several strategies can make variable refrigerant flow (VRF) systems DR-ready. Indoor units in one or more spaces of a building could be turned off, allowing the space temperature and humidity to drift (with some spillover of cool air from adjacent spaces with air conditioning [AC]). In addition, the on-off sequencing between zones could be alternated to minimize temperature changes, which minimizes occupant discomfort. Alternatively, units could be operated at a fraction of normal capacity to maintain minimally effective environmental conditions in the occupied space. It is also possible to start the building's outdoor units sequentially to spread out demand spikes caused by starting-power transients.

This project will assess the ability of a building's installed energy management systems to serve as an available resource for load management. This involves simulating load-shedding events to trigger the VCHP's built-in DR algorithm. The project team will conduct DR tests in field installations and in a controlled laboratory environment on the four-zone VRF testing stand.

Collaboration

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

Status

The monitoring and analysis of the VRF-HR system shows that the operating characteristics were in line with the expectations based on understanding of HVAC systems.

Next Steps

The report will be posted to the Emerging Technologies Coordinating Council website.

DR16.07 Over-generation Pilot Plan

Overview

The goal of this project is to create a pilot plan for the Over-generation Pilot authorized by the California Public Utility Commission (CPUC) in its decision D. 16-06-029. The pilot will aim to address potential available capacity and strategies to offset periods of over-generation as seen by the grid. This pilot will focus on demand side water pumping, water conveyance and processing application to offset the increased availability of renewables on low demand days, allowing a more seamless utilization of renewable generation into the electric grid.

Collaboration

The project is being delivered in collaboration with Engineering Services and Pilots & Demonstration group with SCE.

Status

The pilot plan has been drafted and shared with stakeholders for review and finalized.

Next Steps

This project is complete.

4. Projects Continued Q3–Q4 2016

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

Overview

This field study is evaluating 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 will analyze how automated and optimized DR technology, combined with an 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 is being executed in collaboration with a third party vendor, which conducts research on issues related to the electric power industry.

Status

Equipment construction is complete, and the vendor has implemented monitoring equipment in the field. The commissioning phase has been completed. Data collection was completed at the end of Q2 2016. The demand response controls equipment has been installed and commissioned.

Next Steps

The manufacturer has not yet committed resources to update the field product for the DR functionality, and field tests planned for the summer and shoulder months of 2016 are now delayed. SCE will finalize the results and complete a final report in 2017 when the DR technology is available.

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, is selecting and testing one of these technologies, both in the lab and in the field, to determine its ability to meet SCE's demand- reduction objectives.

Collaboration

This project is co-funded by SCE's Emerging Technologies Program as part of an EE/DR buildings contract with EPRI. The selection and testing will be 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 Project has completed the Field and Lab trials with collected findings on data reporting on a Friedrich Window AC (Internal DR module) and ThinkEco Modlet unit tested in EPRI's Knoxville laboratory and the ThinkEco Modlet units deployed in residential homes in the Southern California Edison Service territory. The draft report will also include recommendations for product enhancements to better support SCE's peak load reduction objectives for connected devices. SCE is finalizing drafts on field and lab data collection and analyses for the project report.

Next Steps

SCE is still awaiting the complete EPRI project team report on the field and lab testing of DR-Ready end-use devices. The report is still under revision due to schedule delays at the contractor and is now scheduled to be completed Q1 2017 based on the additional supplemental data from the lab results that were requested by SCE staff.

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 is being conducted in collaboration with SCE's Advanced Technology organization to leverage their expertise. It will also involve partnering with several third-party vendors to provide the guest room controls equipment and installation.

Status

Since project start, the team has identified customer sites, obtained signed agreements from customers, and installed the guest room controls. Further, the setup of vendors in the DR servers is complete. Two vendors have obtained certification for OpenADR 2.0a, and a third vendor is in the certification process. Data loggers have been installed and information is being collected and is under assessment at this time.

Next Steps

The project is nearly complete and the final report is being reviewed by a technical writer. Project completion is anticipated in 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

A homeowner orientation occurred in March 2016 to kick-off the partnership and to provide homeowners with a comprehensive orientation and information session. Nine customer-side home batteries have been installed in the community to compare performance against homes without storage. Part of the monitoring phase includes a load control and evaluation period in which several operational strategies are being evaluated to better understand the ZNE as grid assets.

Next Steps

Currently, the project is in the post-occupancy monitoring phase, in which circuit-level monitoring is happening for all 20 homes. The team is in the process of collecting high-resolution AMI interval kWh and kVAR data to better understand the impact of the 20 homes on the local distribution system. This approach to understand distribution level service impacts from the ZNE homes will be taken up with Advanced Technology group in Q1 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 use of capacity variation and integrated controls. This engineering approach may allow these new systems to serve as tools for energy efficiency, DR, intermittent generation integration, and other utility load management strategies.

This project explores and documents 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 appropriate systems are selected and laboratory tested, this project intends to field test systems using advanced refrigerants in commercial and small industrial applications at multiple sites in SCE's service area to evaluate their effectiveness for energy efficiency and demand response.

Collaboration

This project was initiated by the Customer Service NPDL group and is being executed by EPRI with project management from SCE's TTC.

Status

The project team has completed the Task 1 survey of technologies and has identified several promising technologies for laboratory and field demonstrations. Testing was completed in Q3 and a draft report was written which will later be integrated into a combined lab/field report.

Next Steps

The project team will continue progressing on the laboratory and field demonstrations that have taken longer than originally scheduled due to changes in the technology that will be included in the final report. The larger draft report that contains the demand response sub-project has now been initiated by the EPRI team and a final report is expected in Q1 2017.

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

Overview

This ZNE Deep Energy Retrofit sub-project showcases a range of high-efficiency IDSMS 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 being considered currently, 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

Thirty “Smart” Programmable Communicating Thermostats were installed in July, 2015 in the thirty units that have been retrofitted. They have collected data for a year and partners are analyzing the data for findings to be included in the final project report, led by EPRI with support from SCE and BIRA. Ten each of three different brands were installed: Trane, Nest and Ecobee.

Next Steps

The project team intends to develop a replicable and scalable financial model for implementing LIMF ZNE retrofits across SCE territory and beyond. After the tests are completed of the 3 brands of Programmable Communicating Thermostats, an additional 70 are planned to be deployed for DR testing at the same MF complex. Completion is scheduled for Q1 2017.

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 SF commercial building towards achieving Zero Net Energy (ZNE). SCE will act as the project's expert and lead for emerging 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

Construction on this retrofit project was completed in early 2016. ETI is now seeking participation in a number of SCE programs in Savings By Design and possible the Self-Generation Incentive Program. SCE is working with ETI to best determine an instrumentation plan but has not yet developed a research plan to examine how the ETI can contribute to the EM&T research agenda.

Next Steps

SCE is still evaluating the research plan and objectives for collaboration in future EM&T activities now that the ETI has finished construction. SCE will continue to gauge ETI's interest for participation in future DR programs.

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 energy efficiency 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 emerging technology measures around the CCS area.

This project will break ground on existing and new construction with CCS, using the 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 NPDG 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 4 homes in 4 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

Completion of the data analysis is scheduled for Q1 2017. A “Phase 2” is being planned to study High Performance attics on the same homes in the CCS study, which will push the completion date out to Q1 2018.

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

Overview

This project evaluates the DR capability of VCHP systems. The tested products will include traditional “American-style” high-static ducted systems. Testing will focus on three products. The project team will leverage lab and field testing to evaluate the response of the VCHP system to demand control signals. An appropriate signaling/controlling method will be selected (such as OpenADR 2.0) to enable DR testing under varying operating conditions.

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

Collaboration

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

Status

In Q3 2015, Tasks for field assessment test plan/monitoring plan/instrumentation specs were completed. In Q4 2015, progress was made on data analysis tasks, but not completed. Vendor re-negotiated project deadline to be extended to Q2 2016.

Next Steps

Project is in the final stages of completion (summary data analysis, draft final report, and commercialization assessment). Vendor will continue data analysis/reporting. Vendor will deliver summary/raw data to project manager. Project manager will review findings and provide feedback. The project report has been initiated and is slated for completion in Q1 2017 depending on the progress of the data quality review.

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 reduces computer power demand in response to an OpenADR signal.

- 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, demand response, 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

Field test completed and draft report submitted for SCE review.

Next Steps

Report to be finalized and posted on the ETCC web site in early 2017 for public dissemination.

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 control software to minimize demand from the Edison system. The GCN software will manage generation from the co-generation and 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 stalled with issues around SGIP incentive issues. The project team has made a decision to collaborate with the DR15.15 UC Deep Energy Efficiency Project. The project is also delayed due to resource challenges with the partners.

Next Steps

The project design is in review, and is expected to be assessed for evaluation to proceed by end of Q1 2017.

DR15.14 Real Estate/Transportation Proof of Concept Study

Overview

The demonstration project objective is to link building energy retrofits with electric transportation system linking buildings to public transportation. To scale adoption of key technologies including energy efficiency, energy storage, distributed generation, charging stations, and electric vehicles

Proof of concept that includes SCE commercial customers and local business improvement district, with city and constituents as benefactor. 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 the Emerging Technologies 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 proposal for the project with Metro and key companies in Culver City to provide electric vehicle and electric shuttle options to and from the light rail line for getting to and from work, hospitals, entertainment and shopping is still being negotiated and finalized. The project is to demonstrate dissimilar companies with appropriate attributes can leverage tax credits to reduce first costs on environmentally friendly transportation. The project team has met with Metro retail, hospitality, and university operators to find partners for demonstration project.

Next Steps

The project team continues to work to develop 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 which would include a specific partnership agreement, cost estimate, and schedule for completion.

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 that give 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, demand response, 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 University of California Office of the President (UCoP).

Status

Project agreements are in development for submission approvals with UCoP. The project site will be at the University of California Irvine campus where two buildings have been identified to examine deep energy efficiency and DR opportunities. Project is still in the assessment phase.

Next Steps

The next step is to redefine the scope of work and develop a project plan with expectations and deliverables that match the current needs of the EM&T program. The process of determining the existing buildings' baseline energy use has been completed and planned discussions with the UCoP will define more research plan opportunities for the current EM&T portfolio. These discussions are expected to commence in Q1 of 2017.

DR15.16 Electric Water Heater Study

Overview

Over the last 5 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 have need for hot water, but do not have full-sized dish washers. Additionally, the DR tactics and planning study identified over 100 MW of DR technical potential in 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 the EE/DR portfolio of offerings.

Collaboration

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

Status

This project was recently repurposed to include other market segments and technologies as well as communication platforms. The testing scenarios are also being re-evaluated.

Next Steps

The project will be examined and perhaps re-charted to explore more relevant advanced technology opportunities for this end-use and market segment. SCE will be reaching out to other vendors through trade ally associations and market participants in early 2017.

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 that 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 will be with the Southern California Gas Company.

Status

The project has been initiated with the Ecovox product installed and operational. Access to the CSDH system has been successful, and team is reviewing system performance. Monthly campus energy reports have been obtained and reviewed.

Next Steps

SCE is continuing to work with the customer to develop an engineering assessment of the plant operations but the project has been placed on hold due to resource limitations. SCE will work to assess next steps for pre-commercialization measure adoption for early 2017.

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 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 plants operation needs to be fully demonstrated to verify that the 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 plants 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 Analyzer that is the key technology for performing this ground breaking work to modify the operation of a wastewater plant to support a DR event.

Status

The wastewater DR project has been initiated with the selection of the Project Advisory Committee and demonstration site selection completed (Inland Empire Utility Authority (IEUA)). The procurement of the equipment to construct the oxygen transfer efficiency (OTE) analyzer, needed for controlling the plant during the DR event, is 50% complete.

Next Steps

The construction of the OTE analyzer will be completed and installed at the IEUA Plant 1. The interface for the OTE analyzer to communicate with the plant will then be installed and tested. The DR demonstration will follow as soon as plant operations and resources allow for this.

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 energy efficiency and demand response capabilities in the individual residential units and possibly in the entire residential complex as a whole.

- 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 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, energy efficiency, demand reduction, demand response, and cost-effectiveness of the technologies chosen. Steps in the project will involve identifying technologies to be evaluated, develop SOW, develop testing plans, installation of equipment/ software, commissioning, conducting DR and other tests, 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 territory and across California. EPRI will be involved as a stakeholder fulfilling EPIC 309 project goals, including integration of DER strategies.

Status

Construction is in progress with foundational work and site preparation. To date, the project team is finalizing their plan for identifying specific technologies for evaluation.

Next Steps

The project team is now focused on the enhanced design changes and the permit adjustments needed for the next phase of the construction. This project construction phase will continue through Q2 2017, with the data collection beginning at the time of first occupancy. The final report slated for completion five quarters after first occupancy, likely Q2 2018.

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) determines the implications for meeting greenhouse gas (GHG) reduction and renewable portfolio standard (RPS) targets, (3) developing solutions to mitigate these impacts, and (4) develops resource and technology planning roadmaps for use by investor-owned utilities 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 UC Irvine, and SCE Emerging Products.

Status

The project contract has been awarded and initial discussions are underway but delayed due to contractual issues.

Next Steps

SCE is renegotiating a new Master Agreement between UCI and SCE.

5. Projects Initiated Q3–Q4 2016

DR15.20.00 Dispatchable Condenser Air Pre-Cooler

Overview

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

The project contract has been awarded and the Research Plan has been developed and approved.

Next Steps

Lab testing will commence in Q1 2017.

DR16.08 Demand Response Clean-up for 2019 Title 24

Overview

The objectives 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 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

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

Draft the CASE Report in Q1 2017. Submit final CASE Report in Q2 2017.

DR16.02 Open Vehicle Grid Integration Platform (OVGIP)

Overview

The goal of this project is to evaluate the potential of Electric Vehicles (EVs) as a potential DR resource while participating in DR programs via an aggregator. To achieve this goal, the SCE will dispatch DR events to OVGIP. OVGIP is a platform that provides single interface to receive OpenADR signals from utilities and translates into proprietary automaker's software platforms. The automaker platform will dispatch vehicles with available capacity to provide the demand reduction.

Collaboration

The project will be done in collaboration with EPRI, multiple industry stakeholders and other state utilities. Internal stakeholders include Engineering Services and AT.

Status

The OVGIP platform is ready and is being enrolled with utility DRAS to begin functional testing. Automakers are preparing for customer enrollment.

Next Steps

Finalize any over-generation scenarios to be tested as part of this demonstration. Complete functional testing of the platform and perform live testing. The report is expected to be published in 2018.

DR16.06 Market Characterization Study of Automated Demand Response Capabilities of VRF

Overview

The objectives of this study are to understand the status of ADR-capable controls across VRF manufacturers, report on VRF controls compliance with the demand response (DR) requirements in both 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 demand response 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 of the Advanced Power and Energy Program and Center for Hydrometeorology and Remote Sensing at UC Irvine, and SCE Emerging Products.

Status

The project report is in the draft stages.

Next Steps

Include market data for equipment and sales in California. Complete report by Q2-2017.

6. Budget

Emerging Markets and Technology Program Recorded Expenses: 2015- 2016 (\$)		
Funding Cycle	2015-2016 (Cumulative)	2015-2016 Authorized Funding
Total 2015-2016	\$3,527,605	\$5,844,313

Note: EM&T projects that were initiated in 2015-2016 and are continuing into 2017 may have committed funding that are held in carryover accounts for budget year 2017. As of January 2017, SCE has identified \$109,779 of 2015-2016 EM&T carryover funding.¹

¹ R.13-09-011, A.08-06-001 et al, and A.11-03-001 et al Report of Southern California Edison Company (U 338-E) on Interruptible Load Programs and Demand Response Programs, February 21, 2017

7. SCE's Third-Party Collaborative DR Stakeholders

- American Council for an Energy-Efficient Economy (ACEEE)
- Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
- California Energy Commission (CEC)
- California Lighting Technology Center (CLTC)
- California Public Utilities Commission (CPUC)
- Consortium for Energy Efficiency (CEE)
- Consumer Electronics Association (CEA)
- Custom Electronic Design & Installation Association (CEDIA)
- Demand Response Research Center (DRRC) at Lawrence Berkeley National Laboratory (LBNL)
- Electric Power Research Institute (EPRI)
- Emerging Technologies Coordinating Council (ETCC)
- Illuminating Engineering Society of North America (IESNA)
- International Association of Lighting Designers (IALD)
- Los Angeles Department of Water and Power (LADWP)
- 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)
- Sempra Energy
- University of California Office of the President
- U.S. Green Building Council (USGBC)
- West Coast Utility Lighting Team (WCULT)