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Emerging Markets & Technology Demand Response Projects Semi-Annual Report: Q3–Q4 2015

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

Prepared by
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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
ARRA	American Recovery & Reinvestment Act
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
CCS	Conditioned Crawl Space
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CES	community energy storage
C&S	Codes and Standards
CS	Customer Service
CSI	Customer Solar Initiative
CPUC	California Public Utilities Commission
CZ	Climate Zone
D	Decision
DOE	Department of Energy
DR	Demand response
DRAS	Demand response automated server
DRMEC	Demand Response Measurement and Evaluation Committee
DRMS	Demand response management system
DRPP	Demand Response Partnership Program
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
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
ISGD	Irvine Smart Grid Demonstration
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 2015* 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 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.

This report on SCE's EM&T Program activities over the second half of 2015 is submitted as directed in D.12-04-045, cited above.

SCE works closely with industry groups, academic institutions, and other utilities to develop a vision for DR, identify technologies that can be leveraged for DR, and establish standards for interoperability of DR technologies. EM&T employees from each of the California investor-owned utilities (IOUs) meet periodically to coordinate, collaborate, and share results from each IOU's portfolio of EM&T projects. In addition, to further institutionalize 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 market, SCE communicates positive 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 account managers within the Business Customer Division (BCD), who educate and influence un-enrolled 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 the Customer Service New Products Development & Launch (NPDL) group and the rest of Customer Service (CS) organization.
- Partnerships with Customer Service's Technology Test Centers (TTC) and the Advanced Technology (AT) organization in Transmission & Distribution to test EM&T products and execute projects.
- Partnership with the Electric Power Research Institute (EPRI) to test and execute DR projects. Besides providing a platform for information exchange among national utilities engaged in cutting-edge DR efforts, EPRI plays a valuable role in developing communication and protocol standards to help manufacturers ensure seamless integration of end-use devices into utility DR programs.
- 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) 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 emerging technologies 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 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.

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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].

In the second half of 2015, SCE completed, continued, and started the EM&T projects in the table below.

Category	Project
Codes & Standards	• Development of Compliance Manual for programmable communicating thermostats and DR-capable lighting systems that are incorporated as new construction building codes by the CEC • Development and implementation of DR standards, such as Open Automated Demand Response 2.0 (OpenADR 2.0) for buildings, appliances, and messaging protocols • Specification development for DR-capable appliances and thermostats for use by the U.S. Environmental Protection Agency (EPA) to label ENERGY STAR products • Initiated the formation of an ASHRAE Demand Response Guideline and Standard committee to develop a document to provide direction to building designers and engineers on how to provide demand response capabilities for new buildings. • Reviewed California 2016-Title 24 building energy standards requirements for Occupant Controlled Communicating Thermostats to recommend updates to the 2019 Title 24 standards. • Provided input and direction to the ASHRAE SSPC 189.1 Green Building Standard committee for updated demand response code language.
Testing, Demonstrating & Simulation	• Scoping study of standards and activities that affect California's DR and permanent load shift (PLS) efforts • Field testing of variable capacity heat pumps and climate appropriate AC systems to understand their DR capabilities • PLS and peak load shifting opportunities using batteries • Pilot project to test and evaluate small batteries as residential energy storage units • Establishment of DR capabilities in smart appliances • Initiate investigation of DR potential of home building energy management systems that would quality for incentives under AB 793 • Evaluation of the DR potential of systems using advanced refrigerants • Field testing of hotel guest room controls for DR capability • Demonstrating integration of ZNE communities, including community battery storage • Advanced DR concepts in data centers • Retrofits for low-income multi-family housing (new and existing), and a commercial training facility • Feasibility study to understand the potential for DR using conditioned crawl space • Field test of EV's on-board communications capability to geolocate the vehicle for testing DR opportunities • Field test of DR for waste water treatment plants • Field test of DR in new multi-family low income housing project
Ancillary Services	• A pumping project to evaluate its potential for serving the ancillary services market • Field test of large batteries to investigate the potential in the commercial and industry segment for fast & flexible DR, non-generation resource (as ancillary service), and distribution grid support opportunities. • Field test of Tesla's residential battery storage systems for fast & flexible DR, non-generation resource (as ancillary service), and distribution grid support opportunities.
Education	• Education of selected professionals (lighting experts and pool pump industry) about the benefits of DR-ready products
Special Projects	• Mitigation of impact from permanent shutdown of two units at the San Onofre Nuclear Generating Station (SONGS) through pilots investigating customer-

owned third-party thermostats and use of a home area networked system to control pool pumps
- Testing residential energy storage units and expanding residential DR in the Irvine Smart Grid Demonstration (ISGD) project
- Study to evaluate DR, deep energy efficiency retrofit, distributed generation, and energy storage opportunities at University of California campuses
- Determines the steps necessary for building resilience against climate change impacts to the electrical distribution system

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.

3. Projects Completed Q3—Q4 2015

DR09.02 Home Battery Pilot at Irvine Smart Grid Demonstration

Overview

This project, which began in 2009, evaluated and tested small (4-kilowatt [kW]) automotive- grade advanced lithium-ion battery modules for use as a residential energy storage unit (RESU). The goal was to evaluate the potential of using in-home batteries during DR events or localized distribution constraints to decrease customer impacts, while still alleviating demand on the power grid. A more detailed explanation of this project can be found in Appendix K[4] of SCE's amended testimony to support its 2009–2011 DR application (A.08-06-001).

Collaboration

The project was a collaborative effort with SCE's Electric Vehicle Test Center (EVTC) in Pomona, California, and leveraged their expertise with lithium-ion batteries.

Status

In December 2010, the project team conducted extensive lab testing of a prototype device received from the vendor. During 2011, the vendor delivered 2 pre-production units and 14 additional units with increased functionality and several other improvements, including web control. These 14 production units went through the complete series of RESU tests, and SCE's energy storage specialists worked with vendor engineers to resolve issues discovered during testing. Due to a delay in Underwriters Laboratories (UL) certification, SCE filed, and received approval for, Advice Letter 2685-E[5] requesting a continuation of the project into the 2012–2014 funding cycle. Following receipt of UL certification early in 2013, the team installed several RESU units as part of the Irvine Smart Grid Demonstration (ISGD) project in June 2013 and conducted several tests to determine the effectiveness of these units over the summer of 2013 using the different modes available in the RESU. Participating customers were placed on a Time of Use (TOU) rate to test additional operating modes during the second half of 2014. Final testing was completed during the 1st half of 2015.

Next Steps

None. This project has been completed and the batteries have been removed from the test sites.

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[4]SCE's Amended Testimony in support of its 2009–2011 DR application (A.08-06-001), Appendices A through M [*available at*: http://www3.sce.com/sscc/law/dis/dbattach1e.nsf/0/DBCA190DAE972CEB882574C90070C520/$FILE/A.08-06-001+2009-11+DR+Amended+App_SCE-04++Appendices+A-M.pdf], pp. 449–455].

[5]AL 2685-E [*available at*: https://www.sce.com/NR/sc3/tm2/pdf/2685-E.pdf].

DR09.08 Expanding Residential DR in the Irvine Smart Grid Demonstration

Overview

SCE has explored ways to capitalize on the Edison SmartConnect™ metering and HAN deployment to further enable residential DR in coordination with EE and distributed energy resources. To advance this goal, the EM&T program provided some of the matching funds—in SCE's proposal for the ISGD project—that allowed SCE to leverage funding from the American Recovery & Reinvestment Act (ARRA) awarded to SCE by the U.S. Department of Energy (DOE)[6] in 2010. The ISGD project demonstrated potential EE and DR approaches to designing zero net energy (ZNE) homes, in step with California's Long Term Energy Efficiency Strategic Plan.

Within the ISGD project, Project DR09.08 focused on demonstrating residential DR by examining various treatments to three separate groups of homes: a community energy storage (CES) block, a ZNE block (that also uses energy storage), and a RESU block. All the homes received communicating thermostats, energy information displays, and smart appliances. The project conducted a variety of DR experiments to evaluate the use of SCE's AMI network and load control systems, and the effectiveness of residential DR utilizing a HAN.

Collaboration

This project was a collaborative effort with SCE's AT organization and the DOE to support their larger Smart Grid demonstration efforts.

Status

Monitoring continued with the HAN devices installed as part of the early field test. An update to the system to enable testing of DR events caused a delay in the DR testing planned for 2012. Due to this and other delays, SCE filed, and received approval for, Advice Letter 2685-E, requesting a continuation of the project into the 2012–2014 funding cycle. The project installed all HAN devices during June of 2013 and successfully completed an initial test. In addition, the team completed several tests during 2013, including a December test to determine any heating loads available during winter months. Testing continued during 2014 with test events in February and June to evaluate additional DR strategies with thermostats and appliances. Additional experiments were conducted during the remainder of 2014. A final report on the ISGD project was submitted to the DOE in December of 2015.

Next Steps

None. This project has been completed.

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[6] U.S. Department of Energy Recovery Act State Memos [*available at*: http://energy.gov/sites/prod/files/edg/recovery/documents/Recovery_Act_Memo_California.pdf].

DR12.01 Demand Response Opportunities with a Permanent Load Shift System

Overview

Electrical energy storage–based devices, such as batteries, are still being explored as emerging technologies for their ability to provide permanent load shift and DR resources, including short-term ancillary services and local voltage regulation support for distributed generation. This project will find a commercial site for field testing an advanced battery-based permanent load shift (PLS) system that will supply all or part of the site's load and be equipped with advanced controls to allow the implementation and evaluation of various advanced DR scenarios.

Through this work, this project will identify the technical requirements needed to enhance the capabilities of a battery-based PLS to perform DR functionality, and investigate and define telemetry and control requirements. The project will also help identify and develop recommendations for any regulatory enhancements to allow the installation of enhanced DR-compatible PLS at a site. The findings of this work will be shared via a technical report to be completed at the conclusion of the project.

Collaboration

This project is being executed by SCE's DSM Engineering group, with support from the EVTC organization.

Status

This project successfully demonstrated and validated a battery based PLS technology to shift a significant portion of the electrical loads from On-Peak hours to Off-Peak hours at a commercial building. With a BESS, we were able to shift approximately 20% of "On-Peak" electrical loads to "Off-Peak" hours. Key finding is that, depending upon a load profile which varies among customers, battery energy storage system could be more effective financially when it is programmed and optimized to reduce the peak demand (i.e., demand limiting application). This requires a careful load profile study, and an intelligent program that remembers the load profile from prior days, and prior weeks (just in case, if there was no business due to holidays), and has ability to deploy strategies to limit the monthly peak demand. The final report was approved, and this project was completed in 3Q of 2015.

Next Steps

This project is complete.

DR12.19 Field Testing of Networked Systems for Fault Detection and Diagnostics

Overview

This project is evaluating the capabilities of currently available networked-based FDD systems in laboratory and field settings. The project will focus on the assessment of the systems' effectiveness in implementing utility DR programs, as well as evaluate their ability to collect, display, and communicate system fault detection and diagnostics (FDD) information when linked with residential and light commercial HVAC systems. Additionally, networked system control and automation functionality to determine the potential for automatic response to FDD signals as a means to optimize HVAC system performance is being explored.

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 project has been successfully completed with the evaluation of three different network-based FDD systems. Rigorous testing confirmed the success of the FDD capabilities of selected systems in laboratory and field settings, as well as the DR capabilities of one system. This project also demonstrated the feasibility of presetting the network-based systems with DR response capability to minimize demand requirements during DR events. The project report was completed in Q4 2015.

Next Steps

Publish the project report.

DR12.25 Ancillary Services Pumping Equipment

Overview

This project, listed as DR11.01 in SCE's Semi-Annual Q3–4 2012 EM&T report, aims to evaluate the potential for customers with water pumping equipment to participate in an Ancillary Services DR program. The project team planned in 2010 and conducted initial market research to determine customer willingness to participate in a program that has short event notifications and durations (e.g., customers must respond within 10 minutes, and the events last no longer than 30 minutes). Market research completed by BPL Global recommended that SCE pursue an Ancillary Services DR program for pumping customers to potentially replace or complement the existing Agricultural Pumping Interruptible DR program, which is subject to a limit (in megawatts [MW]) on the emergency DR statewide. According to initial projections, by 2014 approximately 6% of Agricultural and Pumping customers could participate in an Ancillary Services program.

Collaboration

This project is being conducted in collaboration with SCE's Energy Education Center (EEC)-Tulare, New Program Development & Launch C/I Solutions Pilots, Business Customer Division (BCD), Field Engineering, and the Meter Services Organization (MSO).

Status

New Program Development & Launch C/I Solutions successfully extended the expired vendor contracts, led installation of the equipment at the SCE Energy Education Center-Tulare, and executed device testing during Q4 2015 as reported in the SCE Q1-Q2 2015 EM&T report. Since the SCE Business Customer Division was unable to engage a suitable customer within a specific radius from EEC-Tulare to avoid incurring additional project costs and schedule delays, SCE installed devices on two irrigation pumps at the EEC-Tulare. In order to ensure compliance with SCE Cyber Risk policy, NPDL C/I Solutions requested a Cyber Risk review that the project passed. The electrical work was funded through the EM&T budget. BPLG installed direct load control devices that communicated using On-Ramp Wireless infrastructure. BPLG scheduled test events with on-site and remote SCE personnel to verify operation of the controlled devices from various observations points. BPLG and SCE conducted a product demonstration during which BPLG ran the system through a series of scenarios that demonstrated the ability to fully control the pumps through both BPLG's CNRG software as well as through an OpenADR open source generated command. In addition, an advanced Farmer Portal was demonstrated to show the advantages generated to the farmer or grower who participates in a load control program with SCE. These benefits include remote on/off capability, current and historic operating status of controlled devices, and a weather map overlay feature that shows the farmer or grower the current weather conditions at the site location. The system performed as expected in providing detailed operating information for system, including on/off operating state of each pump, electrical load of each pump while operating, and the aggregate load of all devices being controlled by the system.

Next Steps

DR 12.25 Ancillary Services Pumping Equipment project is now complete.

DR13.01 ENERGY STAR "Connected" Specifications for Residential Products

Overview

This project covers SCE involvement in the EPA's specification development for "Connected" ENERGY STAR products. ENERGY STAR typically recognizes products with top-in-class energy performance by allowing display of the ENERGY STAR logo on such products and use of the logo in advertising campaigns. Manufacturers voluntarily participate by investing the resources required to design equipment that is more efficient than that of their competitors. This program is well-known in the United States and internationally.

In response to the emerging importance of the Smart Grid and recognizing the need for compatible end-use products, in 2011 the EPA began discussions centered on including "Connected" criteria into existing product specifications. "Connected" criteria, which include such functions as communication between a device and the utility and DR capability, represent a significant deviation from ENERGY STAR's historic energy performance realm.

To develop devices that meet "Connected" criteria, developers must define how the products communicate with a utility communication network, what types of signals will be transmitted, and the required responses to those signals. They must also create a test method to verify that the DR functionality exists. Each of these items has many nuances that can affect how utilities design and deploy programs around these capabilities.

History has shown that ENERGY STAR specifications and test methods[7] often are incorporated in whole or in part into mandatory performance standards adopted by DOE or state agencies, such as CEC. It is important to ensure that technical issues are resolved before the specifications and test methods are put into practice and become the mandatory industry standard.

As a participant in the specification and test method development processes, SCE seeks to achieve several objectives:

- Inform the EPA on the technical abilities of Smart Meters and the implications of using various communication schemes
- Provide insight into how DR event definitions play into SCE's vision of its overall DR strategy
- Share SCE's laboratory and field test data on various DR-capable appliances and products
- Comment on the DR verification test methods based on prior lab experience, and alignment with eventual DR program deployments

[7]ENERGY STAR Specifications and Test Methods:
[*specification information available at:* https://www.energystar.gov/products/specs/product-specifications-filtered?field_status_value%5B%5D=Under+Revision&field_effective_start_date_value%5Bvalue%5D%5Bdate%5D=&field_effective_start_date_value2%5Bvalue%5D%5Bdate%5D=&=Apply].

This project is divided into six sub-projects; each addresses a product, as shown in the table below. Updates on active projects are included in the Status section.

Product	Project #	Status
Refrigerators/Freezers	13.01.01	Completed Q2 2013
Clothes Washers	13.01.02	Completed Q1 2014
Climate Control	13.01.03	Cancelled
Pool Pumps	13.01.04	Completed Q1 2015
Clothes Dryers	13.01.05	Completed Q2 2014
Dishwashers	13.01.06	Completed Q2 2015

Collaboration

This project is funding SCE's portion of a collaborative specification development process with multiple interested parties, such as manufacturers, efficiency advocates, utilities, and regulatory agencies.

Status

13.01.03 – Climate Control

The EPA initiated the communicating climate controls effort in 2010. EPA's focus has shifted to EE. While DR is still a consideration, SCE's involvement has shifted to the C&S program. The DR project will be cancelled.

Next Steps

These projects have reached closure. SCE will continue to monitor the ongoing ENERGY STAR specification development activities to ensure that product specifications achieve the intended goal of placing energy-efficient products with DR capabilities into the hands of consumers. SCE will provide comments as necessary to craft these specifications around products ready for immediate enrollment and participation in utility DR programs.

4. Projects Continued Q3–Q4 2015

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 field test has been completed. The project team is coordinating with the manufacturer to implement various hardware and software updates to enable further DR activities.

Next Steps

Field tests have been completed and data has been collected for the entire year of 2015. SCE will analyze the results and complete a final report in Q2 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

The project team planned during Q4 2012, and commenced the study in January 2013. Equipment construction is complete, and the vendor has implemented monitoring equipment in the field. The commissioning phase has been completed. Data collection is in progress until the end of Q1 2016. The demand response controls equipment has been installed and commissioned. Final requirements for permitting, inclusive of HERS rating test is scheduled to be complete by Q1-2016.

Next Steps

The project team has installed the equipment and engaged the manufacturer with equipment hardware prior to summer 2014. The manufacturer has committed resources to update the field product. Field tests are planned for the summer and shoulder months of 2015-2016. SCE will analyze the results and complete a final report in Q2 2016.

DR12.20 Evaluation of Permanent Load Shift Solutions for Integrated Demand-Side Management

Overview

Many energy storage technologies aim to permanently reshape the building load profile by shifting peak-hour loads to non-peaking hours of the day. This project seeks to advance and support participation in the statewide PLS Program by creating, calibrating, and validating a pre-feasibility tool using the latest advanced building energy simulation engine. In this tool, thermal energy storage (TES) models will be defined for chilled water systems, ice tanks, and packaged ice storage. This project will also develop training to support the operation of the pre-feasibility tool, and an energy storage technology report.

Collaboration

This project is being executed in collaboration with SCE's PLS program, Field Engineering, DSM Engineering group, and a third party vendor, which conducts research on issues related to the electric power industry. Lumina and NREL were subcontracted to develop the tool.

Status

The TES pre-feasibility tool has been created and vetted by SCE's Permanent Load Shift Program, supporting members of SCE's engineering staff, other California investor-owned utilities and by a third party engineering firm experience in the deployment of real PLS technologies. The tool has been uploaded for use on SCE's online calculation tools webpage. The development team is scheduling a final training session for handoff to the PLS program, at which point a final report will also be handed over which documents the project drivers, software development process, and user instructions.

Next Steps

The Thermal Energy Storage Screener (TESS) Tool is complete, calibrated and being handed off to SCE's PLS program for finalization. The tool was uploaded to SCE's online calculation tools webpage where customers can use the tool for free. The final report summarizing the project is being finalized. This project is scheduled for completion by Q2 of 2016.

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[8], 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. Finalizing drafts on field and lab data collection and analyses for the project report.

Next Steps

The final draft report was completed and submitted to SCE for approval in Q4 2015. SCE requested project team to include additional data gathered during lab testing. This report revision is scheduled to be completed Q1 2016.

[8]SCE signed an agreement called Buildings III Supplemental Project with EPRI in December 2013 to collaborate with EPRI on RD&D activities in improving energy efficiency, environmental stewardship, and demand response in residential and commercial buildings. The Buildings III Supplemental Project has five sub-projects, A through E.

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 AT 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 in Q1 2013, 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.

Next Steps

SCE installed power monitoring equipment and initiate accounts on the SCE OpenADR 2.0 test server. Demand Response event scheduling with data analysis will commence through Q1 2016. Project completion is anticipated in Q2 2016.

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 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 the host utility, technology lead, and lead on grid-side matters.

Status

The community is called Sierra Crest, where 19 of the 20 ZNE homes have been sold, and more than half have been occupied. A variety of public announcements and media events have occurred by various members of the project team to announce this partnership and celebrate the ribbon-cutting ceremony for this community. A homeowner orientation occurred early in March 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.

Next Steps

Currently, the homes are being commissioned to ensure that appliances, batteries, home networks and other devices are working properly before the official monitoring period begins. A detailed monitoring plan will be developed shortly after that.

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.

For lab testing, a CO2 transcritical booster system has been selected as the test unit. This system configuration has been widely adopted in Europe and is beginning to gain traction in the US. It shows promise form an energy efficiency standpoint, but may have issues operating during heat waves in areas with high ambient temperatures. The booster portion of the system is intended to enable operation during these times. Tests were designed to evaluate performance across a range of ambient conditions and the DR implications/opportunities presented in this operating mode. Testing was completed in Q3 and a draft report was written which will later be integrated into a combined lab/field report.

After a thorough investigation of potential system types, equipment suppliers, and customer sites, the project team selected a MyCom ammonia/CO2 system for installation at Imuraya USA in Irvine as the field portion of this project. The system is a new-to-the-US breed of small packaged refrigeration systems that

take advantage of the superior thermodynamic properties of ammonia by using a small charge ammonia system to cool a secondary fluid that is pumped to provide cooling where it is needed. The small ammonia charge and placement outside of occupied spaces significantly reduce the health and safety concerns of using this type of system. Imuraya is a Japanese mochi dessert manufacturer whose products must be manufactured and stored at sub-zero temperatures. The new system will be installed alongside their existing R-507A system to supply the ~1500 sf walk-in storage freezer. Both systems will be operational, allowing the project team to switch back and forth between the two units as needed. In Q3-4 2015, the project team worked to finalize the system design, construction documents, and instrumentation plan. Installation will occur in Q1 2016 along with development of detailed test plans, including DR scenarios.

Next Steps

The project team will continue progressing on the laboratory and field demonstrations. The project is slated for completion in Q4 2016.

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

Overview

This ZNE Deep Energy Retrofit sub-project will showcase 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 will be 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 now begun data collection and the testing plan is being developed. 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 is scheduled to begin in Q1 of 2016. ETI is seeking participation in a number of SCE programs, including SGIP and Savings By Design.

Next Steps

SCE will continue to support ETI on all matters DSM through the project's construction, once near-completion, a monitoring plan will be finalized for ongoing technology feedback. SCE will continue to gauge ETI's interest for participation in 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 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 2019 or 2022 Building Energy Code Cycle.

Status

The measures have been installed in 4 homes in 4 CZs. Data collection is underway. Preliminary reports from several homeowners are very positive as to the more comfortable conditions within the homes.

Next Steps

The next step is to finalize the details for beginning the data collection of the modular units. The modular site is in the 5th CZ, and final preparations are being made to begin the construction on the modular units. Completion is scheduled for Q1 2017. A "Phase 2" Is being planned to study High Performance attics on the same homes/ modular units as 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, progress was made on data analysis tasks, but not completed. Vendor re-negotiated project deadline to be extended to Q2 2016.

Next Steps

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 is slated for completion in Q2 2016.

DR13.08 EPRI EB III D – Advanced Energy Efficiency and Demand Response Concepts in Data Centers

Overview

The goal of this project is to conduct a field test to evaluate three measures that could provide energy efficiency and demand response capabilities in the data center environment:

- 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, energy efficiency, demand reduction, demand response, and cost-effectiveness of the technologies. Steps in the project will involve identifying technologies to be evaluated, developing test plans, locating field sites for testing, conducting tests, and reporting results.

Collaboration

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

Status

To date, the project team has identified several technologies for evaluation:

- Measurement and monitoring equipment has been installed in the customer site, but their current data center loads are too low to conduct DR tests. Customer is adding load to their computers, to allow DR testing.
- Contractor has set up measurements in their own data center lab. Using a computer program that loads the computer server, contractor is able to increase server load to the point where DR testing will be possible.
- The project team was not able to find field test site.

Next Steps

The project is in process of being re-scoped with EPRI.

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 delayed due to funding issues.

Next Steps

The project design is in review, and is expected to proceed by end of Q1 2016.

DR15.11 EV Enabled DR

Overview

The purpose of this project is to leverage an electric vehicle's on-board communications capability to geolocate the vehicle for testing DR opportunities. Similar to the 3rd party Nest PCT model, Tesla would recruit customers who already own Tesla EVs and future owners for the purpose of encouraging them to participate in selected SCE DR programs. OpenADR 2.0 signals generated by SCE would communicate with Tesla's cloud-based control system for DR-compatible load control equipment, embedded in the electric vehicle, to initiate a DR event. The event could include dropping load as well as increasing load by initiating charging when the EV battery is not being charged.

Collaboration

This project is being conducted in collaboration with SCE's DSM Op Support, Corporate Communications, RSO, Call Centers, and AT organization.

Status

The customer agreement and trademark license agreement (TLA) has been approved and signed by SCE and the customer.

Next Steps

Next steps include enrolling customers, receiving approval from customers to share data, deploying test events, collecting data, performing data analysis and completing the final project report. In parallel, support the development of the fast and flexible DR tariff/program.

DR15.12 Residential Automated Demand Response Using Stationary Battery Storage

Overview

The purpose of this project is to demonstrate a targeted Residential Automated Demand Response project with Tesla using their stationary residential battery storage systems. This project would demonstrate fast & flexible DR, distribution grid support, and aggregated non-generation resource (as ancillary service) in the wholesale market. Some of the demonstration sites would target the Preferred Resource Pilot (PRP) area.

Collaboration

This project will be conducted in collaboration with SCE's DSM Operations Support, Corporate Communications, RSO, Call Centers, and AT organization.

Status

The residential battery storage systems aka powerwalls are expected to be deployed within SCE service territory by end of Q2 2016.

Next Steps

The customer sign up and testing activities will be conducted in 2016.

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

Overview

The purpose of this project is to test the potential 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 two 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 and PV in place, validate energy efficiency and load profile changes and identify and mitigate any power quality and voltage fluctuation issues.

Collaboration

This project will be conducted in collaboration with SCE's DSM Operations Support, and AT organization.

Status

The stationary battery storage systems have been deployed and test sites have been finalized.

Next Steps

The testing activities will be conducted in 2016.

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 being 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 is developing a scope of work for several different opportunities to involving Metro's First-Last mile strategy. The team is also preparing to move to phase II of the project.

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

The project was initiated in 2015. 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.

Next Steps

The next step is to establish a scope of work and develop a project plan with expectations and deliverables. The process of determining the existing buildings' baseline energy use has been defined and is expected to commence in April of 2016.

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 initiated but is on hold due to not yet securing suitable retail fast food partners. Also there have been problems identifying suitable water heater products on the market.

Next Steps

The project team is working with EPRI to determine when new commercial products will be available. The team will also continue to explore opportunities for this end-use and market segment.

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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 with 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

Prepare an engineering report.

5. Projects Initiated Q3–Q4 2015

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. The plant would modify the internal flow of high BOD wastewater to prevent its entry to the aeration basins or would curtail set points for aeration while maintaining the required levels of treatment. The lower temporary BOD loading and other modifications to the operation of the wastewater basin would allow for a one hour reduction in aeration. After the hour event, the plant would return to normal operation for the next hour, processing normally the incoming wastewater. The DR event could then continue again on the third hour and fifth hour if needed until the requirement for the DR event ends for the day. 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 was approved in the second half of 2015 and the purchase order requisition was prepared in late 2015, approved and submitted to Procurement in early January 2016.

Next Steps

The purchase order for the contractor to begin work is anticipated being issued in April 2016. Once the PO is received and accepted by the contractor, work on the project will begin immediately since the project team is waiting to start the work. A Project Advisory Committee will be assembled to provide outside technical support and guidance for the project.

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 technology for individual units or the building complex available as a whole
- 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, developing 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.

Status

To date, the project team has not yet identified specific technologies for evaluation.

- Smart thermostats are being considered as a first step to implement demand response events in a LIMF setting.

Next Steps

The project team is now focused on the design and permit phase of the construction. This project construction phase will continue through Q4 2016, with the data collection beginning at the time of first occupancy. The final report slated for completion five quarters after first occupancy, likely Q1 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.

The goals of the proposed project are to (1) provide an advisory understanding regarding the specific impacts of climate change on the electricity system, their extent, and their implications for the system's ability to satisfy the State's GHG reduction and RPS targets and (2) provide a roadmap for utilities and policymakers for how to build an electricity system that is resilient to the impacts of climate change and capable of meeting the State's environmental and energy targets. The proposed project will be accomplished by meeting the following objectives:

1. Determine the spatially and temporally resolved changes in precipitation, runoff, streamflow, and ambient temperature due to climate change.
2. Determine the impacts of climate change on the performance and behavior of the electricity generation fleet including conventional resources and large hydropower.
3. Determine the impact of climate change on the capacity potential and behavior of renewable resource types such as solar thermal and geothermal.
4. Determine the impact of climate change on the magnitude and distribution of the electricity demand.
5. Assess the combined effect of the identified impacts on statewide electricity system greenhouse gas and renewable utilization performance of currently projected strategies for meeting GHG reduction and RPS targets.
6. Identify and evaluate modifications to strategies for meeting GHG reduction and RPS targets which resist the impacts of climate change on the electricity system.
7. Develop a roadmap for the evolution of the electricity system resource mix for building an electric system which is resilient against climate change impacts for use by State policymakers and utilities.

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.

Next Steps

Complete agreement between UCI and SCE, and finalize SOW.

6. Budget

Emerging Markets and Technology Program Recorded Expenses: 2015 ($)		
Expense Type	2015 (Cumulative)	2015-2016 Authorized Funding
Labor	$1,079,515	
Non-Labor	$730,835	
Total 2015-2016 Funding Cycle	**$1,810,350**	**$5,844,313**

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)
- Consolidated Edison of New York
- 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)
- Environmental Defense Fund (EDF)
- Illuminating Engineering Society of North America (IESNA)
- International Association of Lighting Designers (IALD)
- National Grid
- New York State Energy Research and Development Authority (NYSERDA)
- Northwest Energy Efficiency Alliance (NEEA)
- NSTAR
- 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
- University of California Irvine
- U.S. Green Building Council (USGBC)
- University of California Berkeley's DR Enabling Technology Development Project
- West Coast Lighting Consortium
- West Coast Utility Lighting Team (WCULT)