

CA IOUs Demand Response Emerging Technologies Program Webinar

Presented by: Mark Martinez, SCE; Jeff Barnes, SDG&E; Albert Chiu, PG&E

Moderator: Nicholas Connell, APTIM

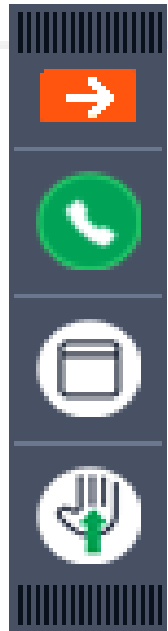
Date: November 17, 2020

ETCC's Goals

- Expand knowledge and capabilities of ETCC member organizations by attracting new technology ideas, solutions, methodologies, and collaboration opportunities and by aligning members' contributions and roles in validating and assisting in the introduction of promising new technologies.
- Strengthen the knowledge and capabilities of the ET community by sharing project results, methodologies, and collaboration opportunities.



Housekeeping



- Each presentation will be approximately 20 minutes. Following each presentation there will be 10 minutes for Q&A.
- If your question or comment is not addressed during any of the Q&A sessions, we've included time at the end to address.
- If you would like to ask a question or comment, please raise your hand.
 - After we turn your mic on, you can then mute/unmute yourself.
- We'll give a 5-minute warning and a 1-minute warning when we're nearing the end of our time for each presentation.

Webinar Overview

- The Demand Response Emerging Technologies (DRET) programs are administrated by Southern California Edison (SCE), Pacific Gas & Electric (PG&E), and San Diego Gas & Electric (SDG&E) (collectively “electric IOUs”) and authorized by the California Public Utilities Commission (CPUC).
- This webinar will provide participants with an overview of each of the California electric IOU’s current DRET programs activities and research focus.

Speakers



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IOU DRET Programs

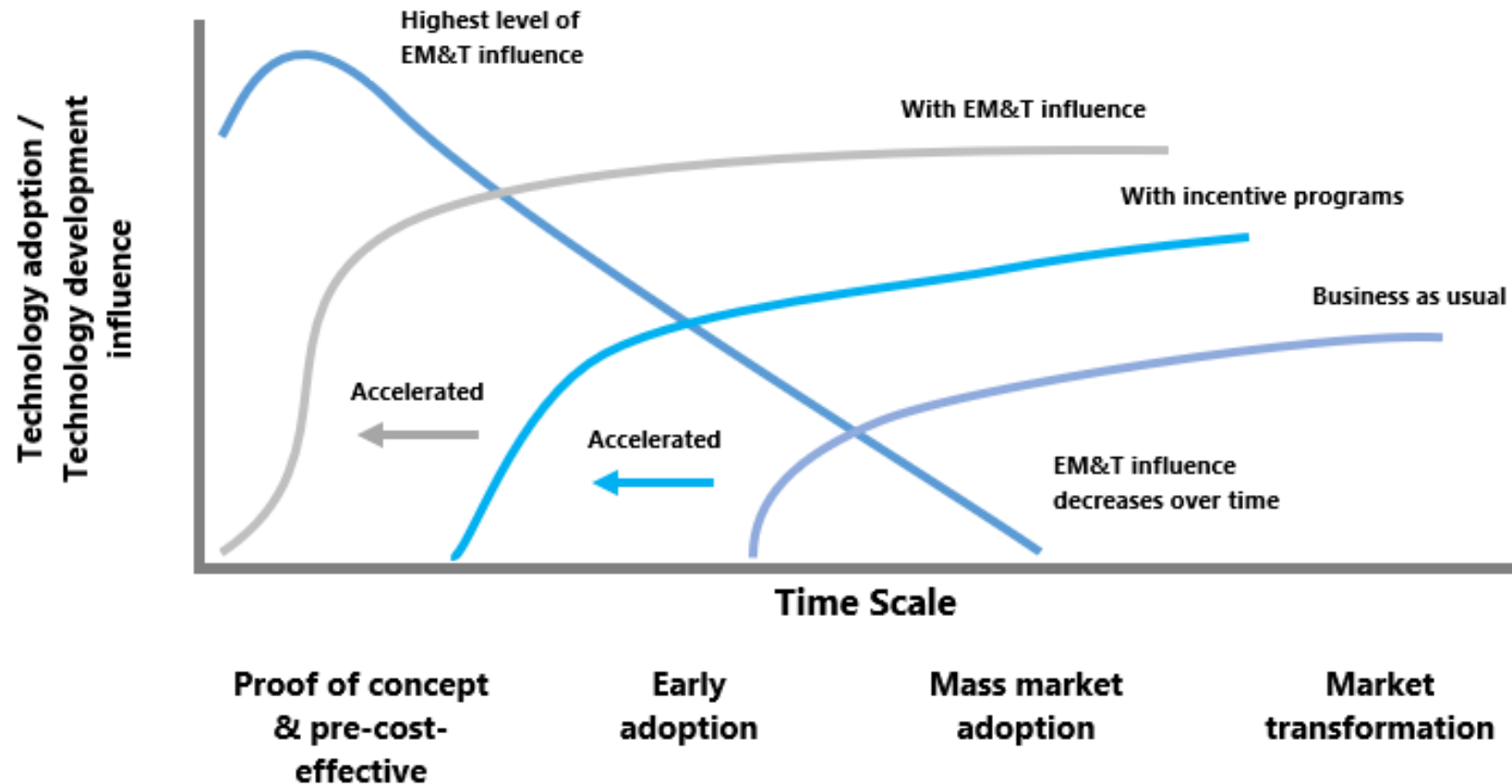
- Approved in 2005 by the California Public Utilities Commission (CPUC) per Decision (D.) 05-01-056 to meet the emerging needs of California's DR policy initiatives.
- Individually administered by California's IOUs SCE, PG&E, and SDG&E to serve customer DR program interests and to evolve in the context of California's DR portfolio in collaboration with the CPUC policy landscape.
- The current programs' funding cycles are authorized by CPUC Decision (D.) 17-12-003, *Adopting Demand Response Activities and Budgets For 2018 Through 2022*.
- Each IOU's program funds research assessments, demonstrations, and field studies to further develop technologies, processes, and software to make demand response more effective for customers and industry and to meet the needs of California's energy future which include energy, environmental, and social aspects over time.

SCE Emerging Markets and Technology

Opportunities, Research, and Advocacy for supporting Smart Customer Choices and Advancing Demand Response

November 17, 2020

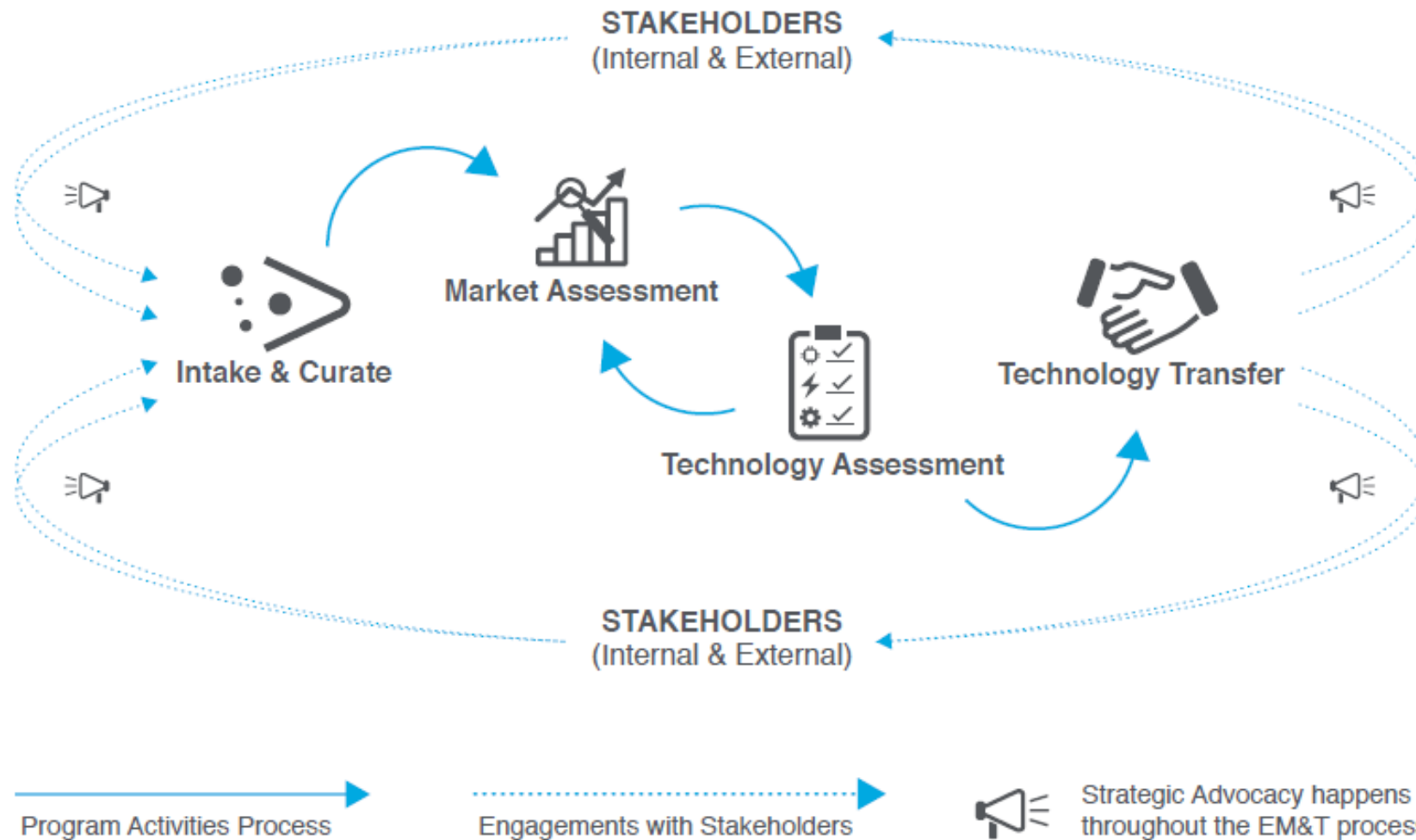
The SCE EM&T program was established in 2005 by the CPUC as a research initiative to identify, assess, and accelerate innovative enabling technologies to support and enhance SCE's demand response programs.



The EM&T program's strategic approach of facilitating a pipeline of innovative solutions for future DR programs is achieved through five EM&T core investment categories are as follows:

- **Intake and Curation**: Identifying projects for inclusion in EM&T's portfolio and selecting which ones to fund based future DR technology needs
- **Market Assessments**: Creating a better understanding of the emerging innovation and consumer markets for DR-enabling technologies.
- **Technology Assessments**: Assessing and reviewing the results of lab and field tests of DR enabling technologies from SCE and other stakeholder research.
- **Technology Transfer**: Advancing DR-enabling technologies to the next step in the adoption process, including raising awareness, building capabilities, and enabling the early stages of product development for commercial deployment.
- **Strategic Advocacy**: Actively supporting markets to integrate DR-enabling emerging technologies into their decisions, including promoting the widespread adoption of current DR-related industry standards.

EM&T's deliverables are cyclical, with the results from each investment activity shared with stakeholders and feeding back into the innovation "ecosystem" to enable more intake and tech transfer outcomes.



To help customers better realize the benefits of demand response program participation, the EM&T program has:

- Tested and assessed pre-commercial innovative enabling technologies and software that are now actively deployed throughout California
- Provided DR innovation advocacy through working groups and industry trade associations for technology-drive DR software and communications
- Shared co-funding and technical support for innovative research and demonstration projects with participants in the California Energy Commission's Electric Program Investment Charge (EPIC) program
- Conducted market research studies that assess customer acceptance and market readiness of cost-effective technologies and solutions
- Engaged with other California DR researchers at UC Davis, UC Irvine, LBNL and the Electric Power Research Institute (EPRI), to test and execute DR projects
- Published reports on EM&T projects on the Emerging Technologies Coordinating Council (ETCC) website for public access and assisted in organizing DR-related conferences to promote and support DR markets and technologies.

ADVANCING OpenADR2.0b SECURE COMMUNICATIONS

- EM&T has for years supported the development of an open standard communications protocol (OpenADR).
- This advocacy would facilitate smart grid communications and price responsiveness with a variety of smart home products.
- Further progress establishes a deeper understanding of the current market and a strategy for favorable business cases for EM&T industry partners.

Group Budget
\$660,000
Additional Funds Leveraged
\$800,000
Time to Impact
0-3 years



KEY ACCOMPLISHMENTS

- CEC Title 24 now requires DR controls to support OpenADR 2.0b.
- Several Amazon Alexa Skills exist to support more flexible and automated DR through in-home OpenADR communications.
- SCE characterized the key automation and control protocols, their applications, and the technology needed for DR with the OpenADR Alliance and other industry stakeholders. .

GRID IMPACTS OF INTEGRATED WHOLE BUILDINGS

- This suite of four projects together aims to prove multiple aspects of DR for the residential multi-family sector including existing building stock and new construction.
- It also includes special consideration for low-income disadvantaged locations.
- These project involve multiple partners which is also important for increasing the DR capabilities in this sector.

Group Budget
\$910,000
Additional Funds Leveraged
\$13,900,000
Time to Impact
0-3 years



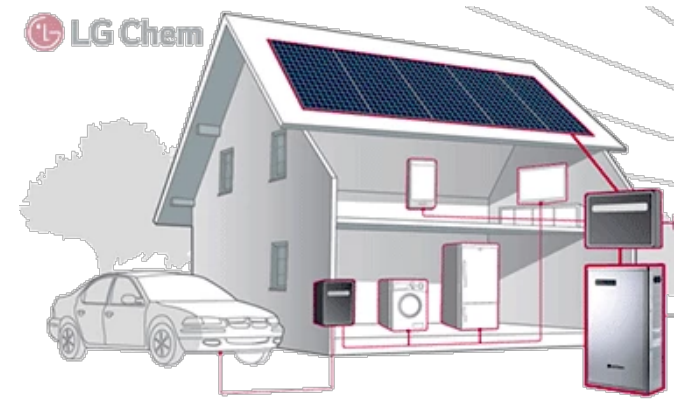
KEY ACCOMPLISHMENTS

- Construction is completed and advanced communicating systems (PV, storage, HVAC, etc) are under evaluation with occupancy
- This suite of projects, once successfully completed, will verify the DR capabilities in the current and future multi-family housing stock.
- These projects should provide stakeholders with confidence as case studies for delivering the benefits that are expected of advanced systems.

RESIDENTIAL ELECTRIC STORAGE (PV with BATTERIES)

- EM&T is researching multiple aspects of residential storage to enable future utility interaction with it.
- Contractors are analyzing the market and technology landscape and developing frameworks to assess data communication functionality.
- SCE is deploying residential storage technologies in the field to test their response to secure DR communication.

Group Budget
\$615,000
Additional Funds Leveraged
\$3,200,000
Time to Impact
0-3 years



KEY ACCOMPLISHMENTS

- Completed a comprehensive assessment of storage market in California and the current value proposition for multiple market actors.
- Identified initial strategies for SCE's engagement with residential storage.
- Shaped SCE's interconnection process for storage systems for large multi-family residences with advanced solar systems.

DR FLEXIBILITY FOR INDUSTRIAL AND WATER PROCESSES

- SCE and EPRI identified industrial DR opportunities including two prime areas: refrigeration and pumping
- The work in industrial pumping continues with early success in using intermittent and variable speed pumping systems.
- Now further SCE tests will study how to use water systems and pumps for DR

Group Budget
\$760,000
Additional Funds Leveraged
\$800,000
Time to Impact
0-3 years



KEY ACCOMPLISHMENTS

- DR and EE both achieved with refrigeration “smart systems” software
- DR works with large scale refrigeration, with low and ultra low (-20 degree) storage systems with multiple compressors
- Proven pumping solutions demonstrated for aeration without impacting wastewater treatment processes

FLEXIBLE COMMUNICATING RESIDENTIAL POOL PUMPS

- SCE's service territory includes 486,000 pumps for in-ground pools. Most of their operative 6-10 hours per day can take place during any time period.
- Upcoming pool technology standards are creating future opportunities to deploy these devices for DR flexibility.
- Many pump manufacturers are now offering connective capabilities for their variable speed pool pumps.

Group Budget
\$450,000
Time to Impact
0-3 years



KEY ACCOMPLISHMENTS

- Updated market knowledge base about smart pool technology availability and developments.
- Collaborated with manufacturer through EPRI to develop and test new DR features in existing products.
- Gathering data on field performance of emerging pump technologies.

ENABLING FLEXIBLE DR IN HVAC SYSTEMS & MARKETS

- The EM&T work on DR for HVAC continues to advance the longer term potential in this area for SCE.
- The multiple projects in the HVAC area have advanced the Open ADR communications in HVAC in VRF systems.
- The projects included in this case study specifically advance the supply chain understanding of adopting OpenADR.

Group Budget
\$715,000
Additional Funds Leveraged
\$1,500,000
Time to Impact
0-3 years



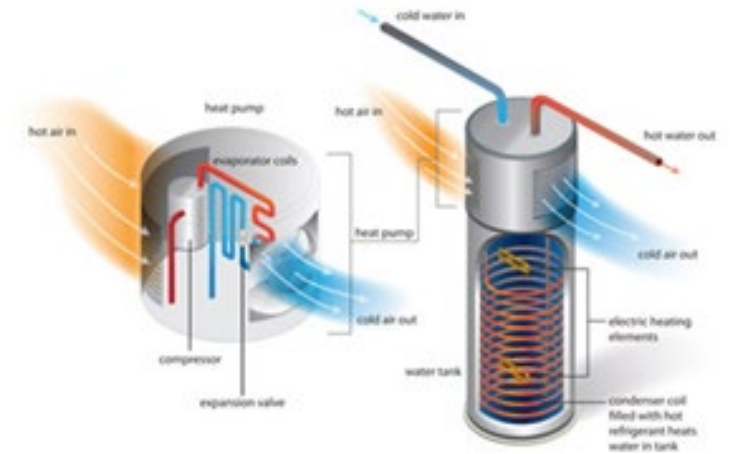
KEY ACCOMPLISHMENTS

- SCE assessment of HVAC systems worked as expected in a lab setting and sometimes in the field. Improved controls recommended to vendors.
- Education on OpenADR for successful HVAC DR has begun for HVAC distributors and VRF manufacturers as upstream advocacy.
- Evaluation of the advanced HVAC DR supply chain has been completed.

DR STRATEGIES FOR BENEFICIAL ELECTRIFICATION

- EM&T is researching opportunities for DR from the beneficial electrification strategies already underway.
- This aligns with SCE's Technology Roadmap priority for customers with Cleaner Energy Choices.
- Initial lab and field studies have focused on residential heat pump water heating.

Group Budget
\$730,000
Additional Funds Leveraged
\$2,500,000
Time to Impact
0-3 years



KEY ACCOMPLISHMENTS

- EM&T has increased its efforts in examining the knowledge of markets and technologies for various HPWH communications technologies for DR
- SCE is building a HPWH testing lab in its Technology Test Center in Southern California to assess HPWH flexibility and DR impacts
- EM&T is also co-funding another Low Income electrification study examining how residential HPWHs can perform in the field

EM&T continues to addresses key CA energy policy issues

- SB100 - goal of 100% renewable & carbon free energy by 2045
 - New flexible DR resources will be needed to increase renewable integration
 - The DR ET programs will examine new technologies and software to enable all customer classes to be price responsive to new TOU rates and other pricing
 - DR ET investments include leveraging other research groups (LBNL, UC Davis, EPRI)
- CEC Title 24 DR requirements – new construction in 2020
 - The revised Title 24 code requires at least one standards-based messaging protocol such as OpenADR 2.0a. More work is needed for the new 2.0b protocol
 - The DR ET programs plan on additional research supporting the OpenADR Alliance and the CEC in advocacy for builders, technology providers, and customer groups for low income and disadvantaged communities
- CEC new Load Management OIR 19-OIR-01
 - The new OIR on flexible load management standards will define new technologies for appliances and communications standards in California

The EM&T's focus on innovation is in alignment with SCE's Pathway 2045 clean energy vision



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SDG&E Demand Response (DR) - Emerging Technologies (ET) Update

November 17, 2020

Current DR-ET Projects



- Permanent Load Shifting Evaluation of a Refrigeration Battery
- Dehumidification & Water Purification Demand Response Project
- Demonstrating DR Performance of Variable Refrigerant Flow (VRF) – Indirect Evaporative Cooling (IEC) Hybrid System
- In-Home Display & Smart Phone App Behavioral Conditioning with TOU Billing
- Voice Activated Assistant for Energy Savings
- Data Analytics to Maximize Demand Response
- Electric Vehicle Charging Impact Study
- SDG&E Program Approved Budget 2018-2022*:

	2018	2019	2020	2021	2022	TOTAL
ET-DR	\$656,100	\$675,900	\$695,700	\$717,300	\$738,900	\$3,483,900

**Approved budget per D.17-12-003*

Permanent Load Shifting Evaluation of a Refrigeration Battery



Overview

Project will demonstrate the Refrigeration Battery's ability to maintain the desired temperature set-points of a supermarket's medium temperature refrigeration systems without running the central compressors or condensers for up to eight hours at a time

Collaboration

- Progress and results shared with other CA IOUs' ET-DR leads
- Project has attracted some media attention and interest from Electric Power Research Institute (EPRI)

Status

- After reviewing measurement and verification data, decided to do additional NMEC analysis to measure achieved demand reduction

Next Steps

- Analyze and finalize the project's economics and complete final report by Q4 2020

Dehumidification & Water Purification Demand Response Project



Overview

Project will evaluate the electric load and demand response capabilities of two types of dehumidification drinking water systems. These units cool air below the dew point to produce water. The collected water is filtered, ozone is injected, then chilled or heated to use as an office “water dispenser” for drinking water.

Collaboration

- Progress and results shared with other CA IOUs’ ET-DR leads
- Collaborated with SDG&E facilities by placing two units for comparison study at its Energy Innovation Center (EIC) and Company office

Status

- Due to COVID-19, all units that were initially placed in facilities throughout the SDG&E territory have experienced a significant decline in usage due to business operations adjustments in response to the stay-at-home orders
- Working with consultant to resume operation of units

Next Steps:

- Project has been extended thru Q2 2021 to allow time for units to become operations and to analyze data collected.
- Final report expected by the end of Q2 2021

Demonstrating DR Performance of Variable Refrigerant Flow (VRF) – Indirect Evaporative Cooling (IEC) Hybrid System



Overview

Project seeks to demonstrate the DR capability of a VRF-IEC hybrid system and to understand the DR characteristics of the hybrid system regulated by a “master controller” during all modes of operation (IEC Only, VRF Only, and simultaneous IEC and VRF) to validate and quantify DR impacts at SDG&E’s Energy Innovation Center (EIC)

Collaboration

- Scope added on to a larger CEC project focused on EE potential of same combination of equipment and controls strategy
- Results will be shared with other CA IOUs’ ET-DR leads

Status

- DR testing of the controller units has concluded. Post trending and data analysis have been completed.

Next Steps

- Vendor is preparing final report

In-Home Display & Smart Phone App Behavioral Conditioning with TOU Billing



Overview

Project is studying a smartphone app that is complimentary to an in-home device, enabling customers to view time-of-use (TOU) pricing periods. Goal of project is to verify if customers will interact with in-home display and interact with smart phone app to shift demand during Demand Response events.

Collaboration

- Results will be shared with other CA IOUs' ET-DR leads
- Coordinated with residential program leads on potential measure value and collaborated with rates and marketing groups to ensure effective messaging efforts

Status

- Testing aligned with SDG&E called DR events concluded in Q4 2020 for approximately 250 registered devices

Next Steps

- Vendor identified plans for second phase of tests
- Post trending and analysis expected to begin in Q1 2021 when testing is completed
- Final report expected by Q3 2021

Voice Activated Assistant for Energy Savings



Overview

Project seeks to understand how voice assistants can advance utility customer engagement, drive energy benefits and play role in allowing new programs or increasing adoption of existing programs. Skill provides messaging to single-family customers for future higher cost TOU periods with recommended actions to reduce use and realize savings opportunities. Project also includes auto-adjustments on end-use devices. Customers are provided feedback on energy use (including actual rate summaries) based on AMI data logger.

Collaboration

- Results will be shared with other CA IOUs' ET-DR leads
- Coordinated with residential program leads on potential measure value

Status

- Testing of phases 1 (rate notification), 2 (rate notification + recommendations) & 3 (actual rate notification based on usage + recommendation) has been completed
- Final phase (auto thermostat control) initiated in Q3 2020

Next Steps

- Testing to be completed in Q4 2020
- Post trending and analysis are under way
- Final report expected by end of 2020

Data Analytics to Maximize Demand Response



Overview

Develop a data analytics tool for the full population of SDG&E non-residential customers that incorporates battery storage to maximize DR programs enrollment and event participation. Key objectives of the tool are to drive up participation in Base Interruptible Program (BIP) and Capacity Bidding Program (CBP). Study also seeks to allow SDG&E to analyze customer benefits from battery storage, understand the degree to which customers with battery storage can benefit from participating in DR programs, and identify which customers could benefit the most.

Collaboration

- Results will be shared with other CA IOUs' ET-DR leads
- Coordinating with DR team to maximize customer participation in CBP and BIP programs

Status

- Vendor is completing development of web-based tool, preparing final analysis and conducting training with SDG&E teams on use of tool

Next Steps

- Reporting and training expected to be complete by end of 2020 so identified customers can be encouraged to enroll in DR programs

Electric Vehicle Charging Impact Study



Overview

Study is being conducted to test the real-world impact of introducing Electric Vehicle (EV) charging on a commercial office building equipped with solar and battery storage systems. The overriding goal is to identify and quantify solar over-generation mitigation as a benefit of interconnected workplace EV charging. The results should provide insight into the potential for mass EV adoptions ability to achieve this goal.

Collaboration

- Progress and results will be shared with other CA IOUs' ET-DR leads
- Coordinating with Clean Transportation team

Status

- Contract executed with vendor in Q3 2020. Study initiated in September and will continue thru Q4 2020.

Next Steps

- Study of EV charging will continue for approximately three months
- Data analysis expected to be complete in Q4 2020
- Final report expected by Q1 2021

Thank You!



Questions?

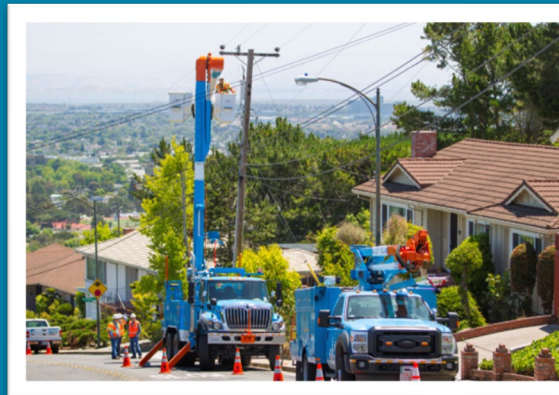
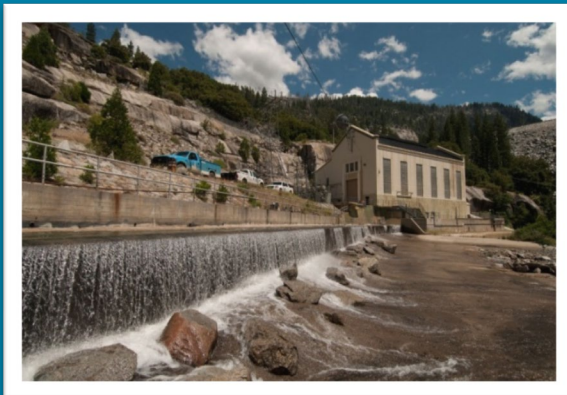
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Demand Response Emerging Technology (DRET)

ETCC Public Webinar

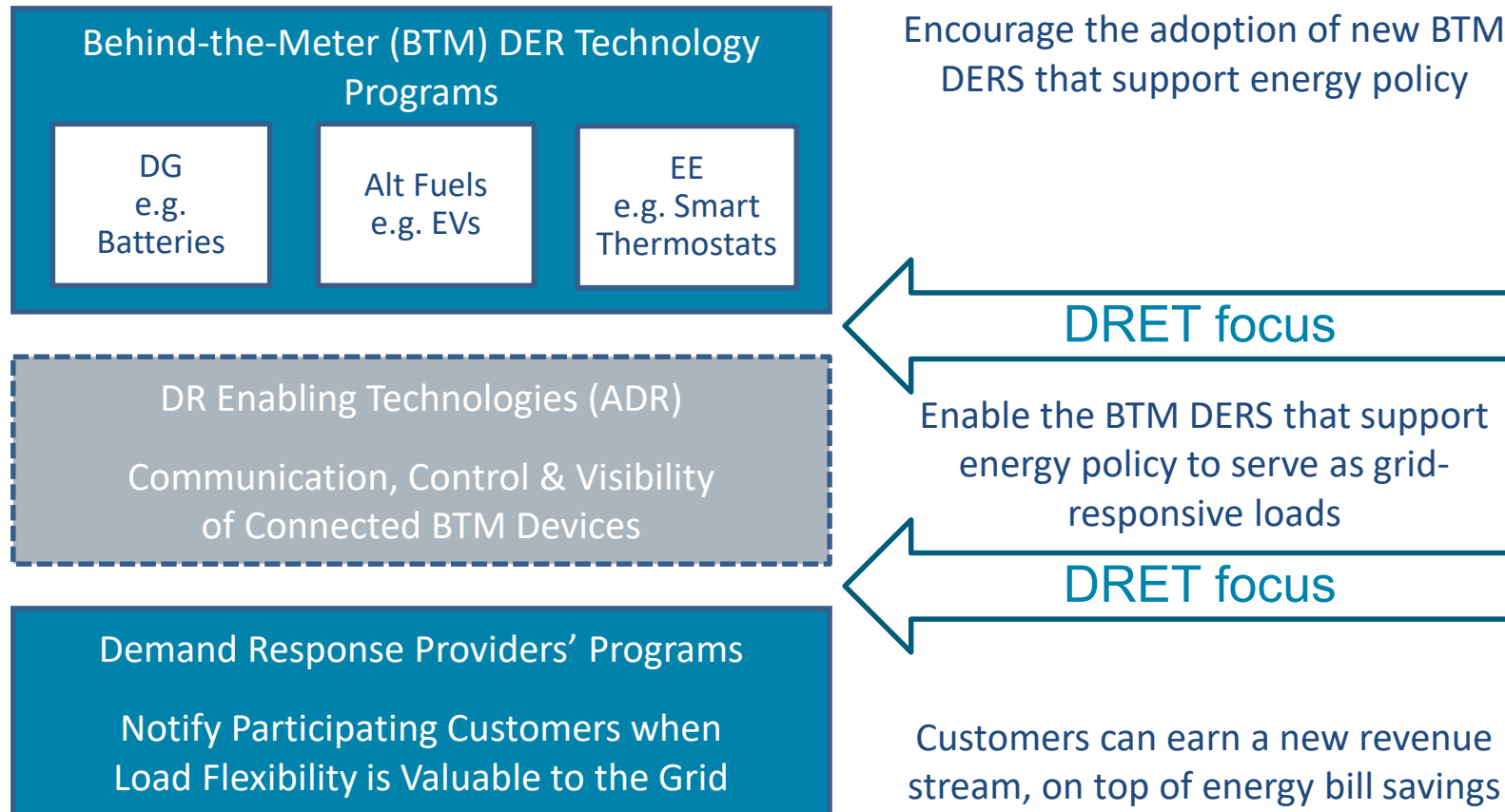
Pacific Gas and Electric Company





DRET Program Mission

Explore new technologies and applications with the potential to bridge the gaps between Technology Programs/ADR and ADR/DR Programs





DRET studies in the past

DR Program cycle	Technology focus
2004-2005	<ul style="list-style-type: none">• OpenADR standard
2006-2009	<ul style="list-style-type: none">• Automating CPP signals
2009-2011	<ul style="list-style-type: none">• Commercial HVAC/Lighting• Industrial Process• Title 24
2012-2014	<ul style="list-style-type: none">• Agricultural EMCS• Refrigerated Warehouse• Smart Thermostat• IDSM Technologies
2014-2017	<ul style="list-style-type: none">• Residential EMCS• Smart Thermostat• SMB ADR Technologies
2018-2022	<ul style="list-style-type: none">• DER Technologies• GHG signal• HPWH• Voice automation• EV/Battery

Heat Pump Water Heater Field Test

Purpose

- Identify Market Adoption Barriers
- Validate Thermal Storage
- Demonstrate Load Shifting/DR

Scope

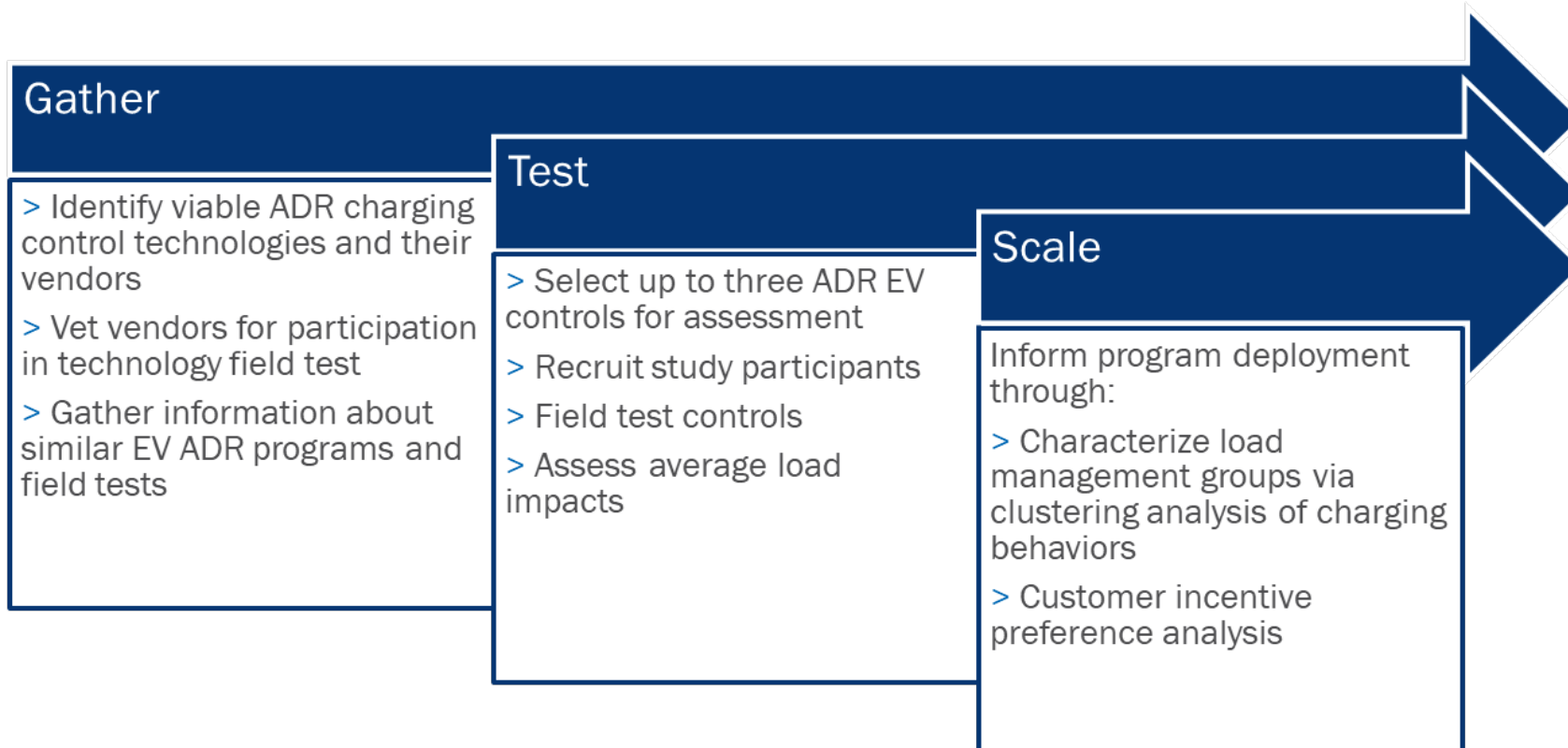
- HPWH Distributors
- 5-10 Plumbing Contractors
- 100 Rheem HPWHs
- 50 Packetized Mello Smart Controllers
- Time-of-Use Education/Enrollment



Residential EV for the ADR Program

Objective

To develop a deemed ADR incentive for residential EV Service equipment and Charging Station





Using Voice automation for load management

Objective - to leverage residential Voice Assistants technology to educate residential customers on energy usage, rates and Time-Of-Use automation/optimization, configuration, and notification via Amazon Alexa

- i. What's my bill?
- ii. What's my energy usage?
- iii. What is my current rate?
- iv. What other rates are available?
- v. Am I on the right rate?
- vi. What's a good time for <doing something>?
- vii. When are prices the lowest?
- viii. Enable/Disable notifications (SMS + Alexa)
- ix. Flex Alert notification
- x. PSPS notification



Residential Digital Rate Study

Objective - to assist our customers with the upcoming changes to rate (transition to TOU) by providing an hourly digital price signal to technology vendors, service providers and manufacturers.

- Define digital rate
- Determine the format of the digitized rate
- Identify which rates to send both static (e.g., TOU, EV rates) and dynamic (e.g., Smart Rate)
- Evaluate existing IT infrastructure that is required to scale this in the future
- Evaluate 3rd parties preferences on the channels (example: API-based push/pull or portal based) and different type of rates
- Evaluate different channels that can provide digital rate to 3rd parties
- Evaluate how well the 3rd parties use the signal to help customer manage their energy use



Grid State Indicator Assessment (GHG Signal)

Objective - to confirm that, in a laboratory setting, end-use energy consumption by certain appliances can be automatically controlled by a combination of:

a frequently changing (every 5 minutes) GHG intensity signal based on near-real-time data from power grid operators

an end-use specific control algorithm (developed by WattTime) that utilizes the GHG intensity signal, energy consumption data, and customer inputs (simulated in the lab) to produce and communicate a dispatch order to a smart controller

a smart controller that can reliably act on the dispatch order created by the control algorithm to shift energy consumed by the appliance into periods of relatively low GHG intensity



For more information:

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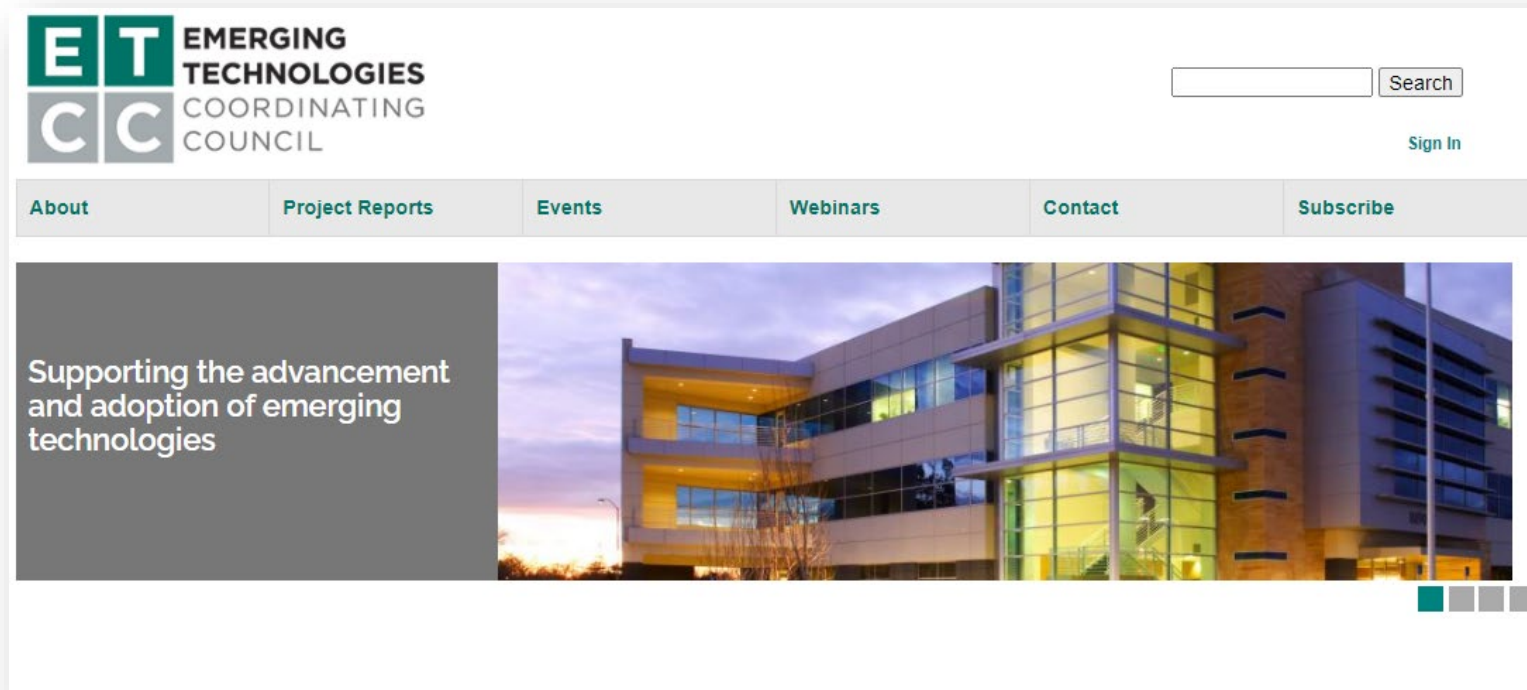
Questions

Final Thoughts



Available Resources

- Final reports can be found on the ETCC website: <https://www.etcc-ca.com/>



Thanks for Joining Us!