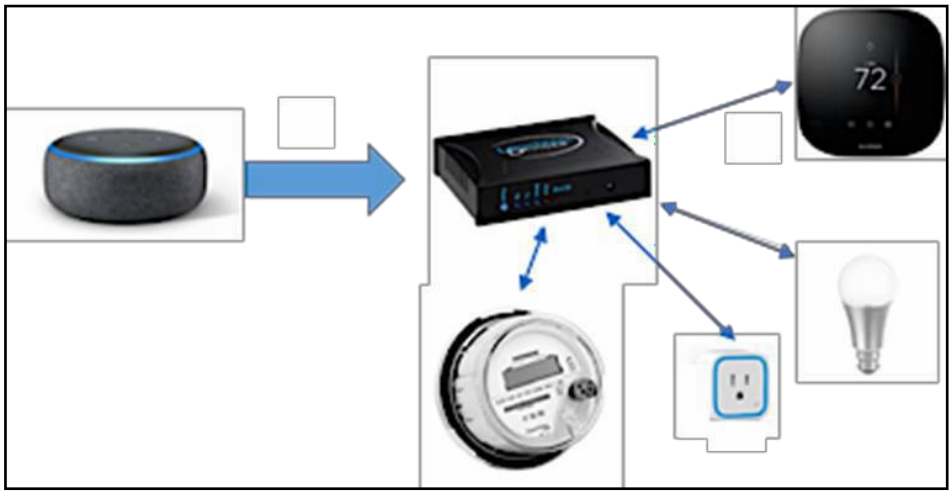
DR19.03 Smart Speakers

Overview

Virtual voice assistant devices such as Amazon's Alexa are increasingly popular with residential electricity customers for use in entertainment, shopping, education, and communications. Since 2015, Amazon has sold over 100 million Alexa-enabled devices across the world. Smart speakers are becoming exceptionally popular, and according to public market research reports, as of 2019, an estimated 35% of U.S. households were equipped with at least one smart speaker. By 2025 the adoption rate is expected to increase to 75%.

With smart speaker technology already integrated into more than 100,000 different smart home products from nearly 10,000 brands in thousands of SCE homes, these devices offer a creative way for SCE to both connect with customers (such as making a payment or receiving energy-saving tips) and enable smart home devices to effectively manage their energy costs through demand response programs and dynamic tariffs.



In-Home Smart Speaker and Control Equipment

As customers are changing their digital interactions with utilities — especially within the connected home arena — SCE wanted to explore the possibility of a voice-enabled smart home service as a "gateway" for customer interaction. This could allow customers to engage with SCE's demand response rates and programs without having to use a computer, phone, or laptop. The primary goals of this project are to:

- Better understand how connected smart thermostats and other "smart" household end-uses can optimize their energy usage via "smart speaker" voice commands subject to SCE's time-of-use (TOU) rates and customer comfort and savings preferences.

- Evaluate how voice interactions related to energy — usage,

estimated bill, best times to use appliances — can be improved to identify optimal voice command "skills" and "smart speaker" interactions.

- Develop optimization algorithms and voice interaction vocabulary specific for the new SCE TOU rates and demand response programs.

The secondary objectives of the EM&T Smart Speaker demonstration project are to:

- Better understand how customers can effectively interact with and use the smart speaker and other connected technologies in the home, for their preferences for energy management.

- Determine how customer satisfaction is impacted by the customers' experience with smart speakers and connected technologies for managing energy, and if the interaction persists or is just a novelty.

- Estimate the change in customer energy use that can be attributed to the enabling technology of a smart energy management hub with Smart Speaker and associated Alexa skills as an "integrated energy management package".

Customers in the study will receive training on how to ask energy-related questions and set their home energy optimization preferences using the smart speaker. A "smart hub" provides algorithms to use various data points, such as the customer TOU rate, energy use, and preferences, to optimize connected devices. Device settings are adjusted to run less during peak times. This project will demonstrate the smart speaker's interactive capabilities with household occupants and will assess whether the smart speaker can enable customers to manage their energy use and cost by optimizing all their connected devices.

The project will use a meter-based assessment that is individualized for each home to assess impacts of energy savings, load shifting, and load reduction. The goal will be to understand energy usage impacts and to potentially develop a deemed IDSM measure for both residential energy efficiency and demand response programs, using real time meter data to assess incremental changes in usage.

The project was funded under the EM&T Technology Assessments and Technology Transfer investment categories, as there are elements of both research goals in this study. The Technology Assessments category assesses and reviews the performance of DR-enabling technologies through lab and field tests and demonstrations designed to verify or enable DR technical capabilities. The Technology Transfer category advances DR-enabling technologies to the next step in the adoption process, including raising customer awareness, developing capabilities, and informing stakeholders during the

early stages of emerging technology development for potential DR program and product offerings.

Collaboration

This work leverages the previous "smart speaker" work funded by the CEC and supported by SCE under the CEC EPIC GFO 15-311 RATES transactive energy project ($3.1M CEC grant). This was a transactive energy pilot that developed certain software and smart speaker skills that are foundational to this current project. This new work is a collaboration among multiple groups within SCE — EM&T, SCE Product Development — other technology stakeholders, and the CEC grant awardees, such as Universal Devices. The technology transfer from this effort leverages over $3M of funding. The M&V study to assess the load impacts or price elasticity effects will be conducted by Nexant under contract to SCE. No other direct cost-sharing or co-funding with any other parties was enabled.

Results/Status

The "first-phase" of preliminary ex post load impact Measurement and Evaluation was conducted by Nexant during Q2 of 2021. The evaluation conducted consisted of summer 2020 data of the participants enrolled in the SCE Smart Speaker project. Initially 91 customers were enrolled but only 63 TOU rate customers remained active. Twenty-five control customers were matched to the 25 treatment customers on TOU rate (4 p.m. to 9 p.m.), known as Rate 4, and 38 control customers were matched to the 38 treatment customers on TOU rate (5p.m.to 8p.m.), known as Rate 5.

Customers on Rate 4 showed load reductions of 1.7% or 0.03 kW during the peak period on average weekdays, but the estimate was not statistically significant (see Figure 1, below). Peak period load reductions for Rate 5 (10.6% or 0.22 kW) were larger in comparison to Rate 4 and were statistically significant (see Figure 2, below).

Figure 1: Ex Post Load Impacts during the Summer Average Weekday and Peak for Rate 4

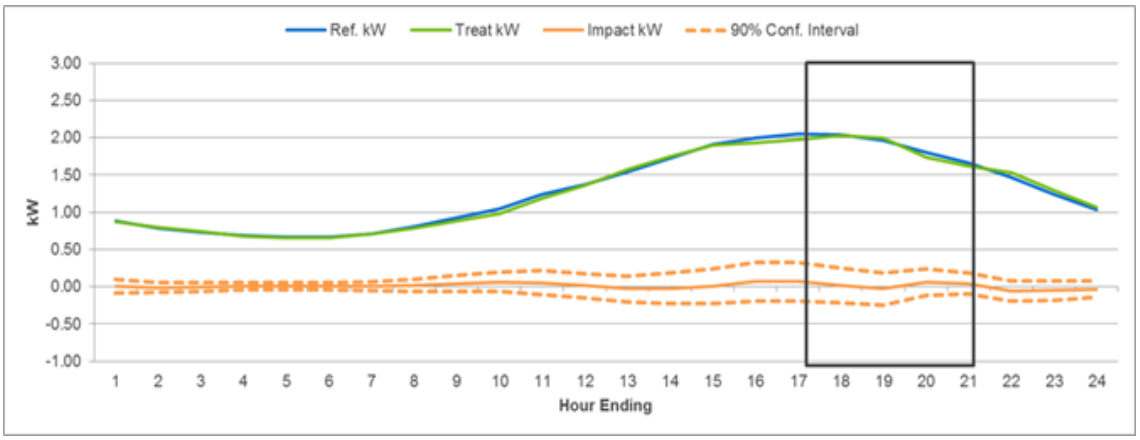


Figure 2: Ex Post Load Impacts during the Summer Average Weekday and Peak for Rate 5

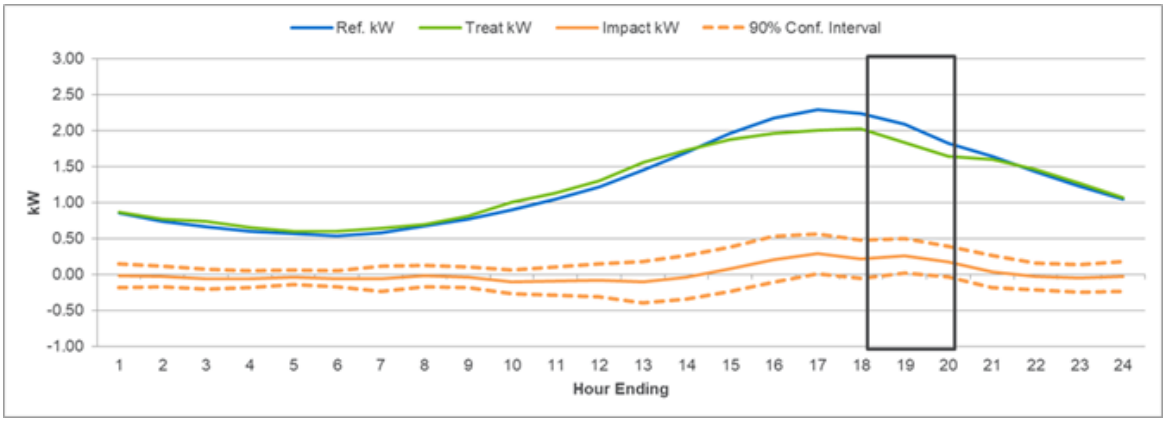


Table 1: Load Impact Summary Statistics for Summer Average Weekday and Peak Period

Rate	Period	Treated Customers	Reference kW	Treatment kW	Absolute Impact	Percent Impact
Rate 4	Peak	25	1.91	1.87	0.03	1.7%
Rate 5		38	2.05	1.83	0.22	10.6%
Rate 4	Day	25	30.97	30.71	0.26	0.8%
Rate 5		38	30.26	29.88	0.38	1.3%

Intent request accounted for 72% of all smart device interactions. Intent requests were questions or requests made by customers to the smart speaker. "Get Electricity Cost" accounted for about one-third of all interactions. Tables 2 and 3 below show participants' interaction with the smart speaker via the different "skills" as per the log of the tracking system and specific requests from customers in the study.

Table 2: Skill Log Summary

Use Type	July	August	September	Total
Intent Request	32	72	24	**128**
Launch Request	12	15	5	**32**
Link skill Account	1	9	2	**12**
Enable Skill	1	0	0	**1**
Change Skill Permission	2	1	1	**4**
Total	**48**	**97**	**32**	**177**

Table 3: Detail Requests

Intent	July	August	September	Total	Percent
Get Electricity Cost	9	40	7	56	32%
Other (Blank in Data)	16	25	8	49	28%
Amazon Fallback Intent	2	13	3	18	10%
Device Use Time	8	2	8	18	10%
Lowest Cost Time	0	5	2	7	4%
Amazon Stop Intent	4	3	0	7	4%
Get Notification Settings	5	0	0	5	3%
Amazon Help Intent	0	2	1	3	2%
Amazon Cance Intent	1	1	1	3	2%
Get Devices	0	1	2	3	2%
Extended Help	0	2	0	2	1%
Disable Notification	2	0	0	2	1%
Get Control Status	0	1	0	1	1%
Get "Good Time For"	0	1	0	1	1%
Health Check	0	1	0	1	1%
Set Comfort Level	1	0	0	1	1%
Total	48	97	32	177	100%

The evaluation was limited by low counts of active participants. Load impacts are evidentfor treatment customers, but the mechanism(s) leading to the effects is unclear. A large portion of initial sets of participants were inactive in the "first-phase" by the time of evaluation. "Second-phase" smart speaker skills rollout and customer re-engagement activities were unsuccessful. Technical hurdles associated with Customer Service Re- platforming (CSRP) of SCE data systems, could not be overcome in a timely manner, and in combination with project budget constraints, the project will begin its equipment decommissioning and closeout. Relevant customer communications regarding project closeout will be sent accordingly.

Next Steps

The research team will conduct project decommissioning and closeout, customer communication activities, and complete M&V activities by Q4 2021. It will also completereporting activities by Q1 2022. The final report will be completed at that time.