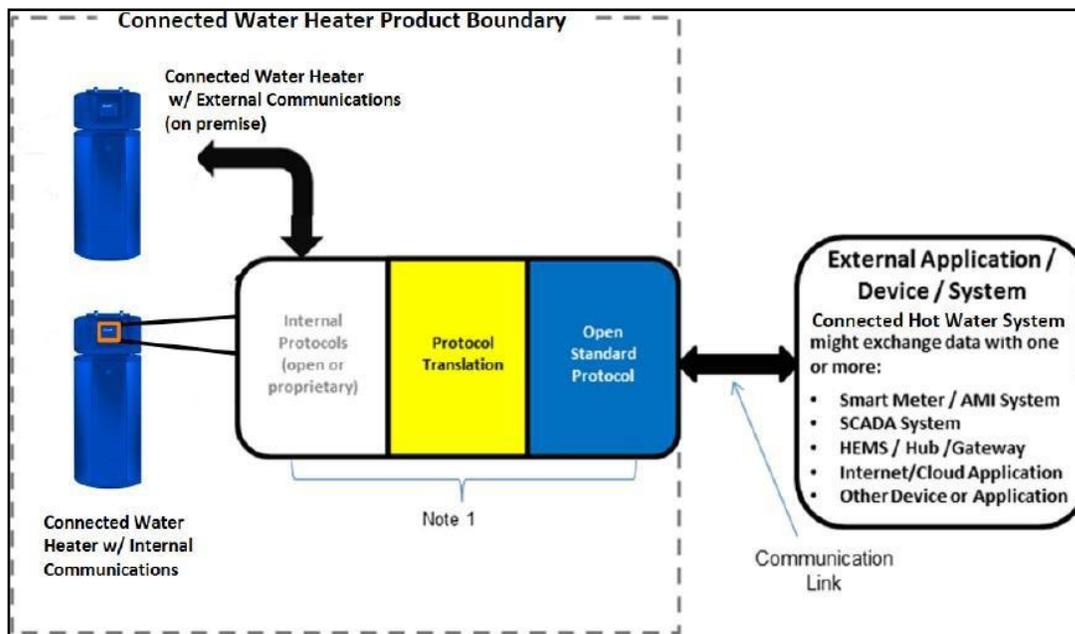


DR19.08 Grid Responsive Heat Pump Water Heater Study

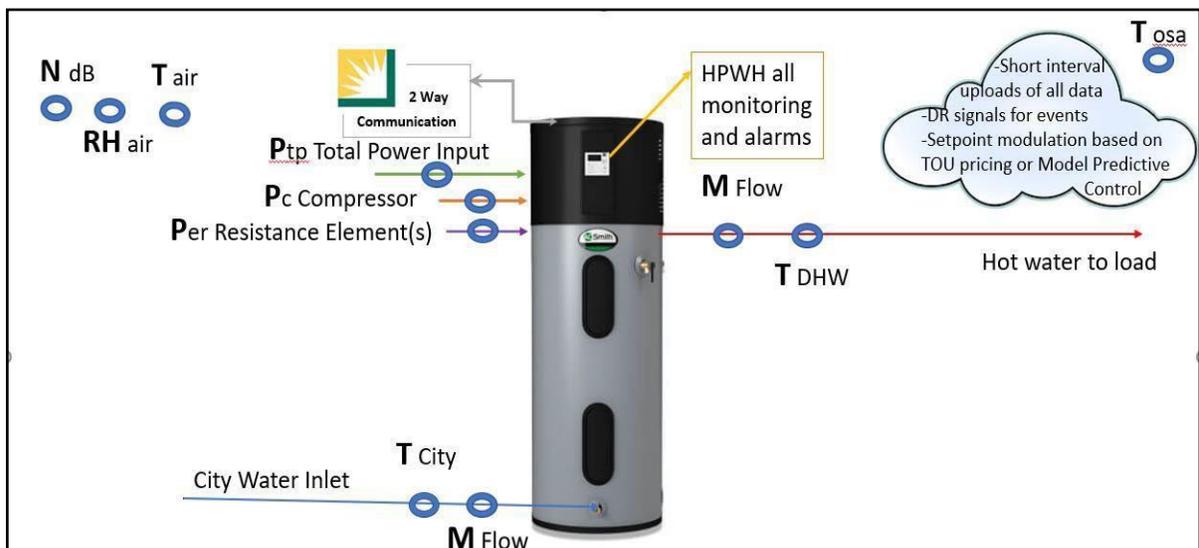
Overview

SCE's Emerging Technologies Program (ETP) and Emerging Markets and Technology (EM&T) Program have been conducting technology assessment studies of heat pump water heaters (HPWHs), and this study is a continuation of those efforts. The research team will be examining innovative emerging data management technologies that will be applied and implemented for the deployment of the HPWH controls and communication equipment, and for the test instrumentation and data collection. The study is in response to CPUC orders which stipulated: "Target installing local preset controls and/or digital communications technologies on 150 heat pump water heaters in each of PG&E and SCE's service territories." In response, SCE proposed the "SCE San Joaquin Valley Disadvantaged Communities Electric Pilot Implementation Plan" (SJV Pilot PIP), which was submitted to the CPUC through Advice Letter 3971-E filed on March 19, 2019.



Connected Water Heater Communications Architecture

As part of San Joaquin Valley (SJV) Disadvantaged Communities Pilot Projects, SCE will deploy electric HPWHs equipped with smart-grid communication technology that will allow the water heater to be used as a grid-responsive heating technology element of the pilot to electrify homes and reduce emissions within the SJV and California City. The SCE pilot will provide 150 qualified single-family homeowners in three SCE communities opportunities to replace their propane water heaters with HPWHs to reduce overall energy costs and improve the health, safety, and air quality of the residents in those communities. Twelve (12) of the 150 HPWHs will have hardware and software to allow grid-responsive communication between the HPWH and the grid to control tank temperature and HPWH operation. The same 12 HPWHs will be instrumented to monitor, at a minimum, the performance of the water heater, signals between the grid and HPWH, operation of the HPWH, water flow and temperatures, local grid conditions, and ambient conditions.



Metering Diagram for HPWH Performance Testing

The study is designed to address the following research issues:

- Assist SCE in understanding integration of renewables and load dispatch as well as helping inform SCE if and how effectively a grid- responsive HPWH can provide flexible load control and hot water storage over various time frames. SCE hopes to gain insight into how heat pump water heaters acting as aggregated distributed resources can be used to benefit the grid and simultaneously offer residents the ability to manage energy consumption through time-of-use (TOU) management of their energy consumption.
- Inform how hot water storage over various time frames can be used to add load or shed load. The demonstration research will provide anecdotal results that should enhance SCE and other stakeholders' understanding of utilizing heat pumps for assisting in the integration of renewables and offering a resource for load dispatch. This will be achieved through detailed monitoring and analysis of the technical performance of HPWHs, including the technical capability of providing local grid impacts from grid responsive HPWHs as well as their performance in supplying hot water for the customers.
- In addition, SCE will gather information on customer experience, technical performance, grid benefits, and impacts of actual performance of the grid-responsive HPWHs as electric appliances in underserved communities.

All 12 homes selected will have a garage for the HPWH and no recirculation system. The 12 homes are part of a larger pilot of 150 electrified homes deployed with the pilot to electrify homes and reduce emissions within the SJV. The prime General Contractor (GC) and Community Energy Navigator (CEN) of the larger project will be responsible for the customer selection and the selection and installation of the grid-controlled

HPWH and a proposed communication package to be used by SCE for the grid responsive signals. SCE plans to minimize the risk of any failures of the technology that might occur at the customer's home; therefore, the HPWH controls and the grid-responsive communications technology will first be functionally tested in a laboratory environment prior to deployment in the homes.

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 by raising awareness, developing capabilities, and informing stakeholders during the early stages of emerging technology development for potential DR program and product offerings.

Collaboration

The research team consists of SCE's Engineering Services group under the direction of the ETP and EM&T program managers and will be assisted by SCE's technology consultants. The SCE Income Qualified Program group will oversee the SJV DAC and will work with the research team to select the customers for the study. Community leaders from the San Joaquin Valley and the communities of California City, Ducor, and West Goshen will also be involved. The project is jointly funded by the EE, DR, and the Energy Savings Assistance (ESA) and California Alternate Rates for Energy (CARE) programs. The EM&T program is only funding a portion of this 12-home study for the development of the specific demand response research outcomes.

Results/Status

The project team has continued its collaboration with the SJV DAC Pilot team and its customer site recruitment activities. The customer agreement template has been finalized. Sites where HPWHs have been installed or are planned to be installed are being reviewed for feasibility in the study. The Data acquisition and instrumentation plan is being finalized. Monitoring and instrumentation rigs are being prefabricated and assembled, to better streamline their eventual implementation in the participating sites. Additionally, research and training are underway to enable the Virtual Top Node and Virtual End Node configurations for HPWH testing and their interface with the SCE test Demand Response Automation Server.

Next Steps

The project team will continue site recruitment activities for suitable installations. Finalize instrumentation/monitoring plans. Complete customer agreements with selected participants. Test and evaluate the assembled monitoring/instrumentation rigs. The

overall impact to the project schedule and timing of the data collection due to the COVID-19 restrictions may continue to slow the HPWH research activities with the overall schedule effects yet to be determined.