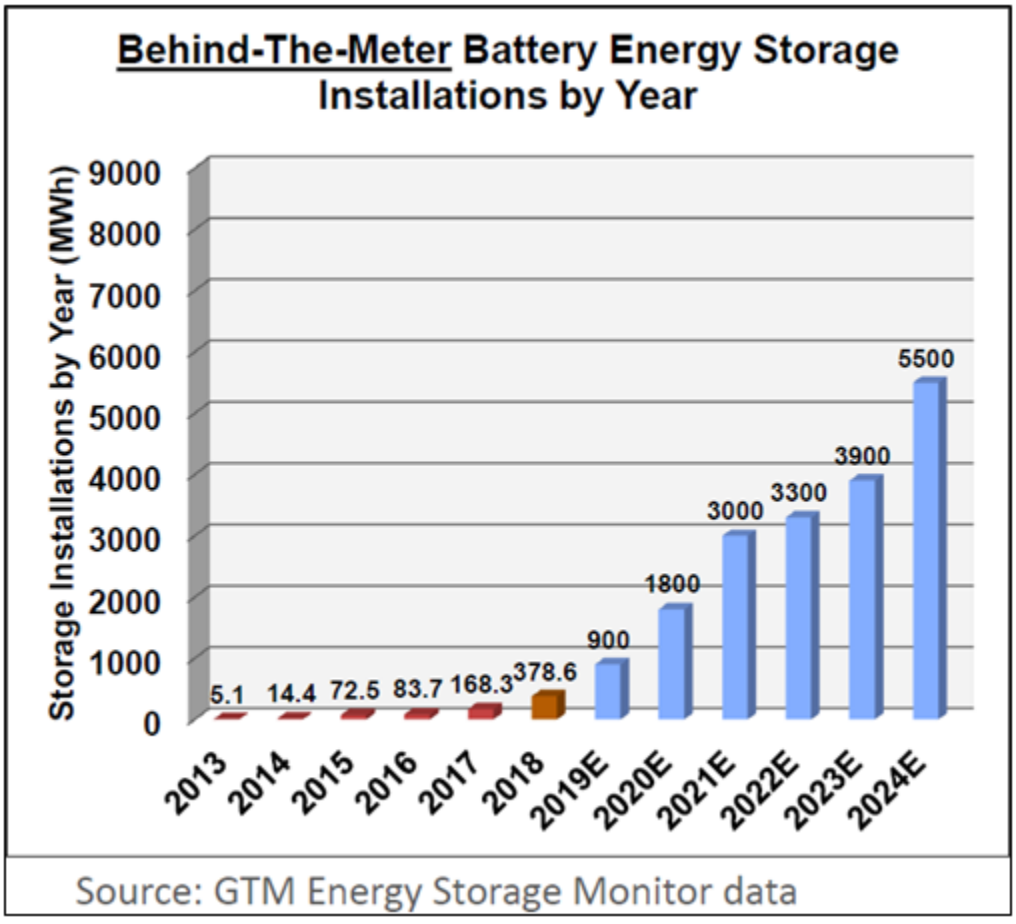
SCE EM&T PROJECT: DR18.05 RESIDENTIAL ENERGY STORAGE STUDY

Status: In progress

Overview

Customer-sited battery energy storage products are emerging quickly, due to cost and performance improvements in lithium-ion battery technology, and government and utility programs that support grid resilience and improved integration of renewable energy. Storage may be adopted by customers for electric bill savings, backup power, or increased use of local renewable energy. As a result, electric utilities are increasingly faced with the opportunity to interface with customer-sited storage systems, either as interconnected devices or potentially as shared resources with multiple uses.



GTM Energy Storage Monitor Data

Distributed energy storage is regarded as one important solution to support increased distributed solar in California while minimizing operations stress on the distribution grid. SCE and other IOUs, the California Independent System Operator (CAISO), and the CPUC are exploring various approaches to dispatching and

compensating behind-the-meter customers. In-home batteries with PV are growing in popularity and installations are accelerating rapidly, especially in California.

The flexibility of the battery to either charge or discharge on short notice has a huge advantage as it can store energy for later discharge and thus accommodate more variable solar generation. It is important for utilities to understand the systems being interconnected to the grid from functional, safety, and power quality perspectives. The EM&T program developed a project to examine the application of retail tariffs with highly dynamic prices for energy storage and explore the automated dispatch of storage to address customer economics and grid operational issues, with an emphasis on demand response capabilities for shift and shed.

The Residential Energy Storage (RES) project has been identified as a venue for testing and validating behind-the-meter energy storage system functions such as load shifting and demand response load reduction. LG Chem batteries with SolarEdge inverters have been installed at three homes, and an additional unit has been installed in an SCE Smart Home. The proposed project allows for the extension of concurrent and previously established research to gain a comprehensive understanding of the technical performance of the system as well as the benefits and impacts for both the customer and grid operator.

Residential Battery Storage System Under Assessment

Another goal of the project is to better understand how smart inverter APIs can demonstrate the monitoring and automated control of behind-the-meter residential

batteries for grid support, demand response, and price elasticity to dynamic tariffs. This project will assess the performance of three residential lithium-ion batteries with SolarEdge smart inverters that have been installed and commissioned in the Moorpark area. The research will also address some important overarching issues around how SCE can include behind-the-meter battery systems to meet the local needs for grid-interactive communities to ensure distribution upgrade affordability, reliability and resilience, and environmental performance. These include the following:

- Dynamic Management: Building end-uses can be designed to help meet grid needs and minimize electricity system costs, while meeting occupants' comfort and maintain lifestyle productivity.

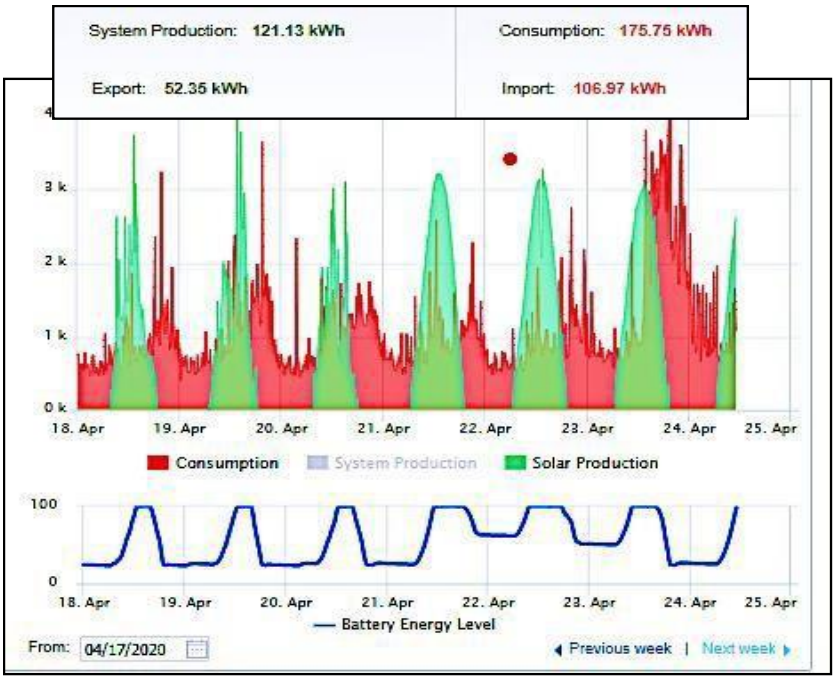
- Resource Co-Optimization: Device design prioritization with buildings to provide greater value and resilience to both utility customers and the grid.

- Integrated Value: Energy efficiency, demand response, and other services provided by facility resources.

The research outcomes from this project will prepare SCE and its technical stakeholders for the adoption of customer energy storage as it impacts tariff compliance, customer and grid economics, and technical grid services that might be achieved through independent and coordinated operation of these potentially flexible assets. The research team will develop a test plan that will examine the following:

- Charge and Discharge Setpoints — The ability to accurately schedule commands for the battery system to charge and discharge are paramount for end users, utilities, and permitting jurisdictions to rely on the further installation of energy storage systems in this and other behind-the-meter contexts for the future.

- • Retail Energy Time Shift — Battery energy storage systems can be used to reduce electric bills by using stored energy during times when the retail rate for energy is highest. Given that the utility prices the tariff based on marginal costs for providing power to a facility, this use case and application has potential benefits to both the customer and distribution system. The test plan, however, will examine how to maximize customer benefits in accordance with the TOU-D PRIME rate from SCE.



Residential Battery Storage System Charge/Discharge Profile Alignment with SCE Tariff TOU-D-Prime

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

SCE is leveraging three residential participants from a previous CEC EPIC grant project, who have allowed the battery energy storage system (BESS) to be installed by a third-party systems integrator. The BESS includes a SolarEdge smart inverter system and the LG Chem RESU battery panel installed by Promise Energy. Kliewer & Associates has facilitated the system commissioning and city/county inspections of each home and is currently developing a training module for the grid interactive SolarEdge API that will enable SCE engineering staff to schedule the systems for grid-responsive flexibility testing. The project is wholly funded by the EM&T program and no co-funding or cost-sharing with other utilities, private industry, or other third-party groups was requested or received for this project.

Results/Status

The project field testing work during the first quarter of 2020 was placed on hold due to COVID-19 restrictions that prohibited scheduled on-site customer engagement. The SCE project team subsequently secured licensing for an enhanced version of the BESS control APIs designed for aggregators (SolarEdge Grid Services) and is examining how the software can be managed for both remote scheduled BESS operation and customer real-time management. The project team secured safe work practice recommendations at the end of May 2020 and subsequently performed final BESS commissioning at all three sites, aligned BESS scheduling to the Prime-D tariff, and successfully demonstrated transactive load control response via remote charge/discharge scheduling.

Due to continuing COVID-19 restrictions in Q3-Q4 2020, the project team has been safely working to install Polisy home automation equipment at each of the customer sites which will enhance the ability to collect data to understand tariff and TOU rates for each customer. The project team coordinated with Universal Devices to implement Public Safety Power Shutoffs (PSPS) modes for the BESS by using Alexa smart tools and the smart speaker algorithm developed by Universal Devices for SCE's Smart Speaker project. Final inspections were conducted at all three customer sites to verify proper installations of BESS and customer surveys were distributed for feedback on BESS technology and smart tool integration.

Next Steps

The research team plans to continue to collect data with remote programming of the BESS and site visits for inspections under safe work practices, and at the same time follow the most restrictive state, county, or local orders. SCE will use data developed via remote execution of the test plans to complete a final report detailing design validation, selection of use cases, test plan development and test plan execution.

The development of a final report that includes test plan results is planned for Q2, 2021. The research outcomes from this project will be shared with SCE and its technical stakeholders for the continued understanding of the technical capabilities of residential customer energy storage as it impacts tariff compliance, customer and grid economics, and technical grid services that might be achieved through independent and coordinated operation of these potentially mass market flexible assets.