DR18.06 Willowbrook Low-Income Multi-Family DER: Energy Storage with PV

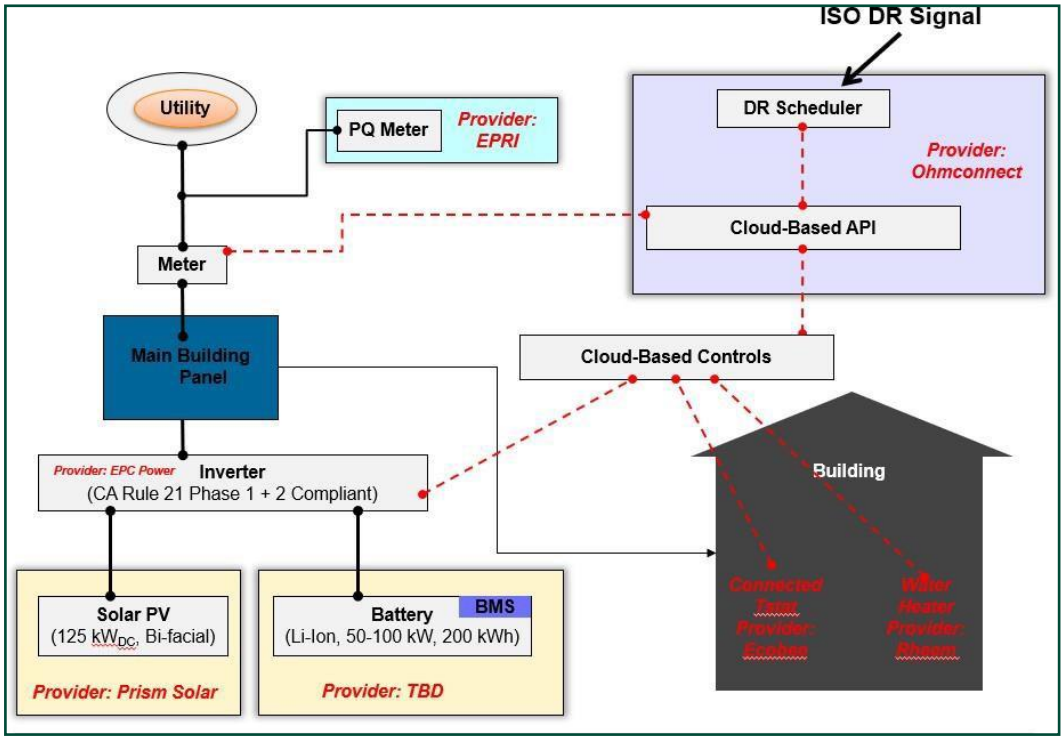
Overview

This in-situ DER demonstration project is an innovative research demonstration study located at a residential community called Mosaic Gardens. This housing was developed by LINC Housing in the Willowbrook neighborhood of Compton, California. The building consists of 61 apartments with 1, 2, and 3 bedrooms, of which half are family housing, and the other half are reserved for formerly homeless and regular users of county services. This project showcases a host of DER technology advances that collectively can contribute substantially to the understanding of how DERs can meet the state's clean energy goals.

Aerial View of the Willowbrook PV Installation

There are many market barriers to the adoption of DER innovation in retrofitting multi-family buildings with solar and storage technologies, and this study, funded by the CEC, will address cost, efficiency tradeoffs, and space constraints. These are all potential barriers to meeting the Zero Net Energy goals in both residential and commercial buildings. Advanced bifacial PV are being installed at this site with a target efficiency of about 23%. The project is studying the use of a DER integration platform that is communications agnostic. The multi-port storage arrangement with smart inverter configurations enables a "shared savings" model. Relevant M&V efforts will include a comparison of pre- versus post-treatment energy utilization, disaggregated by end-use as well as feedback on the customer experience. Many customers will be trained and provided a smart phone app for energy management.

The project, according to the CEC EPIC grant funding opportunity that was awarded to EPRI, is also looking at developing and implementing innovative testing techniques to evaluate new configurations for solar and optimization, and how DR dispatch strategies with the storage can be investigated for overgeneration mitigation.



Willowbrook DER Architecture Overview

An overview of the technologies being demonstrated includes:

- Bifacial solar with target efficiency around 23% that can substantially assist commercial and multi-family buildings with roof area constraints to meet Zero Net Energy goals. Commercial buildings commonly have a lack of roof space for solar, which is necessary for meeting ZNE performance.
- Demonstration platform that can manage both loads and storage to manage diurnal solar production, evening peaks, and increase overall efficiency of solar utilization in multi-family communities. This will be achieved using customer-responsive as well as automated demand-side resources (i.e., thermostats, lighting, and HVAC).

- Integration of DC mini-grids that will eliminate conversion losses for solar PV to feed loads and further enhance overall system efficiency, and evaluation of direct DC-powered air conditioners and lighting systems.

- Evaluation of multi-family code readiness for 2020 and future code cycles, analyzing performance at the community and individual level to current code, including meeting criteria for JA5, JA12, and JA13 using DC-integrated solar and storage.

- Integration of solar and storage on the DC side using smart inverters to enable customers with segmentation of storage for meeting various needs, such as peak demand management, utility-controlled distribution grid flexibility, etc.

As part of the CEC EPIC work, EPRI will be examining the following overarching research objectives:

- What are the combined economics (real and net present value) of a community-level solar plus storage solution?
- What is the feasibility of community scale solar plus storage to attain California's ZNE goals or meet the needs of T-24?
- What are pre- or early-commercial technologies that can help overcome economic and field implementation barriers for solar plus storage?
- What are ratepayer and broader societal benefits for community-scale solar plus storage systems given renewable goals?
- What are some alternate business models or arrangements to engage IOUs more effectively in community-scale, customer-sited DERs for both end-customer and grid-support benefits?

The use of DR strategies with storage is a new concept that will be investigated in this project, as part of the overall DER design in the building. Specifically, EPRI will be examining how the bifacial PV and DC microgrid can be optimized with the DER integration platform that will receive CAISO dispatches. The goal of that effort is to design, build, and test the overall community solar, storage, and load control system, which is connected to each DER asset (PV, battery, advanced inverter, smart thermostat, etc.), receive price/control signals from the utility, market, and/or a DSO, and optimize the aggregated system's dispatch and control for stacked value at the customer and grid level.

The project team also plans to investigate innovative business strategies – such as those informing community solar programs and value-of-solar tariffs – to maximize the value of DER to both end-users and the utility. Another overarching objective of the project is to demonstrate a cost-effective solution for achieving Zero Net Energy (ZNE) within an affordable housing community, and thereby realize California's 2020 goal for new sustainable and scalable ZNE communities.

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 EM&T program is funding the DR portion of the project through an EPRI Supplemental Program Agreement (SPA) as a co-funding commitment to a larger CEC grant. The overall project is being designed and operated by EPRI under a contract with the CEC's EPIC program. Other partners include LINC Housing, Canadian Solar, E-Gear, GridScape, EPC Power, Staten, Kliewer and Associates, and OhmConnect (some of these are partners to the EPRI grant). While the EM&T program is funding the project through a contract with EPRI, SCE is also leveraging its membership in EPRI with learnings and best practices from the parallel research by other EPRI utility members as a cost-sharing strategy. Also, as a corporate funding member of EPRI, SCE is co-funding parallel research investments with other utilities and leveraging that research to assist in this market assessment study, but no other direct cost-sharing or co-funding with any other parties was enabled.

Results/Status

The systems were commissioned by EPRI with SCE present as a part of the approval process. Los Angeles County inspections for the electrical, mechanical, fire, and whole building are complete. SCE installed the Net Generation Output Meters (NGOM) at each building. With NGOMs are set, Permission to Operate (PTO) was officially granted. The design of the DC micro-grid was finalized with the submittal of drawings for plan check of the electrical and mechanical permits.

The project team worked to on-board residents for participation in the OhmConnect program. Most residents have now enrolled. OhmConnect software is being utilized to allow the tenants to receive a message to encourage conservation of on-premises HVAC, water heating, and plug loads and provide that load data to the Open Demand Side Resource Integration Platform (openDSRIP) as a behavioral DR resource. Some residents have changed their energy use behavior because of OhmConnect, and are excited about saving money on their electric bill.

Measurement and Verification equipment installation began in Q2 2021, but due toCOVID travel restrictions and other factors, EPRI was not able to complete the installation during Q2. Reports on commissioning and implementation technology assessment in will be available in Q3.

Next Steps

EPRI plans to have the M&V Equipment installation completed in Q3 2021 and will coordinate with SCE on the next steps for the Distribution System Analysis, Cost Benefit Analysis, and the Customer Value Proposition of Distribution Grid Services Reports completed in Q3 2021. EPRI hired a third-party vendor to commission the PV arrays. Theprocess was started in Q2 and hit some roadblocks but will be completed in Q3 2021.
The DC Mini-Grid components will be installed during Q3 – Q4 2021. This includes DClighting as well as a DC Mini-split HP in the Willowbrook Electrical room.

Full completion of the project is expected in early 2022 and a final report will beavailable at that time.