

## **DR22.01 LBNL Hardware in the Loop Flexible Modeling DOE FOA-0002090**

### **Overview**

Lawrence Berkeley National Laboratory (LBNL) submitted a proposal to the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Building Technologies Office (BTO) in response to the DOE's Energy Efficiency and Renewable Energy (EERE) funding opportunity exchange DE-FOA 0002090, "BUILDINGS ENERGY EFFICIENCY FRONTIERS & INNOVATION TECHNOLOGIES (BENEFIT) – 2019". The BTO's overall goal is to improve the energy productivity of buildings without sacrificing occupant comfort or product performance. The goal is to use energy more productively and efficiently, not simply to use less energy. Progress towards achieving this goal will make building energy costs more affordable to the benefit of American families and businesses. Achieving BTO's priorities across the building technology landscape requires sustained, multifaceted innovation.



**LBNL FLEXLAB Test Site**

The proposal submitted by LBNL was titled "A framework to characterize the performance of building components in providing flexible loads and building services using a hardware-in-the-loop approach" and was awarded a contract agreement by the DOE for \$1.6M to fund the development of a framework to characterize the performance of building components in providing flexible loads and building services using a hardware in-the-loop approach. The overall project objectives are to measure demand flexibility for different grid services and system/building types (commercial) and generate data for researchers/policy makers.

SCE provided a Letter of Commitment (LOC) in support of LBNL's proposal titled "A framework to characterize the performance of building components in providing flexible loads and building services using a hardware-in-the-loop approach" in response to the DOE's BENEFIT FOA 0002090 solicitation, intending to cost share \$300,000. This DOE project will generate high fidelity measurements of building system energy use and their ability and performance to provide grid services and demand flexibility while maintaining acceptable levels of service to building occupants. It will measure demand flexibility for different grid services and system/building types (commercial) and generate data for researchers/policymakers.

Research questions include:

- How much demand can be actually "shifted" by a light commercial building?
- What are the controllable end-uses and equipment types that provide the highest impact?
- How do mass and insulation affect the amount of shiftable load?

The project objectives are:

1. Generation of high-resolution data (i.e., 1 min sampling or less) measuring the performance (building and grid service) of at least 3 systems (e.g., HVAC, lighting, plugs) while operating under all four flexibility modes (i.e., efficiency, shed, shift, modulate) in at least 5 different scenarios (e.g., a mix of weather, occupancy, building characteristics)
2. Development of test procedures to measure building flexibility
3. Generation of a component-level and system-level Modelica model of FLEXLAB to be used in future simulation research (e.g., to test advanced controls)
4. Setup of a hardware-in-the-loop infrastructure at FLEXLAB to support new lab experiments

The project was funded under the EM&T Market Assessments and Technology Assessments investment categories, as there are elements of both research goals in this study. The Market Assessments category is designed to create a better understanding of the emerging innovation and developments of new consumer markets for DR-enabling technologies and an awareness of consumer trends for smart devices. 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.

## **Collaboration**

The project is supplementary to work funded by the DOE's Energy Efficiency and Renewable Energy (EERE) funding opportunity exchange DE-FOA 0002090, "BUILDINGS ENERGY EFFICIENCY FRONTIERS & INNOVATION TECHNOLOGIES (BENEFIT) – 2019". SCE is working with LBNL as a funding partner and active reviewer of the work in progress.

## **Results/Status**

SCE-LBNL contracting for the co-funding agreement with deliverables for SCE's investment was completed in Q4 2022 and the work at LBNL is ongoing.

## **Next Steps**

LBNL and SCE have ongoing coordination as the project progresses. This will include presentations/sync-ups, provision of modeling plan test procedures summary, provision of calibration data, and FLEXLAB experiment results and associated reports. Receipt of deliverables is expected throughout Q1-Q2 2023.