

**B633442**  
**Statement of Work**

**Project Title:** Capacity Utilization of Building Energy (CUBE) via Multi-Scale Metrics

**Background Introduction:**

The goal of the project is to develop metrics to evaluate peak shaving and shifting capacities of buildings over multiple time scales for grid services. The developed metrics will provide a consistent measure to evaluate building's peak shaving and shifting capacities, which will help various stakeholders – including grid operators, regulators, building energy managers, potential and current building owners, developers, and users – make decisions to leverage building energy flexibility for their financial and operational interests and needs. Grid services of various time scales that will be explored include capacity (multi-year), energy (day- to hour-ahead/real-time), and voltage support (day- to hour-ahead in distribution). The focus of this project will be on investigating differences in building energy flexibility (i.e., peak shaving and shifting capacities) by region, climate, building end use (e.g., residential vs. commercial), and control functionality (i.e., levels of automated control). Actual building energy models and data will be used to simulate and validate various use cases in California and New York, in particular. Especially, the impacts of distributed energy resources (e.g., rooftop solar photovoltaic (PV) and smart electric vehicle charging) on the values of building energy flexibility will be examined by simulating use cases on actual distribution feeder models.

**Objective:**

The overarching goal of the project is to provide consistent metrics across various use cases for grid operators, building energy managers and owners, and regulators. In order to achieve this goal, the project team will 1) identify a set of building energy flexibility metrics from the perspectives of grid operators and building developers/users, respectively, 2) improve estimation of building energy consumption and peak shaving/shifting performance with calibrated building energy models and data analytics, and 3) simulate building energy models with the grid models to validate different use cases and demonstrate effectiveness of the metrics. The objectives by year/phase are:

Year 1: Identify a set of peak shaving/shifting capacity metrics for buildings

- Identify metrics required for grid operations over various time scales (capacity, energy) and by operation levels (transmission and distribution)
- Identify metrics required for building energy management and development
- Identify use cases of metrics with TAG

Year 2: Estimate peak shaving/shifting capacities with energy models and data analytics

- Develop and calibrate building energy models
- Identify relationships between building parameters and ex and flexibility performance

Year 3: Validate effectiveness of metrics with simulation and demonstration of use cases

- Simulate building energy performance with building and grid models

- Evaluate metrics for different use cases and compare results among different buildings and settings

**Statement of Work:**

Contra Costa County will be responsible for 1) providing data regarding energy consumption, especially electricity, of the public service buildings that the Public Works Department manages, 2) providing assistance in identifying parameters for developing building energy models (for example, EnergyPlus), 3) providing guidance on energy management of public service buildings, including sharing the experience and expertise in demand response programs and energy efficiency efforts, and 4) facilitating site visits by the project team of at least the LLNL staff members.

**Tasks, Milestones, Deliverables, Schedules:**

| TASKS  | MILESTONES  | DELIVERABLES  | SCHEDULE  |
|--|---|---|-----------|
| Assist LLNL in data identification, transfer, and processing | Complete data management plan by LLNL and the project team                | Provide guidance in data availability on the CCC sites; provide data identified by project team; provide guidance in data processing by LLNL and team | By 9/2019 |
| Assist LLNL in building energy model development             | Complete building energy models (EnergyPlus) by LLNL and the project team | Provide assistance and facilitate site visits, if necessary, in developing energy models for select buildings at CCC sites                            | By 9/2020 |
| Facilitate site visits                                       | At least one visit of select CCC PWD facilities                           | Host a facility visit by the project team from LLNL and PG&E  | By 9/2020 |
| Provide input in project reports                             | Provide input and feedback in annual reports coordinated by LLNL          | Review parts relevant to activities by CCC in the annual reports, including data availability and experience/expertise as energy manager              | By 9/2021 |