GO solar CALIFORNIA

CSI RD&D PROGRAM

Distributed Energy Resources Integration

Grantee:
National Renewable Energy Laboratory

Phase I Partners:
Davis Energy Group, Pacific Gas & Electric, Energy and Environmental Economics, Inc.

Phase II Partners:
Davis Energy Group, Pacific Gas & Electric, Sacramento Municipal Utility District

CSI RD&D Funding:
Phase I: $982,934
Phase II: $97,989

Match Funding:
Phase I: $230,540
Phase II: $75,596

Project Timeframe:
Phase I: 2011-2014
Phase II: 2014-2015

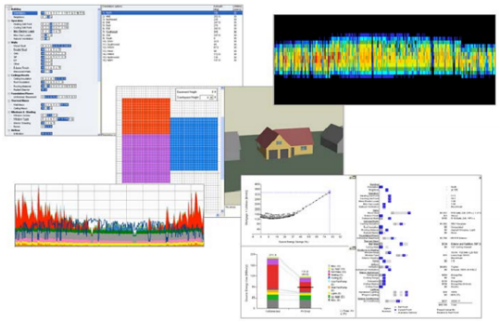
RD&D Project Portal:
Phase I
calsolarresearch.ca.gov/csi/62
Phase II
calsolarresearch.ca.gov/csi/121

Itron | CSI RD&D PROGRAM MANAGER

BEopt: Modeling Capabilities for Zero Net Energy Single-Family and Multifamily Homes in California

OVERVIEW AND OBJECTIVES

Combining and optimizing energy efficiency (EE), demand response (DR), and photovoltaics (PV) in the residential market can be very challenging, because the skills and expertise do not reside within a single company or organization. The market also lacks tools that support quantitative analysis for these options. To meet California's energy policy goals, a tool that can accurately model and optimize for energy efficiency and solar energy is essential. To address these barriers, the National Renewable Energy Laboratory (NREL) was funded to conducted research in two phases.



BEopt Inputs and Outputs

Phase I: The goal of the project was to develop a software tool, BEopt-CA (Ex) (Building Energy Optimizer for California Existing Homes), that facilitates the integration of energy efficiency and demand response with PV in the residential retrofit market. This software tool provides utility program managers, contractors, consultants, architects, and engineers with a means of balancing this integration and optimization for existing homes.

Phase II: Building on the Phase I work, the NREL team extended the software tool to the multifamily sector (duplexes, triplexes, townhouses, flats, and low-rise apartment buildings). Specific multifamily modeling additions include developing multifamily-specific operating conditions, adiabatic surfaces, enhancements to input screens (geometry, option, and site screens), enhancements to output screens (aggregate results), multithreading capacity (parallel simulations and use of multiprocessors for faster simulations), and multifamily heating, ventilation, and air conditioning (HVAC) and domestic hot water (DHW) systems (including solar).

This document provides a brief project description. For more detail on the project and the California Solar Initiative's (CSI) Research Development, Demonstration & Deployment (RD&D) Program, please visit calsolarresearch.ca.gov

The CSI RD&D Program is managed by Itron on behalf of the California Public Utilities Commission (CPUC).

PHASE I: METHODOLOGY

The approach began with the existing BEopt software to develop a new modeling tool, BEopt-CA (Ex), to properly accommodate the analysis of certain aspects of existing buildings. Retrofit options and costs were tailored to the characteristics of existing California buildings to streamline analysis. Modifications to the model allowed the use of typical California utility tariffs, custom tariffs, incentives, rebates, and tax credits. The project team modified BEopt to include currently available demand response measures and technologies that shift loads away from peak times. The new BEopt-CA (Ex) was then validated and calibrated with statistically relevant data from typical California communities.

PHASE I: RESULTS AND OUTCOMES

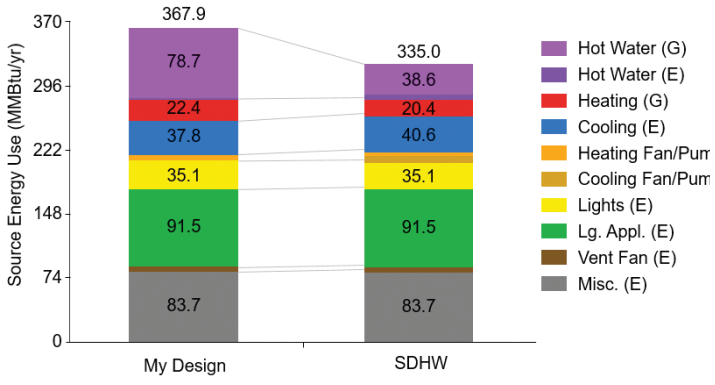
This research resulted in the BEopt-CA (Ex) version 2.2 software tool that optimizes EE, DR, and PV in existing homes. The enhanced software now includes retrofit analysis for existing homes, retrofit measures and cost data, utility tariff capabilities, utility cost-effectiveness tests, incentives for PV and whole house efficiency, and DR.

PHASE II: METHODOLOGY

Building on the Phase I research, the NREL team developed multifamily building analysis capabilities for BEopt, including a multifamily drawing tool which enables users to quickly define the geometry of multifamily buildings. Additional HVAC and DHW technologies were also developed and implemented. Throughout the project, the software framework was tested to ensure that the BEopt multifamily enhancements were accurate and reliable.

PHASE II: RESULTS AND OUTCOMES

The outcome of this project is an enhanced BEopt tool for analysis and optimization of multifamily buildings. BEopt version 2.5, released in October 2015 by NREL, enables users to quickly define the geometry of multifamily buildings. All of the enclosure and equipment options from BEopt's single-family mode are now available for multifamily analysis. New categories added for the multifamily mode include central water heaters, central hot water recirculation, central solar water heating, central solar photovoltaic systems with virtual net metering, steel stud wall construction, and corridor lighting. This enhanced tool is now available for use on California's four million multifamily homes.



BEopt Multifamily Output – End Uses

PUBLIC BENEFITS

Building owners, remodelers, architects, and builders can use BEopt to comprehensively analyze and optimize EE, DR, and PV across California's existing single-family and multifamily buildings. The tool is ideal for zero net energy building design.

For energy professionals, BEopt provides an analytically sound platform, enabling them to quantify the benefits of energy performance enhancing upgrades. BEopt can become a standard for analytic tools in use to make recommendations to building owners and home owners by architects, designers, home rating professionals, and builders.

Utility program planners can use BEopt to develop preferred cost-optimal packages of EE, DR, and PV in planning and designing demand-side programs for single-family and multifamily buildings. These can be tailored for particular climate zones and building types and optimized for subsequent solar installation.

BEopt serves as a valuable tool for developing new measures for California's 2019 Title 24 Zero Net Energy standards for both single-family and multifamily building types.