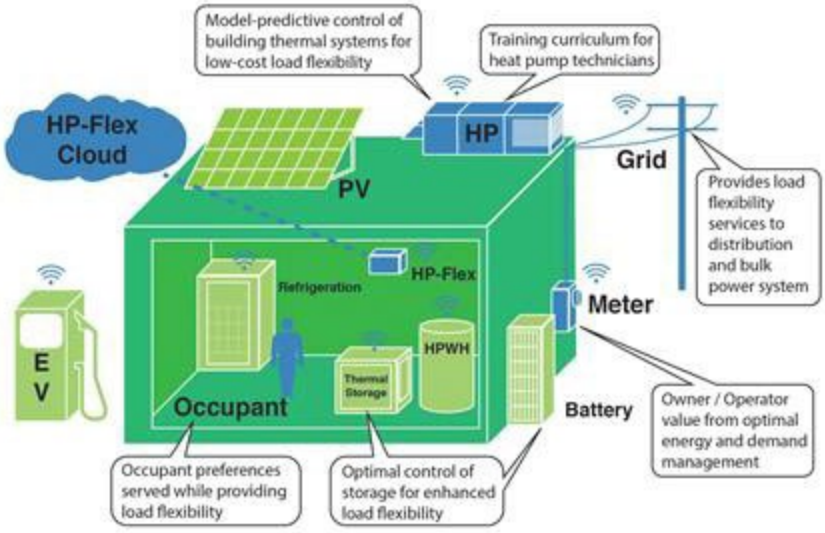
DR22.02 HP-Flex: Next Generation Heat Pump Load Flexibility DR

Overview

Lawrence Berkeley National Laboratory (LBNL) submitted a proposal to the CEC in response to Electric Program Investment Charge (EPIC) solicitation GFO-19-301, Group 4. The proposal was awarded a contract agreement (EPC-19-013) by the CEC for a $3,000,000 grant to fund the development and field site evaluation of an open-source, scalable, low-cost control solution (called HP-Flex) for optimal demand management of high-efficiency heat pumps in small and medium commercial buildings. The goal of the CEC Agreement is to develop open-source control algorithms and educational curricula to train the next generation of engineers and technicians, to help promote the large-scale deployment of replicable, demand-flexible heat pump (HP) installations in small to medium-sized commercial buildings, to increase benefits to both individual building owners and the distribution grid compared to standard HP installations.



HP-Flex: Next Generation Heat Pump Load Flexibility

Southern California Edison (SCE) provided a Letter of Commitment in support of LBNL's proposal for the EPIC GFO 19-301 Group 4 EPIC solicitation, intending to cost share $300,000 ($150k / $150k from EE & DR funds). The project will develop and demonstrate an open-source energy and load management system designed to control advanced heat pumps on small/medium commercial buildings. This system will minimize energy use and bills while allowing buildings to effectively participate in load shed, shift, shimmy and shape DR programs and dynamic pricing tariffs, to provide reliable and cost-effective load flexibility to the grid.

The project objectives are:

- Develop an advanced, integrated, open-source control system to cost-effectively provide energy optimization and load flexibility to heat pumps in small and medium commercial buildings (SMC).
- Verify that HP-Flex integrated in SMC buildings can meet the following criteria:
    1) Achieve a 20% reduction in site peak energy costs compared to an SMC heat pump with scheduled thermostatic control.
    2) Provide 50% load shed during summer or winter peak-load events.
    3) Provide 20 kWh of daily load shift capacity for a typical SMC building during the shoulder seasons.
    4) Provide "shimmy" services equivalent to 10% continuous response of average baseline load.
    5) Enable 25% of the baseline load to respond to dynamic prices to shape daily load profile in summer and winter.
    6) Meet a payback time of 2 years.
- Integrate and control a thermal energy storage system with a SMC heat pump.
- Develop educational curricula to train engineers and technicians on the design, installation, and maintenance of load-flexible HP systems.

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 being co-funded by the SCE Emerging Markets and Technologies and Emerging Technologies program and is supplementary to work at LBNL funded by the CEC Electric Program Investment Charge.

Results/Status

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

Next Steps

LBNL and SCE have ongoing coordination on the following activities/deliverables expected to occur throughout Q1-Q2 2023: the development, technical reviews, and testing of Model Predictive Control algorithms; presentations/sync-ups; associated memos and M&V plans; and selection of 3 or more field test sites in SCE service territory.