



Hawai'i Natural Energy Institute Research Highlights

Grid Integration

Hawai'i Virtual Power Plant (Hi-VPP) Demonstration

OBJECTIVE AND SIGNIFICANCE: The project aims to develop, evaluate, and demonstrate the performance of novel algorithms to optimize the charge/discharge of shared fleet vehicles for energy cost minimization. Project experience and results will not only advance energy research but also inform the university's consideration of options such as the electrification of fleet vehicles, advanced car share applications, integration of distributed energy resources on campus, and the optimal management of campus energy use and cost containment.

BACKGROUND: Upon the successful conclusion of the JUMPSmart Maui (JSM) smart grid project funded by the New Energy and Industrial Technology Development Organization (NEDO) of Japan, HNEI negotiated an Equipment Transfer Agreement, through which HNEI acquired from NEDO significant grid assets deployed in the JSM project. HNEI GridSTART capitalized on this acquisition by utilizing the Sunverge Solar Integration System (SIS) BESS + PV units located at Haleakala Solar's business office to conduct this VPP project.



Figure 1. Sunverge SIS BESS + PV units.

PROJECT STATUS/RESULTS: HNEI GridSTART developed optimization algorithms that integrate building energy load and rooftop solar power generation forecasts. This system optimizes charging and discharging schedules of BESS units, thereby reducing electricity costs for building owners while meeting utility-initiated demand response requirements. A methodology was created to evaluate potential benefits of customer participation in Hawaiian Electric Company's VPP program, which uses an incentive-based demand response scheme. Figure 2 illustrates the system overview.

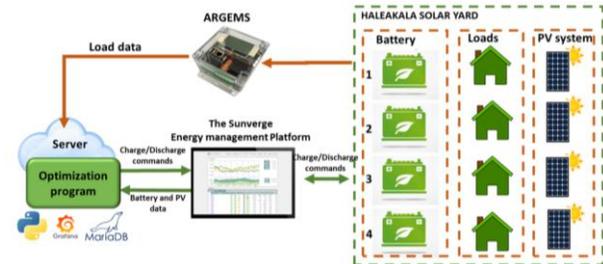


Figure 2. System overview.

Additionally, a web-based dashboard (Figure 3) was developed for real-time monitoring and data collection of SIS BESS+PV units.



Figure 3. Web-based dashboard interface.

Using collected real-time data, HNEI GridSTART tested the optimization algorithms for two scenarios: participation in the VPP program and non-participation. Results indicated that customers benefit from reduced electricity costs when participating in the incentivized VPP program with BESS optimization, compared to BESS optimization cases without VPP program participation.

The integrated tool, comprised of the optimization system, methodology, and dashboard, illustrates the financial incentives and aids customer decision-making regarding VPP participation. The project has also contributed to academic literature, resulting in two published conference proceedings papers. Following the project's field operational completion, HNEI GridSTART completed equipment decommissioning, removal, and reporting in the subsequent months.

Funding Source: Office of Naval Research

Contact: Leon Roose, lroose@hawaii.edu

Last Updated: May 2025