



Hawai'i Natural Energy Institute Research Highlights

Grid Integration

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

OBJECTIVE AND SIGNIFICANCE: HNEI's Grid System Technologies Advanced Research Team (GridSTART) has developed the Hawai'i Virtual Power Plant Demonstration Project (Hi-VPP). Its primary goal is to assess the economic value and operational effectiveness of customer-sited battery and solar (BESS+PV) resources, where these resources can simultaneously serve both the customer's interests and needs of the grid when aggregated as part of a virtual power plant (VPP). The significance of this initiative lies in its potential to reduce customer electricity costs while enhancing grid operator demand response capabilities, providing valuable insights into the effectiveness of incentive-based VPP programs.

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 on Maui.

PROJECT STATUS/RESULTS: HNEI 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.

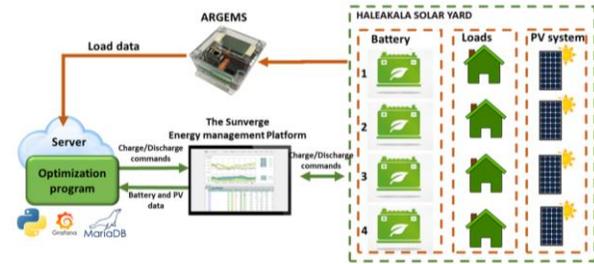


Figure 2. System overview of the VPP program.

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 in August 2024, HNEI aims to expedite the finalization of equipment decommissioning, removal, and reporting in the subsequent months.

Funding Source: Office of Naval Research

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Last Updated: November 2024