



Hawai'i Natural Energy Institute Research Highlights

Energy Efficiency & Transportation

Bi-Directional EV Charging Demonstration Project

OBJECTIVE AND SIGNIFICANCE: The main objective of this demonstration project is to develop and evaluate the performance of novel algorithms to optimize the charge/discharge of shared fleet vehicles. Project experience and results will inform University consideration of options such as the electrification of fleet vehicles, advanced car share applications, integration of distributed renewable energy resources on campus, and the optimal management of campus energy use and cost containment.

BACKGROUND: HNEI is collaborating with Hitachi Limited and IKS Co., Ltd. on a technology development, test, and demonstration project to install two bi-directional electric vehicle (EV) chargers (Hybrid-PCS on the campus of the University of Hawai'i at Mānoa, at two designated parking stalls indicated by the red rectangle in Figure 1, located adjacent to the Bachman Annex 6 building indicated by the orange rectangle in Figure 1.



Figure 1. Location of bi-directional EV chargers.

The new control algorithms will ensure that the shared vehicles are efficiently assigned and readily available for transport needs, while providing ancillary power and energy services by virtue of charging or use of the stored energy in the vehicle batteries to benefit both the customer (UH Mānoa) and possibly the operational needs of the local grid operator (Hawaiian Electric).

The two EVs will be used by designated university personnel through a limited-user pool car sharing system via a smart phone/web-based application made available to the drivers. The EVs are planned to replace the present use of two existing UH gasoline-powered vehicles for the duration of this multi-year demonstration.

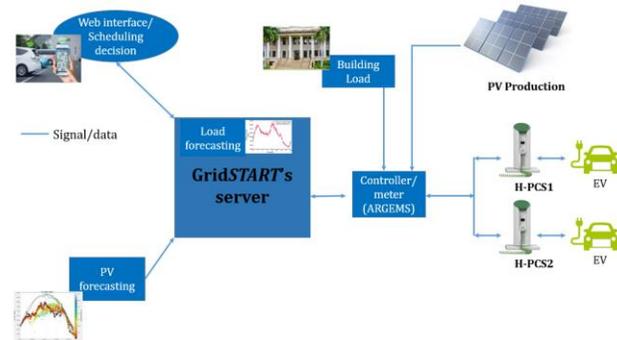


Figure 2. Functional system diagram.

This project is being conducted by HNEI's GridSTART team. The team is developing a web-based software suite for EV drivers to sign-out the cars for use and will design, code, and integrate software to optimize charge/discharge schedules for the EVs, balancing transport needs and power/energy benefits for the University (e.g., time-of use tariff rates, building load shaping, smart EV charging, etc.), and possibly grid ancillary services. The Hybrid-PCS can also incorporate solar PV power as a source of energy for EV charging. The optimization software will incorporate in-house developed state-of-the-art solar forecasts and maximization of solar energy as the preferred source for EV charging.

PROJECT STATUS/RESULTS: An EV has been purchased and HNEI has taken delivery of the first Hybrid-PCS for the project. Engineering design drawings for charger installation are complete. The procurement of construction services and equipment needed to install the bi-directional EV chargers on campus is underway. EV charge/discharge control algorithms and EV car scheduling software is under development, along with plans for hardware-in-the-loop testing of controls and communications. Delivery of the second Hybrid-PCS is expected in February 2021, with project installation and go-live to follow.

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