



# Hawai'i Natural Energy Institute Research Highlights

## Alternative Fuels

### NELHA Hydrogen Station

**OBJECTIVE AND SIGNIFICANCE:** The overall objective of the project has been to evaluate the technical and financial performance and durability of the hydrogen production and dispensing station equipment, and support a fleet of hydrogen Fuel Cell Electric Buses (FCEB) operated by the County of Hawai'i Mass Transit Agency (MTA).

**BACKGROUND:** Under a series of awards, HNEI developed and commissioned a 65 kg/day hydrogen production and dispensing station at the Natural Energy Laboratory Hawai'i Authority (NELHA) on the Island of Hawai'i (Figure 1). The system was designed to dispense hydrogen at 350 bar (5,000 psi) to support refueling of heavy duty fuel cell electric buses (FCEB) intended for public service.

The knowledge gained in this project was intended to inform the MTA on benefits and issues associated with transitioning from a diesel bus fleet to a zero emissions FCEB fleet in support of the County of Hawai'i's clean transportation goals.

**PROJECT STATUS/RESULTS:** In 2021, HNEI commissioned a 65 kg/day hydrogen production and dispensing station at NELHA. The station uses a Proton Onsite (now Nel) electrolyzer to produce hydrogen at an outlet pressure of 30 bar (440) psi with a HydroPak compressor to compress the hydrogen to 450 bar (6,600 psi). The first on-site fill of an electric-fuel cell hybrid bus (FCEV) for public transportation took place on March 24, 2022.

The hydrogen dispensing system is connected to a fueling trailer via an underground hydrogen piping distribution system. The hydrogen dispenser is fully automated and programmed to "fail safe" for unattended operation.

The station includes a power monitoring system, which can monitor and control station operations by interfacing with the NELHA supervisory control and data acquisition (SCADA) system which monitors the NELHA microgrid and solar electric inputs. The total power consumption of the hydrogen system including the electrolyzer, compressor, and balance of plant is ~210 to 240 kW when operating at the maximum production rate of 65 kg/day (2.73 kg/hr). This corresponds to approximately 78-88 kwh/kg of compressed hydrogen.



Figure 2. Concept map of hydrogen distribution.

As illustrated in Figure 2, the concept was to produce fuel cell grade hydrogen at NELHA and deliver it to the MTA base yard in Hilo to support heavy-duty

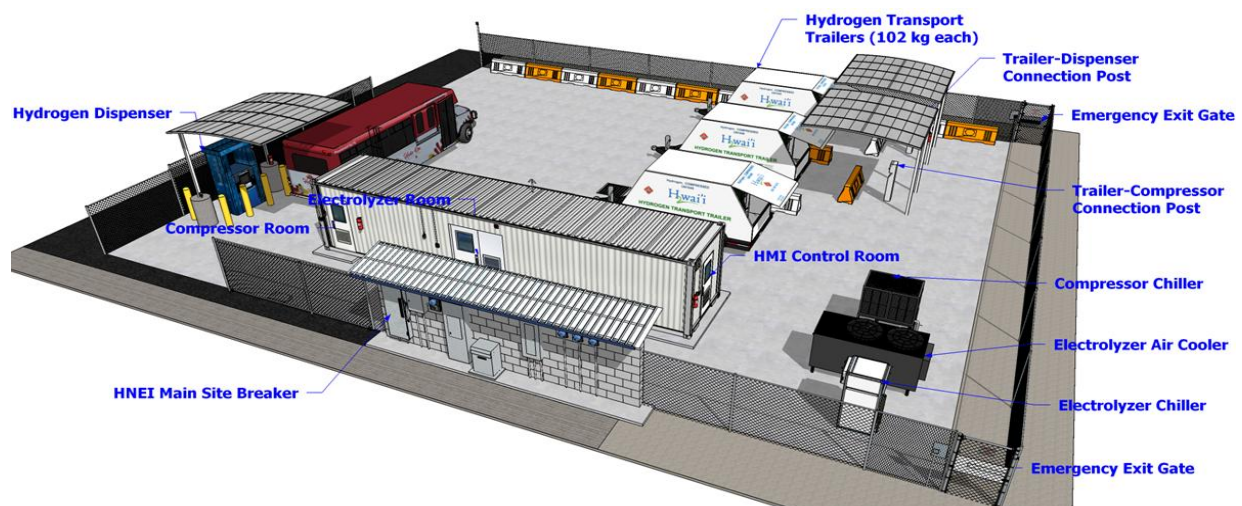


Figure 1. A diagram of the main components of the HNEI NELHA hydrogen station.

FCEBs operated by the MTA Hele-On public bus service. Three hydrogen transport trailers (HTT) each with a capacity of 105 kg were procured for transporting hydrogen between the production and fueling site.

In addition to technical demonstration, the station has supported community engagement and education of hydrogen technologies, such as the “Meet the Bus” community engagement event and educational tours.

The Hele-On 21-passenger FCEB (Bus #111) (Figure 3) was previously purchased with funds from the Energy Systems Development Special Fund. This bus, manufactured by Eldorado National, and converted to a hydrogen-electric drive train by U.S. Hybrid, is ADA-compliant.



Figure 3. The Hele-On 21-passenger FCEB.

Onboard hydrogen is stored in composite lightweight carbon fiber cylinders located under the bus with a capacity of 19 kg. The fuel cell power system is integrated with two 11 kWh (total 22 kWh) LG Lithium-ion battery packs to provide motive power to a 200 kW electric drive system. At cruising speed, the fuel cell maintains the battery state of charge within an optimal range to preserve performance and extend battery life.

Within the last year, the fuel cell power system was upgraded by replacing the original 30 kW Hydrogenics fuel cell with a new state-of-the-art 40 kW U.S. Hybrid fuel cell. Data on bus and fuel cell performance has been collected and is being analyzed.

Work on this project has also produced three peer-reviewed publications:

- 2023, A. Ku, et al., [Opportunities for the materials research community to support the development of the H2 economy](#), MRS Energy & Sustainability, Vol. 10, Issue 2, pp. 158-173.

- 2020, M. Virji, et al., [Analyses of hydrogen energy system as a grid management tool for the Hawaiian Isles](#), International Journal of Hydrogen Energy, Vol. 45, Issue 15, pp. 8052-8066.
- 2020, A. Headley, et al., [Valuation and cost reduction of behind-the-meter hydrogen production in Hawai'i](#), MRS Energy & Sustainability, Vol. 7, Paper E26.

Negotiations are currently underway to transfer ownership of the station to NELHA, a state agency under the Department of Business, Economic Development and Tourism (DBEDT). Transition of assets, along with ongoing operations and maintenance, are currently being addressed between HNEI and NELHA.

*Funding Sources:* U.S. Department of Energy; Office of Naval Research; NELHA; U.S. Hybrid; State of Hawai'i Hydrogen Fund; County of Hawai'i; Energy Systems Development Special Fund

*Contact:* Richard Rocheleau, [rochelea@hawaii.edu](mailto:rochelea@hawaii.edu); Aaron McCall, [apmccall@hawaii.edu](mailto:apmccall@hawaii.edu)

*Last Updated:* November 2025