HNEI HYDROGEN PRODUCTION AND FUELING STATION AT NELHA



The Hawaii Natural Energy Institute Hydrogen Station is Located in the Hawaii Ocean Science & Technology (HOST) park at the Natural Energy Laboratories of Hawaii Authority (NELHA), south-west of the Ellison Onizuka Kona International Airport at Keahole Point on the Big Island of Hawaii. The station is expected to be fully operational in 2019.



HYDROGEN STATION OVERVIEW

The HNEI-NELHA hydrogen production and fueling station provides touch screen user interfaces, manual override capabilities for station maintenance personnel, data logging and an automated email feature for sending reports and fault messages. Station design is by HNEI and Powertech Labs Inc.

Hydrogen is produced on site by a Proton OnSite (now dba. NEL Hydrogen) C30 electrolyzer using Proton Exchange Membrane aka. Polymer Electrolyte Membrane (PEM) electrolysis to convert water in an electrochemical reaction into hydrogen and oxygen using electrical energy from the HELCO grid and filtered county water. The C30 electrolyzer can produce up to 65 kg of gaseous hydrogen per day at 99.999% purity.

Renewable sources of energy in HOST Park such as Ocean Thermal Energy Conversion (OTEC) and solar power help to offset the energy used to produce the hydrogen on site.

The electrolysis of water at the HNEI NELHA hydrogen station uses approximately 65 kWh of electricity per kg of gaseous hydrogen produced, and approximately 2.6 gallons of water per kg of H_2 . 1 kg of gaseous hydrogen has approximately the same energy content as 1 gallon of liquid diesel fuel, but fuel cell vehicles typically have about twice the efficiency of internal combustion engine (ICE) vehicles.

After the hydrogen is produced through PEM electrolysis, it is compressed to 450 Bar (atmospheric pressure is 1 Bar at sea level), and is stored in mobile hydrogen transport trailers that can hold 102 kg of hydrogen each. These tube trailers are used as mobile hydrogen storage, and can be hauled to other sites on the island of Hawaii with dispensing capabilities. A hazmat certified hauling company will be responsible for tube trailer delivery between NELHA and off-site fueling operations.

The hydrogen tube trailers interface with the 450 Bar Hydro-Pac compressor and 350 Bar hydrogen dispenser via connection posts. Manual connections and control valves are operated by qualified HNEI personnel. Programmable logic controllers ensure safe automated operations through temperature and pressure sensing as well as gas detection sensors.



MAJOR STATION COMPONENTS

Hydrogen is Produced on Site Through Water Electrolysis Then Compressed to 450 Bar and Stored in Mobile Hydrogen Tube Trailers



Proton Onsite C30 Electrolyzer

Hydro-Pac 450 Bar Compressor

Powertech/HNEI Mobile Hydrogen Tube Trailer

The HNEI NELHA hydrogen station includes the following components:

- Generation and compression container which includes the Hydro-Pac 450 Bar compressor, Proton Exchange Membrane (PEM) electrolyzer and electrical/control room.
- Three 450 bar mobile tube trailers, each composed of 12 Type 3 DOT composite storage cylinders. Each trailer can hold up to 102 kg of hydrogen compressed to 450 Bar.
- Hydrogen dispenser composed of a 350 bar nozzle assembly, programmable logic controller (PLC), and human-machine interface (HMI) screen with personalized pins for station users.
- Cooling systems, including an electrolyzer chiller, electrolyzer air cooler, and compressor chiller.
- Two connection posts used to connect the generation and compression container to the tube trailers, and connect the tube trailer to the dispensers.



Tube Trailer Interface Connection Post

Powertech 350 Bar Hydrogen Dispenser





US-Hybrid Hele-On Fuel Cell Shuttle Bus to be Operated by Hawaii County

Hydrogen that is produced at the HNEI-NELHA hydrogen station will be used by hybrid hydrogen-electric fuel cell vehicles that use 350 Bar hydrogen for electromotive drive. The first vehicle that will be supported by the station is a 29 passenger US-Hybrid ADA compatible Hele-On fuel cell shuttle bus based on a Ford F550 Cabin manufactured by Eldorado National Co. and converted to hydrogen-electric drivetrain by US-Hybrid. The Hele-On shuttle bus will be operated by the County of Hawaii.

The fuel cell shuttle bus incorporates an electric drive system with plug-in battery charging customized to the vehicle configuration of the Ford F550-Eldorado Bus.

Two (2) 14 kW-hr Lithium-ion (Li-ion) battery packs provide power to a 200 kW electric drive system during acceleration and cruise with the electric motor generating power back into the battery during deceleration and braking (regenerative braking).

A Fuel cell system composed of a US-Hybrid 40kW PEM hydrogen fuel cell and type III composite hydrogen tanks holding up to 20kg of gaseous hydrogen compressed to 350 Bar acts as a range extender, keeping the battery charged when the bus is in use. The bus has a range of approximately 200 miles (25 miles on the battery alone).



Hybrid Shuttle Bus Component Overview

Additionally, a power export system has been added to the bus to enable the bus to provide 110/220VAC electric power for various uses such as support for civil defense operations during environmental disaster events. The power export system is capable of producing 10kW of continuous power for up to 30 hours with 20kg of hydrogen.



Fuel Cell Power Export Unit