

Hydrogen – What will it take in Hawaii?

Mitch Ewan

Hydrogen Systems Program Manager

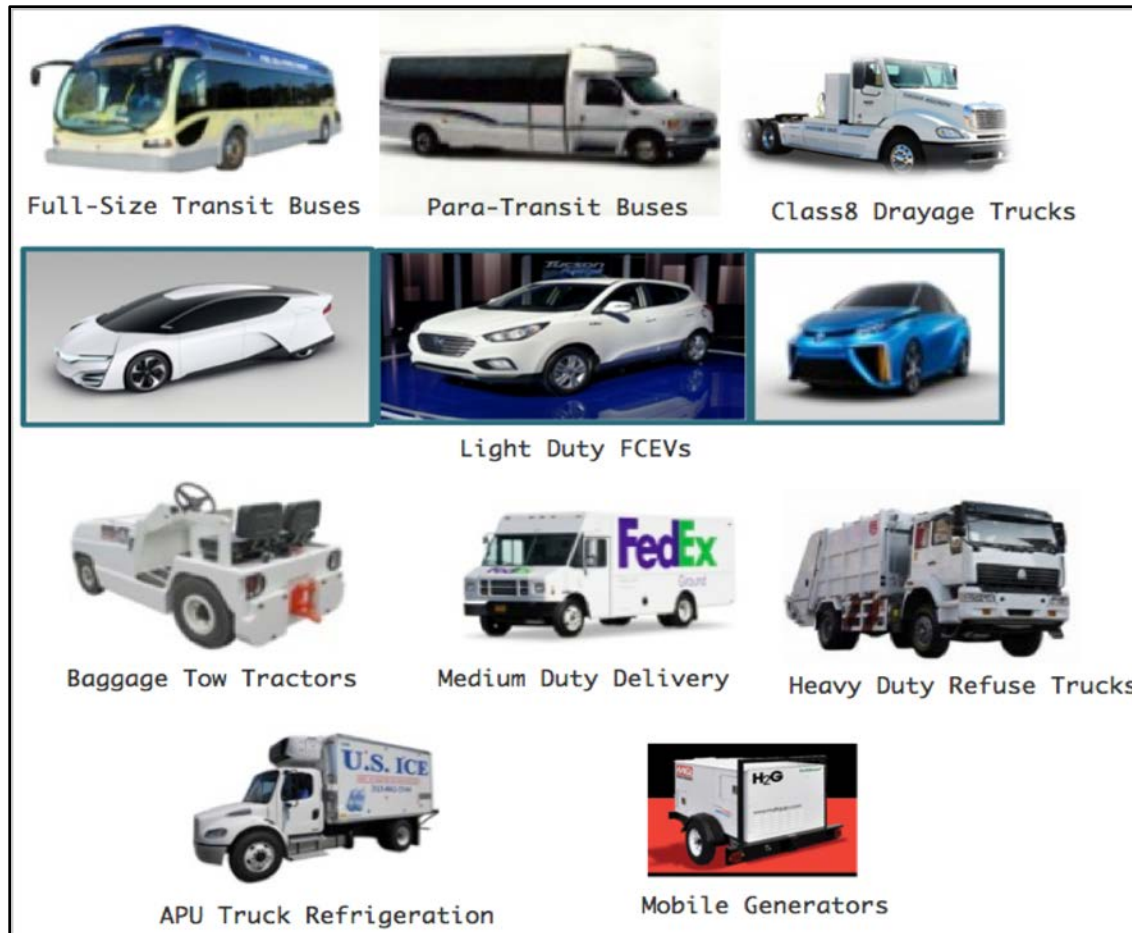
Hawaii Natural Energy Institute

School of Ocean Earth Science and Technology

University of Hawaii at Manoa

30 October 2018

Fuel Cell Electric Vehicles have Arrived



Automotive industry has made big advances in FC vehicle technology

Why Hydrogen in Hawaii?

- ✓ **Potential to displace imported fossil fuels for transportation;**
- ✓ **Can be manufactured using any of Hawaii indigenous renewable energy resources;**
- ✓ **Energy security for Hawaii;**
- ✓ **Retains money in Hawaii which is good for the economy and jobs.**

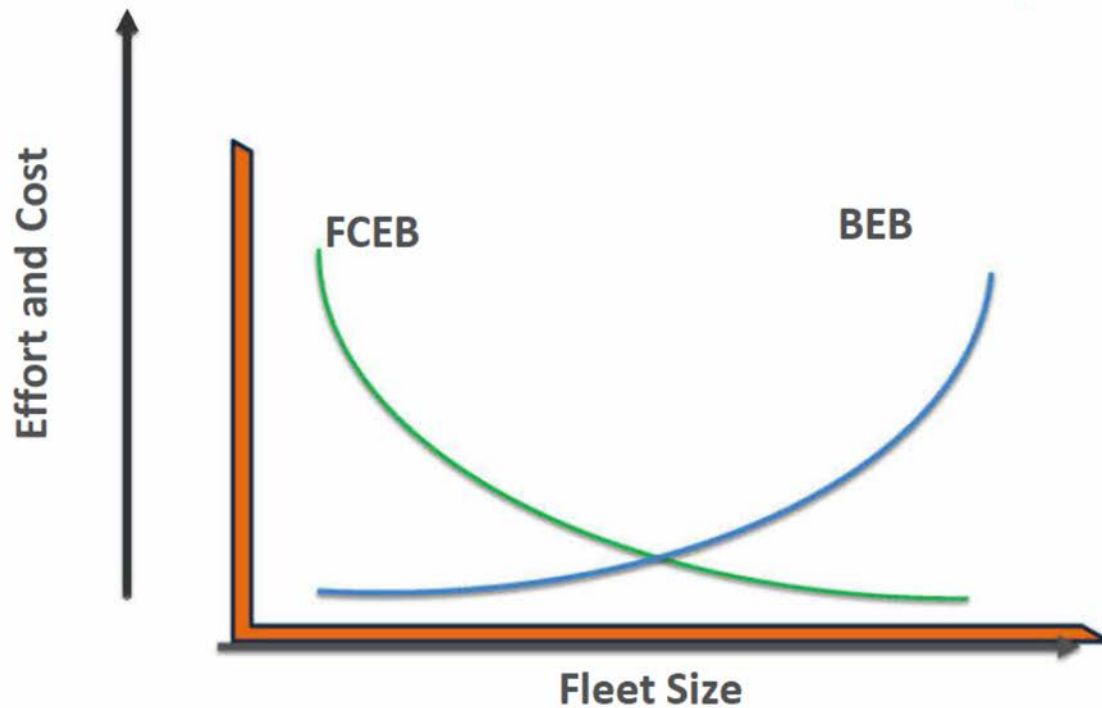
Strategic Focus for Hawaii

- ✓ **Demonstrate cost effective infrastructure to produce, distribute, and dispense hydrogen;**
- ✓ **Focus on fleet vehicles starting with public transportation & county trucks;**
 - **Central fueling - 30 kg per day per bus;**
 - **Public benefit - tax dollars support public transportation needs;**
- ✓ **Industry will take care of the vehicles;**
- ✓ **Support early heavy users of hydrogen to develop a hydrogen market;**
- ✓ **Private industry will take over infrastructure when it sees it can make money.**

The Challenge for 100% ZEB Deployment



Infrastructure and Scalability



PROJECTS



Projects Need to be Strategic

- **Need to demonstrate the economic viability and benefits of the technology.**
- **Will not get private investment until the numbers work out relative to other options.**

HNEI Fuel Cell/Hydrogen Research

- ***HI Sustainable Energy Research Facility (HISERF) (ONR, USDOE, HECO, NASA, Industry)***
 - Testing fuel cell and battery systems for manned and unmanned vehicles;
 - Development of advanced air filtration for FC operations in harsh environments.
- ***Marine Corps Base Hawaii Dual Pressure “Fast-Fill” H₂ Fueling Station (USDOE, ONR)***
 - Basis for design of public stations;
 - Unattended operation, 400 fills since Nov 2014.
- ***Hydrogen Energy Systems for Grid Management (USDOE, ONR, SOHI, Industry)***
 - Demonstrate the use of electrolyzers to mitigate the impacts of intermittent renewable energy;
 - Evaluate effect of multiple revenue streams on overall hydrogen costs.
- ***Grid Analysis – Integration of renewables into HI grid systems***



Fuel Cell Electric Buses for the Big Island



County of Hawaii Bus (1)
29 Pass, 200 miles



HAVO Bus (2)
19 Pass. 100 miles

- **Fuel Cell Electric Shuttle Buses demonstrate to the general public the advantages of fuel cell buses and electric drive.**
 - **Quiet ride;**
 - **No diesel fumes;**
 - **Potential for lower O&M costs;**
 - **An experience for thousands of people.**

Option: 10kW Export Power Unit



- ✓ Power a critical load in a civil defense emergency.
- ✓ Can deliver 10kW for 32 hours
- ✓ AC Output: 110/220 VAC 60 Hz
- ✓ Stand alone operation
- ✓ Efficiency: 94%
- ✓ Refill hydrogen tank in 15 minutes another 30 hours.

NELHA Hydrogen Plant



- 65 kg/day, 275 kW PEM electrolyzer/compressor production system housed in 40 foot ISO container;
- 3 hydrogen transport trailers;
- 350 bar dispenser fuels HELE-ON 25-passenger shuttle bus;
- Powered from HELCO grid ~ 50 to 83% renewable energy;
- Automated system for unattended operation;
- Remote monitoring.

NELHA Hydrogen Dispenser



Education & Social Acceptance

- **Transitioning from limited use by trained workforces to public use will require a balancing of existing regulations;**
- **The use of hydrogen as an energy carrier is a relatively new concept and may be vulnerable to erroneous public perceptions;**
- **Education is essential and must provide information on safety as well as emphasizing the environmental advantages of hydrogen as a fuel.**