

VII.5 Hawaii Hydrogen Power Park

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Contract Number: DE-FC51-02R021399 A008

Project Start Date: June 29, 2009

Project End Date: December 31, 2014

Fiscal Year (FY) 2012 Objectives

Island of Hawaii (Big Island)

- Install hydrogen fueling station infrastructure at Hawaii Volcanoes (HAVO) National Park on the Big Island of Hawaii
- Support the operations of the HAVO hydrogen fuel cell electric vehicle (FCEV) shuttle buses through December 2014
- Conduct engineering and economic analysis of HAVO bus operations on different routes, grades, elevations and climatic conditions
- Validate fuel cell system performance in harsh environments including high SO₂ concentrations
- Position HAVO as an alternative fuel vehicle test bed for the National Park Service (NPS)
- Attract new partners and applications for the Big Island hydrogen infrastructure
- Conduct outreach to local authorities and the general public regarding hydrogen infrastructure

Oahu

- Support operations of the General Motors Equinox FCEV Hawaii demonstration project in partnership with Office of Naval Research (ONR)

- Install a 350-bar Powertech fast-fill hydrogen production, storage, and dispensing system at Marine Corps Base Hawaii (MCB Hawaii)
- Upgrade the Powertech fueling system to support fast-fill fueling at 700 bar (ONR funded)
- Procure and operate a lightweight hydrogen delivery trailer to support fueling requirements
- Conduct engineering and economic analysis of GM FCEV fueling operations

Barriers

This project addresses non-technical issues that prevent full commercialization of fuel cells and hydrogen infrastructure as indicated in the following sections of the April 2009 edition (amended in 2011) of the Fuel Cell Technologies (FCT) Program Multi-Year Research, Development and Demonstration Plan:

Technology Validation, Section 3.6.5

- (A) Lack of Fuel Cell Vehicle Performance and Durability Data
- (C) Hydrogen Storage
- (D) Lack of Hydrogen Refueling Infrastructure Performance and Availability Data
- (E) Codes and Standards
- (G) Hydrogen from Renewable Resources

Hydrogen Safety, Section 3.8.4

- (A) Limited Historical Database
- (D) Liability Issues
- (F) Safety is Not Always Treated as a Continuous Process
- (G) Expense of Data Collection and Maintenance
- (H) Lack of Hydrogen Knowledge by Authorities Having Jurisdiction
- (I) Lack of Hydrogen Training Facilities for Emergency Responders

Technical Targets

No specific technical targets have been set.

FY 2012 Accomplishments

- Re-scoped project to support the GM Hawaii Equinox FCEV rollout at MCB Hawaii
- Developed several legal agreements among project partners to address liability issues:

- HAVO
- Kilauea Military Camp
- MCB Hawaii
- Initiated actions to relocate Powertech integrated hydrogen production and dispensing system to MCB Hawaii on Oahu
- Initiated actions to upgrade Powertech station to 700-bar fast-fill to support GM Equinox FCEV fueling requirements
- Developed infrastructure design for MCB Hawaii hydrogen fueling station
- Selected contractor to install fueling infrastructure at MCB Hawaii
- Secured additional \$400k in state funding for MCB Hawaii infrastructure
- Purchased hydrogen delivery tube trailer for use on Oahu



Introduction

This project addresses barriers to the widespread deployment of hydrogen vehicles through the deployment of hydrogen infrastructure including 700-bar “fast-fill” and novel cascade non-compressor fueling systems. The Power Park project scope was expanded in 2011 to support collaboration between DOE and the Department of Defense that includes installation of higher capacity hydrogen infrastructure at the Puna Geothermal facility on the Island of Hawaii (see Hydrogen Systems as a Grid Management Tool) and Office of Naval Research/General Motors FCEV demonstration project at Marine Corps Base Hawaii on Oahu. The project will support the operations of the HAVO hydrogen FCEV shuttle buses through to December 2014 and in particular validate fuel cell system performance in a harsh environment including high SO₂ levels.

Approach

- Leverage DOE/Naval Research Laboratory 65-kg/day geothermal-to-hydrogen grid management project to supply HAVO hydrogen requirements
- Leverage ONR investment (\$1.8 million) in GM vehicles to be operated from MCB Hawaii and other Department of Defense sites on Oahu
- Leverage National Park Service, State of Hawaii investment, ONR in FCEV shuttle buses (NPS \$1 million + State of Hawaii \$300k + ONR \$500k) at HAVO
- Develop and demonstrate SO₂ mitigation technologies and operational techniques to manage impact of high SO₂ on proton exchange membrane fuel cell performance and durability at HAVO

- Install Powertech fueling station at MCB Hawaii on Oahu to support GM Equinox FCEV project
- Use hydrogen produced at Puna Geothermal under DOE/NRL hydrogen grid management project to fuel HAVO buses using high pressure tube trailers and cascade non-compressor dispensing technology
- Collaborate with existing data analysis groups to compare system data under different operating conditions (fueling stations and vehicles)
- Evaluate the effect of different grades, climatic zones, air quality conditions including SO₂ on vehicle performance
- Engage the DOE Hydrogen Safety Panel to support hydrogen safety including equipment installation, project hydrogen safety plans, outreach to the authorities having jurisdiction, and first responder training
- Transfer results to industry and government agencies

Results

- Re-scoped project to support the GM Hawaii Equinox FCEV rollout at MCB Hawaii
- Developing several MOAs among project partners:
 - HAVO
 - Kilauea Military Camp
 - MCB
- Issued purchase order to upgrade Powertech station to 700-bar fast-fill
- Developed infrastructure design for MCB Hawaii
- Selected contractor to install infrastructure at MCB Hawaii
- Secured additional \$400k in state funding and \$600k in ONR funding for MCB Hawaii infrastructure and station upgrades
- Purchased hydrogen delivery tube trailer for use on Oahu
- Installing dual 350/700 bar hydrogen dispenser at MCB Hawaii

Conclusions and Future Directions

Oahu

- Execute remaining memorandums of agreement with project partners
- Install Powertech 350-bar system at MCB Hawaii
- Install Powertech 700-bar “fast-fill” system at MCB Hawaii

Island of Hawaii

- Install hydrogen 350-bar non-compressor dispensing system at HAVO

- Purchase tube trailer to deliver hydrogen from Puna Geothermal to HAVO - deliver geothermal hydrogen to HAVO with tube trailer;
- Support HAVO FCEV bus operations
- Collect and analyze fueling station and vehicle data
- Seek opportunities for expansion of fleets and/or additional hydrogen infrastructure

A major project challenge to the timely deployment of hydrogen infrastructure and equipment necessary to conduct operations has been the amount of time required to develop legal agreements to address liability issues. This is approaching two years in this project. This in turn has required our requesting no-cost extensions to extend the project to meet operational test duration requirements. This represents a large investment in outreach and education of all parties concerned including the legal profession, risk managers, first responders, and authorities having jurisdiction. Hopefully follow-on projects will not take so long.

FY 2012 Publications/Presentations

1. R. Rocheleau and M. Ewan, "The Hawaii Hydrogen Power Park," *US DOE Annual Merit Review*, Washington, D.C., May 2012.