VII.12 Hydrogen Fueling Infrastructure Research and Station Technology

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Project Start Date: March 2014
Project End Date: Project continuation and direction determined annually by DOE

Overall Objectives

- Reduce the installation cost of hydrogen fueling stations to be competitive with conventional liquid fuel stations
- Improve the availability, reliability, and cost while ensuring the safety of high-pressure components
- Focus a flexible and responsive set of technical experts and facilities to help solve today's urgent challenges and the unpredicted needs
- Enable distributed generation of renewable hydrogen in a broader energy ecosystem

Fiscal Year (FY) 2014 Objectives

- Establish relationship structure between Hydrogen Fueling Infrastructure Research and Station Technology (H2FIRST) and hydrogen fueling station technology stakeholders (e.g., industry, state agencies)
- Coordinate capabilities between NREL and SNL for effective application in R&D activities
- Commence work on reference station design activity to show trade-offs between component selection and design by identifying gaps and generating example designs through industry feedback and modeling
- In cooperation with technology stakeholders, form project teams focused on high-priority technical needs with aim of initiating R&D activities

Technical Barriers

This project addresses the following technical barriers from the Technology Validation section of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:

(C) Hydrogen Storage

(D) Lack of Hydrogen Refueling Infrastructure Performance and Availability Data

(E) Codes and Standards

This project addresses the following technical barriers from the Hydrogen Delivery section of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:

(B) Reliability and Costs of Gaseous Hydrogen Compression

(K) Safety, Codes, and Standards, Permitting

This project addresses the following technical barriers from the Hydrogen Safety, Codes, and Standards section of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:

(A) Safety Data and Information: Limited Access and Availability

(C) Safety is Not Always Treated as a Continuous Process

(G) Insufficient Technical Data to Revise Standards

Contribution to Achievement of DOE Delivery, Technology Validation, and Safety, Codes and Standards Milestones

This project will contribute to achievement of the following DOE milestones from the Technology Validation and Safety, Codes and Standards sections of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:

- Technology Validation Milestone 3.2: Validate novel hydrogen compression technologies or systems capable of >200 kg/day that could lead to more cost-effective and scalable (up to 500 kg/day) fueling station solutions for motive applications. (4Q, 2014)
- Technology Validation Milestone 3.4: Validate station compression technology provided by delivery team. (4Q, 2018)
- Technology Validation Milestone 4.4: Complete evaluation of 700-bar fast fill fueling stations and compare to SAE J2601 specifications and DOE fueling targets. (3Q, 2016)
- Safety, Codes and Standards Milestone 2.19: Validate inherently safe design for hydrogen fueling infrastructure. (4Q, 2019)

- Safety, Codes and Standards Milestone 3.3: Reduce the time required to qualify materials, components, and systems by 50%, relative to 2011) with optimized test method development. (1Q, 2017)
- Hydrogen Delivery Milestone 2.8: By 2015, reduce the cost of hydrogen delivery from the point of production to the point of use for emerging regional consumer and fleet vehicle markets to <$4/gge. (4Q, 2015)

FY 2014 Accomplishments

- Designed and released a request for quotation for the procurement of a hydrogen station equipment performance (HyStEP) testing device.
- Simulated over 100 station concepts through the H2A Refueling Station Analysis Model. The station parameters included design capacity, peak performance, number of hoses, fill configuration, and hydrogen delivery method. The simulation output includes fuel cost, capital cost, and return on investment and is used to support the future work of selecting and fully defining 3–5 reference stations.
- Gathered information to support draft requirements for an in-line hydrogen contaminant detector. Environmental requirements (e.g. temperature, pressure, and location) and contaminant requirements (e.g. likely contaminants from production techniques, process upsets, and maintenance activities) are considered.
- Established H2FIRST Coordination Panel, populated from the H2USA Hydrogen Fueling Station Working Group, to:
  - Provide industry perspective on R&D needs to support hydrogen infrastructure growth
  - Perform bi-yearly reviews of the H2FIRST project progress and impact
  - Identify potential project partners
  - Participate as project partners
  - Providing feedback to H2FIRST principal investigators on the impact of H2FIRST projects relative to H2FIRST goals and objectives
- Coordinated expertise and capabilities at the National Renewable Energy Laboratory and Sandia National Laboratories through a Memorandum of Understanding between the two institutions to address the technology challenges related to hydrogen refueling stations.
- Identified high-priority and near-term technical activities and formed project teams with industry and state agencies to support them. Formed five initial project activities and teams that included:
  - Station Acceptance: accelerate station acceptance by developing, validating, and implementing test methods and hardware for capacity and performance testing of commercial hydrogen stations
  - Research Dispenser: reduce cost and improve reliability through component and fueling technique enhancements
  - Reference Stations: improve station components and design by identifying gaps and generating example designs through industry feedback and modeling
  - Technical Assistance: provide a flexible, responsive set of technical experts and facilities to solve urgent/unexpected challenges for hydrogen stations
  - Hydrogen Contaminant Detector: develop a cost effective, deployable, inline fuel quality system that can be installed at stations to prevent damage to fuel cell vehicles

Future Directions

- In reference station task, establish peer reviewed designs for three to five station types
- Initiate at least one R&D task from each identified priority area Station Acceptance, Research Dispenser, and Hydrogen Contaminant Detector teams
- Foster active collaboration between H2FIRST and other DOE projects
- Convene H2FIRST Coordination Panel at Fuel Cell Seminar (November 2014) to review H2FIRST tasks, provide feedback, and identify additional high-priority technical needs
- Complete the final validation of the HyStEP device prior to pre-deployment testing at a commercial station

Special Recognitions & Awards/Patents Issued

1. Jennifer Kurtz, DOE Hydrogen and Fuel Cells Program Awards, Technology Validation, 2014.

2. Brian Somerday and Chris San Marchi, DOE Hydrogen and Fuel Cells Program Awards, Hydrogen Delivery and Safety, Codes and Standards, 2014.