

## VIII.C.4 California Hydrogen Infrastructure Project\*

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*\*Congressionally directed project*

### **Objectives**

Air Products will conduct a comprehensive, California-based, multi-year hydrogen infrastructure demonstration project to develop and demonstrate strategically located fueling stations. The final infrastructure for the proposed project is expected to include flexible modes of supply: pipeline-supplied hydrogen, delivered liquid and gas. The primary objective will be to demonstrate a model of a “real-world” retail hydrogen infrastructure and acquire sufficient data within the project to assess the feasibility of achieving DOE’s infrastructure goals.

### **Approach**

Air Products will lead this project and will focus on supplying hydrogen infrastructure for the advancement of a national hydrogen economy. The project will be performed with support from several automobile manufacturers, South Coast Air Quality Management District, and energy companies. The project will open its stations to authorized users undertaking demonstration programs in conjunction with the federal, state and local governments to promote widespread demonstration of hydrogen infrastructure. For station usage, the U.S. fuel cell vehicle OEMs have expressed interest in fueling at selected stations to meet their individual DOE fuel cell program needs. Automakers Honda, Nissan, and Toyota have agreed to provide a sufficient number of fuel-cell vehicles to the project at no expense. Automaker BMW will also provide vehicles at no expense, operating with hydrogen internal combustion engines (H<sub>2</sub>-ICE) and onboard liquid hydrogen storage to allow the project to demonstrate yet another important infrastructure component – liquid hydrogen refueling. Under this project’s umbrella, each of these auto companies, whose vehicles will be used for the infrastructure demonstration, will be allowed to obtain access to the infrastructure for hydrogen fueling purposes. This umbrella effort is intended to aggregate distinctly different fuel-cell vehicle platforms at common stations to simulate an infrastructure embodying “real-world” fueling, as opposed, for example, to the dedicated fueling of fleets by a single manufacturer. By encompassing a variety of vehicles, customer profiles, and fueling experiences, this proposed infrastructure project will obtain a picture of real market needs. These various infrastructure concepts are as follows:

- *Hydrogen Fueling Stations*: A fully automated system consisting of stand-alone compression, gaseous storage, and dispenser skids with an integrated control system. These stations have the flexibility to accept a variety of hydrogen supply options such as pipeline, on-site generation, delivered liquid, or delivered gas. In addition, the Hydrogen Fueling Stations are fully skidded, and their modular design facilitates future expansions without losing station availability. For example, these stations can easily be upgraded to high-pressure dispensing by adding compression modules.
- *Hydrogen Fuelers* consist of a fully automated and integrated gaseous storage and dispensing system that sits on a wheeled trailer. The Hydrogen Fueler is a totally self-contained unit that is DOT compliant and does not require any utility connections. As a result, the Hydrogen Fuelers are portable and can easily be relocated. Hydrogen Fuelers can be filled at hydrogen production sites that have high-pressure compression capabilities.
- *Hydrogen Based Units (HBUs)* consist of an innovative automated system for storing and dispensing hydrogen. The HBUs are being designed to be used specifically in conjunction with a new liquid-gaseous hydrogen delivery concept that will also be developed as part of this project.

## **Project Tasks**

The following includes summaries of the tasks to be performed as part of this project.

### Task 1: Torrance, Calif. Pipeline Hydrogen Fueling Station

Air Products owns and operates 17 miles of hydrogen pipeline located in the highly industrial, commercial, and residential districts of the Torrance and Wilmington areas of metropolitan Los Angeles. The excess hydrogen currently available on this pipeline can provide a reliable supply of lowest cost hydrogen for fueling stations or fuel cell power plants. The only one of its kind in North America in an urban area, this pipeline can serve as a baseline station to fuel tens of thousands of hydrogen vehicles in and around the city and prove the economic potential for hydrogen in a congested area. The pipeline is currently fed by 2 large steam methane reformer plants capable of reliably delivering 800 psi hydrogen. In this task, Air Products will design, construct and operate a Hydrogen Fueling Station on its pipeline at a site in Torrance, California to provide hydrogen for a variety of fuel cell vehicles supplied to the Project by a variety of auto companies. Other third party sites will be evaluated for acceptability and compliance, in addition to the greenfield site already available. These sites may result in added project costs to all parties due to piping tie-ins, rights of way, and safety considerations for existing facilities. This station will be used as a model baseline to validate infrastructure performance, cost, reliability, maintenance, environmental impacts, and to develop a better understanding of the emerging vehicle and fueling infrastructure requirements.

### Task 2: Hydrogen Fuelers in LA Area and Installation of Hydrogen Fueler Refill Capability in Northern California

As more hydrogen vehicles become available, the Project plan is to consider growing infrastructure capability beyond the pipeline baseline station in Torrance to pave the way for the eventual rollout of a regional hydrogen infrastructure in California and to extend the driving range of hydrogen vehicles in the region. In order to accomplish this in the most cost-effective manner, while providing consumers with a real-life fueling experience to increase market acceptance, the expansion will involve multiple retail fueling station sites selected in both southern and northern California, where portable Hydrogen Fuelers will be located. Up to 4 sites owned by ConocoPhillips, Shell and others to be determined, will be chosen based upon vehicle availability and customer use patterns within the LA area. The fourth site will be justified based on vehicle availability and customer use patterns while giving consideration to the National Program and the corresponding vehicle providers. Upon justification of the vehicle traffic, the fourth site will be appropriately chosen and a Hydrogen Fueler placed at that site. The chosen sites will be publicly visible for maximum outreach and education potential, early concentration will be in southern California. The team will seek to provide direct driving access from the LA basin to the Las Vegas station by evaluating the appropriate number

and location of fuelers to place along I-15 (Barstow /Baker) based on vehicle traffic and vehicle range. Considerations for providing permanent stations will be made for installations outside the scope of this Project. In addition, this task will include installation of a refilling station to provide the capability for filling Hydrogen Fuelers in northern California. This new site will complement the already existing site at Air Products' Wilmington Plant in southern California to make gaseous hydrogen readily available for dispensing from Hydrogen Fuelers statewide.

#### Task 3: Upgrades to Existing Hydrogen Fueling Stations

To meet the regional demand for hydrogen infrastructure as vehicle demand grows while preserving the existing hydrogen infrastructure in the region, this task will serve to leverage and upgrade several existing Hydrogen Fueling Stations already located in southern California and Nevada. This upgrade will create an incentive for drivers to utilize hydrogen vehicles within the region in a mode consistent with current gasoline vehicle use, thus obtaining realistic infrastructure data and station utilization. In addition to the OEM's that are directly part of this effort, other OEM's will be encouraged to utilize the stations for maximum data acquisition and capital deployment benefit. The Hydrogen Fueling Station being constructed at the National Fuel Cell Research Center in Irvine, California will be used as part of this proposed Project and will be upgraded to dispense 700 bar hydrogen and provide a major fueling location for the Project in Orange County. Also, as part of this task of the Project, the DOE Nevada distributed energy station, located in Las Vegas, NV, will be considered for upgrades to provide 700 bar fueling and to supply liquid hydrogen fueling capability. Other sites will be considered as well for these upgrades. A review of the final location of these capabilities will be completed with the DOE. If sufficient vehicle demand warrants, Air Products will evaluate the economics of restarting the existing steam methane reformer at the site.

#### Task 4: Tahoe Hydrogen Based Units (HBU) with Novel Liquid-Gas Delivery System

One of the principal objectives of this Project is to demonstrate the viability of lower cost hydrogen and low-cost larger station deployment. A principal objective of this task is to establish at least 2 sites for hydrogen refueling in northern California using a new concept, the Hydrogen Based Unit (HBU), as defined earlier. One unit will be located at or near Lake Tahoe, California to test the effect of cold climate on both vehicle and infrastructure performance, and a second site will be selected somewhere between Tahoe and Sacramento to provide an interstate range for hydrogen vehicles driving between northern California (Sacramento and Bay Area) and Tahoe. The HBU will be similar to the Hydrogen Fuelers in that it will be self contained; however, it will be larger and more extensive in capabilities. The HBU is intended as a stationary system, which is to be fueled by a new liquid delivery concept, as a demonstration of the bridge to a final infrastructure.

#### Task 5: Life Cycle Assessment of Hydrogen Infrastructure and Fuel Cell Vehicle Technologies

Within this Project, the evolution of a new hydrogen infrastructure and its enabling technologies allows a special opportunity for the application of a life cycle assessment in order to guide the evolution of the hydrogen economy and avoid pathways that could lead to less than satisfactory results.

#### Task 6: Infrastructure Data Collection, Analysis and Delivery

Air Products will establish and implement the necessary IT programming and equipment to enable data collection at the refueling sites by deploying its eRAM data collection system for the Project.

### **Accomplishments**

This project is newly initiated and no there are no accomplishments to report to date.