

Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown, PA 18195-1501
Telephone (610) 481-4911

20 June 2012

California Energy Commission
Hydrogen and Transportation, Docket 12-HYD-1

**Subject: Submittal by Air Products and Chemicals, Inc. in support of 22 June 2012 workshop
“Approaches for Selecting Locations for the Hydrogen Infrastructure Network”**

California Energy Commission

**DOCKETED
12-HYD-01**

TN # 65887

JUN 20 2012

Please find attached the slides that will be presented by Air Products at the 22 June 2012 workshop.

Air Products, the leading global supplier of hydrogen for the production of cleaner burning transportation fuels, has unique experience in the hydrogen fueling industry. These varied fueling applications provide an opportunity to assess consumer experiences, evaluate product performance and advance product improvements. The company has placed over 150 hydrogen fueling stations in the United States and 19 countries worldwide using multiple delivered and onsite generated supply platforms. In addition to the light-duty fueling market and its current requirement for H70 (700 bar) fueling, Air Products has deployed low-cost fueling stations serving applications at H35 (350 bar) pressure levels, including trucks, vans, buses, scooters, forklifts, locomotives, planes, drones, cell towers, material handling equipment, and even submarines. Use of the company’s technology is increasing and is approximately 400,000 hydrogen fills per year and, in certain market applications, fueling rates at several individual sites of over 50,000 refills per year are occurring.

Extensive work and demonstration have been performed regarding key early markets for the sale of light-duty fuel cell electric vehicles and the supply of hydrogen to these markets over the last 10 years by various governmental, academic and NGO’s. Air Products urges CEC to use the learnings from these efforts in support of the concepts behind identification of and supply to station clusters. In addition, from the perspective of the provider of hydrogen fueling infrastructure, several major factors need to be considered by the Commission in its approach for siting these early stations:

- In order to achieve sufficient information to develop the business case for hydrogen fueling infrastructure, fewer than 20 stations, if properly placed, are required within a single region (such as southern California) which can be served by a common mode hydrogen production, distribution, and maintenance services.
- The production of hydrogen constitutes more than half of the cost of the hydrogen infrastructure for fuel cell electric vehicles; existing production systems should be utilized in early station investment.
- The early market for fuel cell electric vehicles is better served at this stage by greater coverage of stations within a given region as opposed to larger or redundant stations serving a single community.
- Selected fueling station technologies should be modular and expandable, and minimize footprint to use existing retail gasoline forecourt locations, which significantly lowers the initial cost of infrastructure.

We look forward to continuing to work with the Commission as it develops plans for additional investment in hydrogen fueling infrastructure under the AB118 program.

Selecting Locations for Hydrogen Infrastructure

Presentation by

Edward C. Heydorn

Business Development Manager

Presentation to the CA Energy Commission

June 22, 2012

1



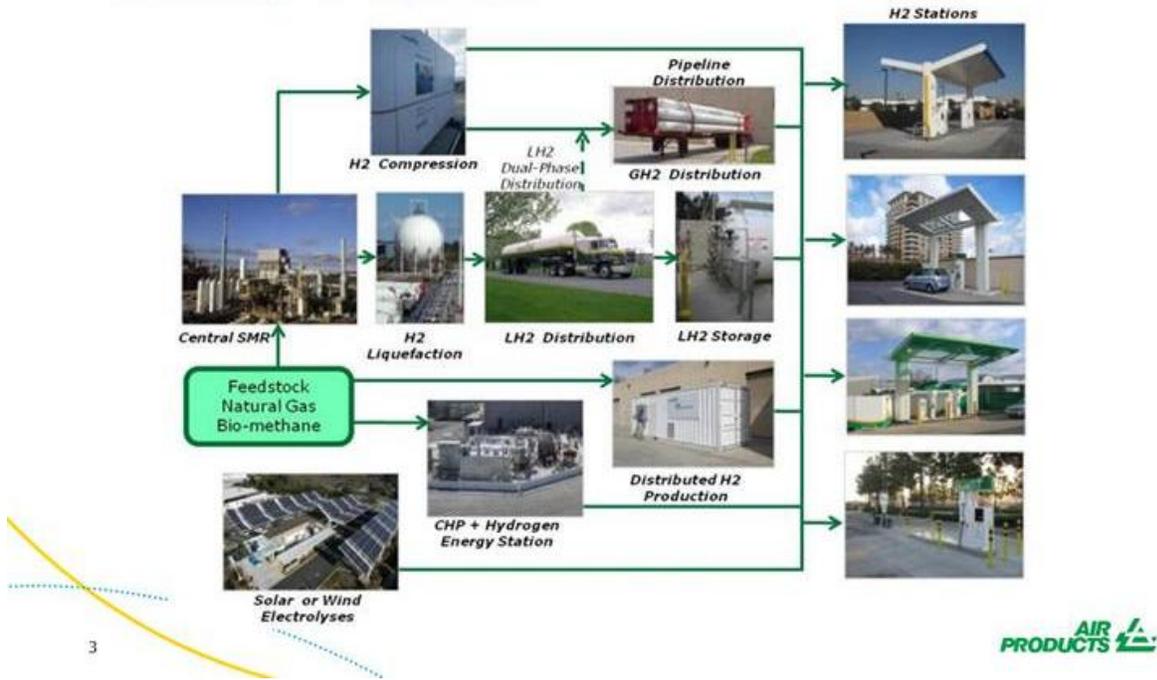
Agenda

1. Supply Chain Options for Hydrogen Fueling Stations
2. Optimal Siting for Hydrogen Fueling Stations
3. Design of Solicitation for Hydrogen Fueling Stations

2



Supply Chain Options for Hydrogen Fueling Stations



Definition of Terms Related to Siting of Hydrogen Fueling Stations

- Infrastructure is supported in specific regions which consist of one or more clusters and is served by a common mode of:
 - supply,
 - distribution, and
 - maintenance services
- A single region (for example, southern California) with a number of clusters (concentrated early market communities) can provide sufficient information to allow for rollout of infrastructure to follow-on areas
- Connector stations enable travel outside clusters and regions, can be the starting point for a future cluster and require time to achieve a self-sustaining business case
- Destination stations are located outside of a region and will have little to no fuel sales volume for a significant period of time

Key Criteria for Selection of Hydrogen Fueling Stations

- Rely on experience from past (1) programs and (2) analysis as basis for technology selection
- Sources of Information:
 - US Dept. of Energy (DOE) Technology Validation Program
 - Recommendations of the Expert Panel of Hydrogen and Fuel Cell Technology Advisory Committee (HTAC)
 - National Academy of Sciences study
 - National Petroleum Council - Future Transportation Fuels study
- The above resources indicate the need to take advantage of existing infrastructure (production, distribution) to reduce cost barrier and be competitive to gasoline
- Commercially viable and mass deployable today!

5



Critical Elements for Initial Station Rollout

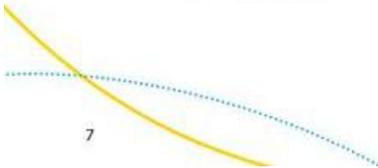
- Need best information on sales potential of fuel cell electric vehicles to select location for fueling stations
 - Automakers have best information on early adopter markets via market research and sales history. Their participation is vital.
 - Commercial station success is completely dependent on OEM ability to sell vehicles in large numbers and where.
- Need to consider cost of infrastructure investment in making decisions on number of clusters and communities within clusters
 - "Build-it and they will come" is not a viable business proposition
 - A major statewide initial build out is not a prudent investment
 - Prove the fueling business case within a single region for sustainable success
 - Operating support is needed for stations with throughput below the point where self-sustaining economics take over
 - Site stations where earliest markets are expected
 - Investments in secondary markets and destination locations should be deferred without guaranteed loading or long-term financial support

6



Optimization of Hydrogen Fueling Network

- Models from UC Irvine and UC Davis provide assessment on driving habits which help identify early fueling needs within key early clusters
 - Important to complete coverage within a single region first before considering addition of either second region or capacity/redundancy within any cluster
 - Consider model results in selecting between stations within community (consideration of proximity to freeway or to residential areas)
 - Expandable stations can provide early market coverage, follow demand growth with time, and limit initial investment



7



Design of Future Hydrogen Infrastructure Solicitations

- Perform more rigorous assessment of station technology offerings
 - Consider experience base beyond light-duty vehicle fueling (automakers, warehouses, bus, military.....) on a worldwide basis as to capabilities, and solicit input from these station users
 - Number of fueling events as a barometer vs. number of stations executed (some stations are built with few if any vehicles)
- Consistent interpretation of renewable hydrogen content
- Seek applicants that engage with key stakeholders and drive change in the deployment of hydrogen



8



Thank you...
tell me more



9

AIR 
PRODUCTS