



Clean Fuels Program Advisory Group Meeting

Stationary

Hydrogen and Natural Gas Stations

September 30, 2011



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AQMD Support for H2 Infrastructure

• Original five cities	\$1,916,000
• Five cities contract extension	\$1,079,000
• Burbank O&M*	\$ 200,000
• Torrance Pipeline	\$ 489,051
• Fountain Valley	\$ 750,000
• UCI support	\$1,063,400
• CEC Awards to APCI	\$1,000,000
• Diamond Bar station	<u>\$1,107,000</u>
• TOTAL	\$7,604,451

* (also \$300k from CARB & \$360k from DOE)

Stationary and Mobile Fuel Cells

- California Fuel Cell Partnership
- CA Stationary Fuel Cell Collaborative
- Bridge to transportation and renewable feedstock



Courtesy of FCE and APCI



AQMD Hydrogen Station

- AQMD hydrogen fueling needs have increased with vehicle growth
- 24 kg/day current capacity
- 150 kg/day new station capacity
- 350 and 700 bar
- AQMD RFP



Fountain Valley Project

- Orange County Sanitation District
- Use digester gas as feedstock
- Molten Carbonate Fuel Cell
 - Produces electricity, hydrogen
 - Waste heat is recovered
- Hydrogen is dispensed from a refueling station for fuel cell powered vehicles
- 100% renewable source of energy and hydrogen
 - 100 kg/day of hydrogen
- \$750,000 AQMD cost; \$8.7 million total project cost



Other AQMD Funded Hydrogen Stations

- Burbank
- California State University, Los Angeles
- University of California, Los Angeles
- November 2010 CEC award
- December 2010 AQMD \$1 million Board approval
- Linde, Laguna Nigel \$250k in cost-share



Hydrogen Vehicle Demonstrations

Fuel Cell Vehicle Demonstrations

- Light-Duty
 - Projects completed
 - Honda FCX, DaimlerChrysler F Cell, Toyota Highlander FCHV, Chevy Equinox
 - Projects in progress
 - Honda FCX Clarity
- Heavy-Duty
 - Sunline Transit American Fuel Cell Bus
 - ISE and New Flyer Industries
 - Sunline Transit AT Fuel Cell Bus
 - BAE Systems and El Dorado



Retail Stations Still Needed



Shell Newport Beach



Shell Hydrogen — Santa Monica



CalState LA



Mebtahi-Chevron, Harbor City

Station Costs

Projected High-Volume Cost of Hydrogen (Dispensed)—Status

(\$/gallon gasoline equivalent [gge], untaxed)

NEAR TERM:

Distributed Production

- ▲ Natural Gas Reforming
- ▲ Ethanol Reforming
- ▲ Electrolysis

Low-volume (200 kg/day)

- ▲ Steam Methane Reforming
- ▲ H₂ from Combined Heat, Hydrogen, and Power Fuel Cell

LONGER TERM:

Centralized Production

- Biomass Gasification
- Central Wind Electrolysis
- Coal Gasification with Sequestration
- Nuclear

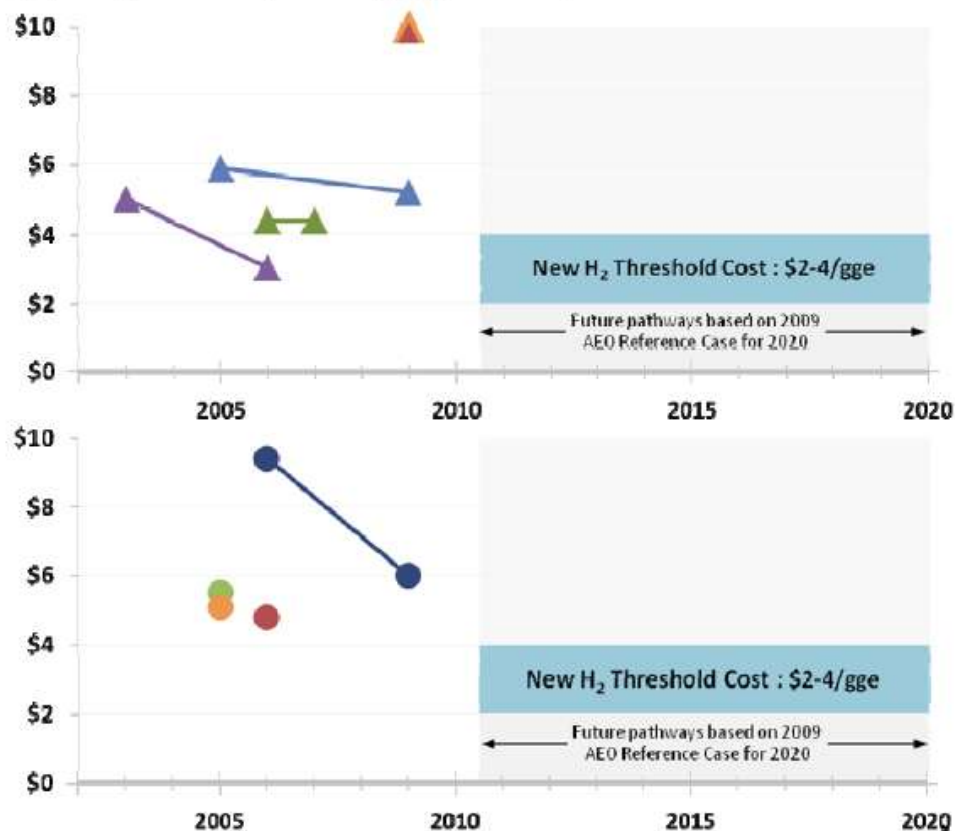


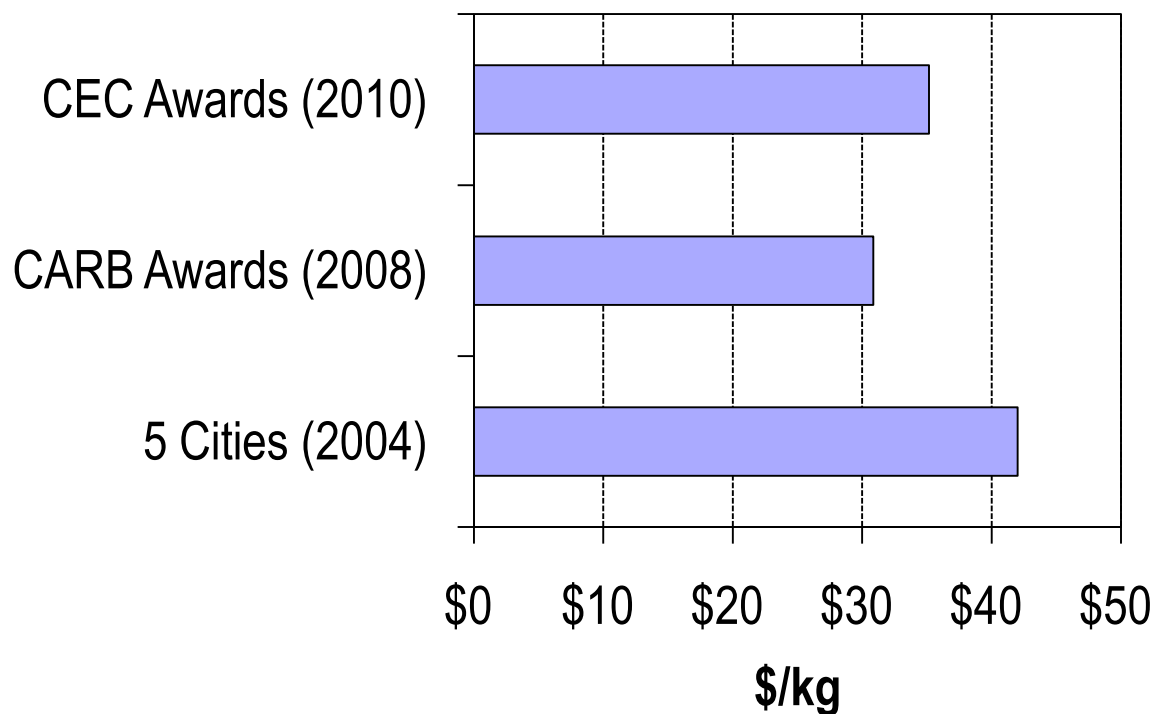
Figure 2.1. Hydrogen Production Cost Status and Targets. Significant progress has already been made in several hydrogen production pathways. Distributed cost status and targets assume station capacities of 1,500 kg/day, with 500 stations built per year. Status and targets for centralized production assume the following capacities: biomass gasification—155,000 to 194,000 kg/day; central wind electrolysis—50,000 kg/day; coal gasification—308,000 kg/day; nuclear—768,000 kg/day; and solar high-temperature thermochemical—100,000 kg/day.



CA Station Costs

Highly variable depending on

- Technology
- Renewables
- Capacity
- Number
- Production vs. Delivery



Hydrogen Vehicle and Infrastructure Summary

- Southern California is primary market
- Infrastructure and vehicles must be deployed together
- Early deployments highly dependent on government support (no business case)
- Infrastructure is critical for early success and further deployments
- Need to re-engage Federal government



CNG Station Upgrades for Schools

School	Award
Placentia - Yorba Linda USD	\$60,000
West Covina USD	<u>\$60,000</u>
Total	\$120,000



CEC AB 118 Alternative and Renewable Fuel and Vehicle Technology Program Awards

AWARDEE	CEC FUNDING	COST SHARE
Clean Energy Hollywood 76 Station	\$200,000	\$345,000
Clean Energy Los Angeles Coliseum	\$200,000	\$600,000
Clean Energy City of Torrance	\$200,000	\$626,000
Clean Energy Ware Disposal	\$200,000	\$730,000
Clean Energy Montebello	\$200,000	\$1,575,803
Clean Energy Otay Mesa	\$448,135	\$1,042,315
City of Corona	\$200,000	\$200,000
Tilden-Coil Constructors, Inc.	\$200,000	\$200,000
Rainbow Disposal	\$200,000	\$200,000
Border Valley Trading/Hayday Farms	\$251,865	\$252,135
Waste Management	\$300,000	\$1,288,100
TOTAL	\$2,600,000	\$7,059,353

