California Hydrogen Infrastructure Project

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Air Products and Chemicals, Inc.

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Project ID
#TV007

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Overview

Timeline

- Start – Aug. 2005
- End – Dec. 2010
- 85% Complete

Barriers

- Cost of delivered hydrogen

Budget

- Total project funding
  - DOE $5.5 million share
  - Contractor $5.4 million share
- Funding received in FY09: $0
- Funding for FY10: $0

Partners

Various collaborators and funding groups including:

- South Coast AQMD
- OEM's
- UC Irvine
- Energy Companies
- FuelCell Energy, Inc.

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Objectives - Relevance

- Demonstrate a cost effective infrastructure model in California for possible nationwide implementation
  - Design, construct and operate five hydrogen fueling stations
  - Collect and Report Infrastructure Data
  - Document permitting requirements and experiences
  - Validate expected performance, cost, reliability, maintenance, and environmental impacts
- Implement a variety of new technologies with the objective of lowering costs of delivered hydrogen

Approach

- Work with OEM's to determine vehicle usage needs and general station equipment requirements
- Work with OEM's and others to determine preferred locations/areas for fueling station deployment
- Select potential Station Operators and work to locate suitable sites
- Initiate and complete required agreements, determine and address specific site issues including liability, billing, etc.
- Complete detailed Station Design, permits, installation, operation, and maintenance of stations
- Collect and report Infrastructure Data to the DOE once stations put online
- Monitor and collect feedback which can be incorporated to improve station user's fueling experience

Project Tasks

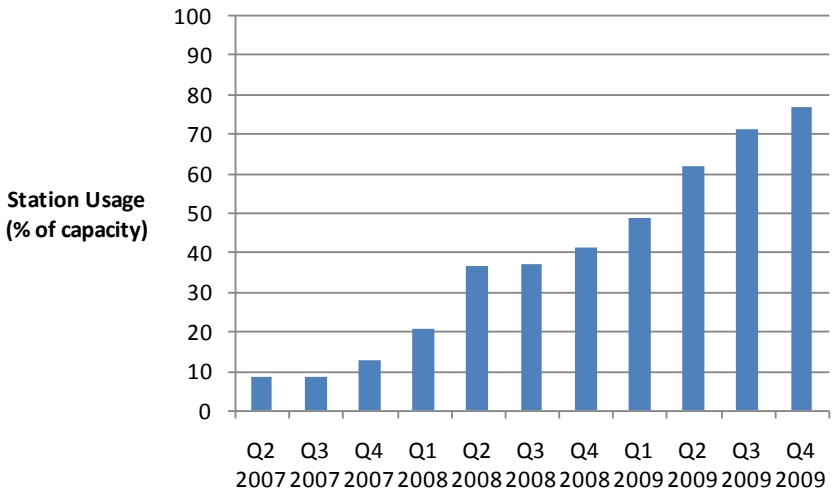
- **Station Installation**
  - **UCI Fueling Station**
  - **Torrance Pipeline Fueling Station**
  - **Northern California Mobile Fueler (HF-150)**
  - **Fountain Valley Renewable Station**
  - Long Beach Mobile Fueler (HF-150)
- New Delivery Concept (NDC)
- Infrastructure Data Acquisition, Analysis and Delivery (includes eRAM)
- Hydrogen Infrastructure Study (UC Irvine)

University of California, Irvine

UCI 350/700 Bar Station

- 25 kg/day capacity, liquid hydrogen supply
- Actual demand higher, regularly approaching 50 kg/day
- 350 and 700 bar fueling capability
- Excellent operating performance
- Station usage doubled over past year
- UCI recently applied for local funding to expand 700 bar fueling system (storage, cooling)

The UC Irvine Fueling Station operated by the National Fuel Cell Research Center (NFCRC)
photo by Lorin Humphries.



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Torrance Pipeline

Torrance Pipeline Station

- 48 kg/day capacity, pipeline hydrogen supply
- 350 and 700 bar fueling capability
- Greenfield station, retail-like design
- Station construction began February 2010
- Anticipated onstream mid-2010
- Expandable with additional compression to 96 kg/day

- Funding support by Shell Hydrogen and South Coast Air Quality Management District

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Northern California HF-150

Placerville Station

- Gaseous hydrogen supply
- 350 bar fueling capability
- Host site: U.S. Forest Service, Eldorado National Forest
- Installed March 2010
- Planned 6 month deployment
- Seeking second 6 month operation in South Lake Tahoe area
- Funding support by Nissan

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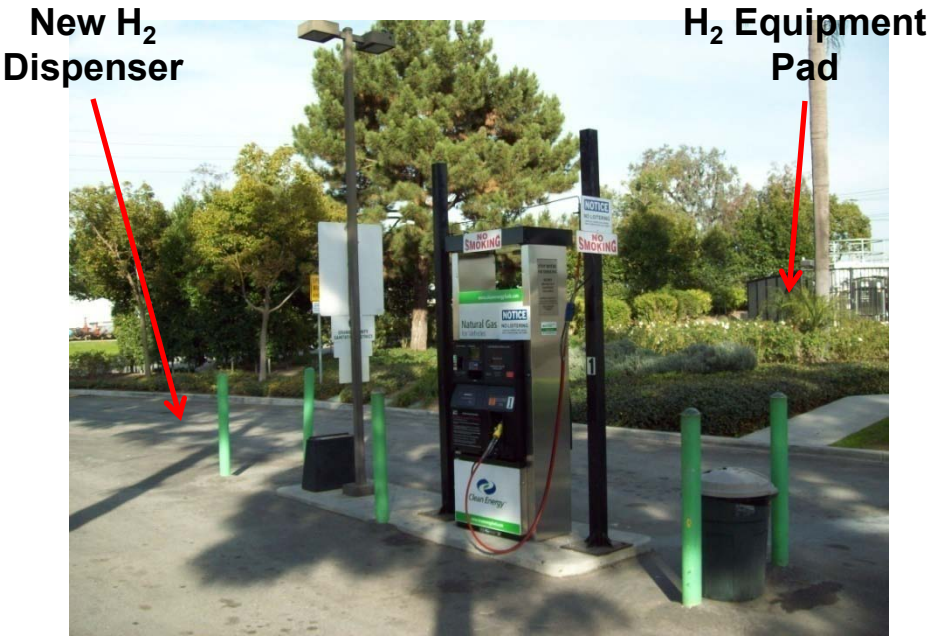
Fountain Valley Renewable Hydrogen

Fountain Valley Station

- 100 kg/day capacity
- 350 and 700 bar fueling capability
- Host site: Orange County Sanitation District
- Co-located with existing CNG dispenser
- Renewable hydrogen production using Hydrogen Energy Station
- Scope includes design/procurement of ADG fuel treatment system



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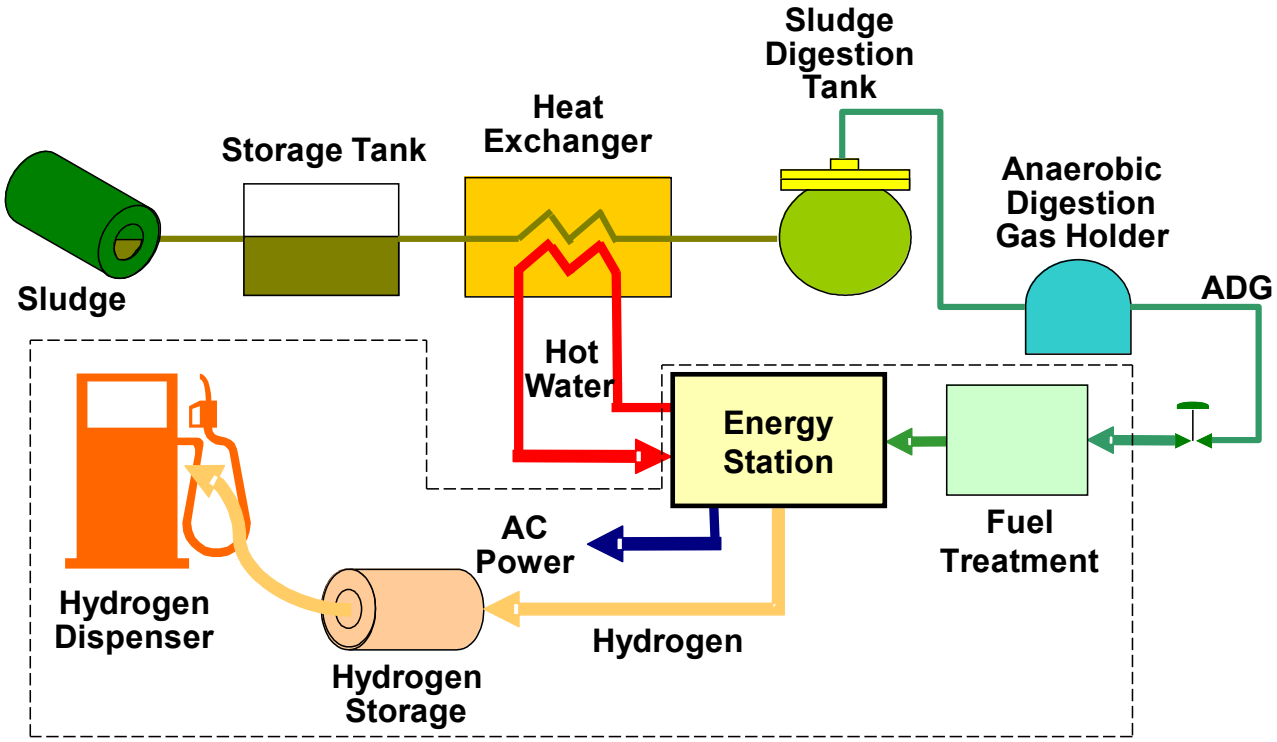
Hydrogen Energy Station



- Technology developed under second DOE Cooperative Agreement (No. DE-FC36-01GO11087)
- Overall project selected for funding by California Air Resources Board and South Coast Air Quality Management District
- Anticipated onstream Summer 2010

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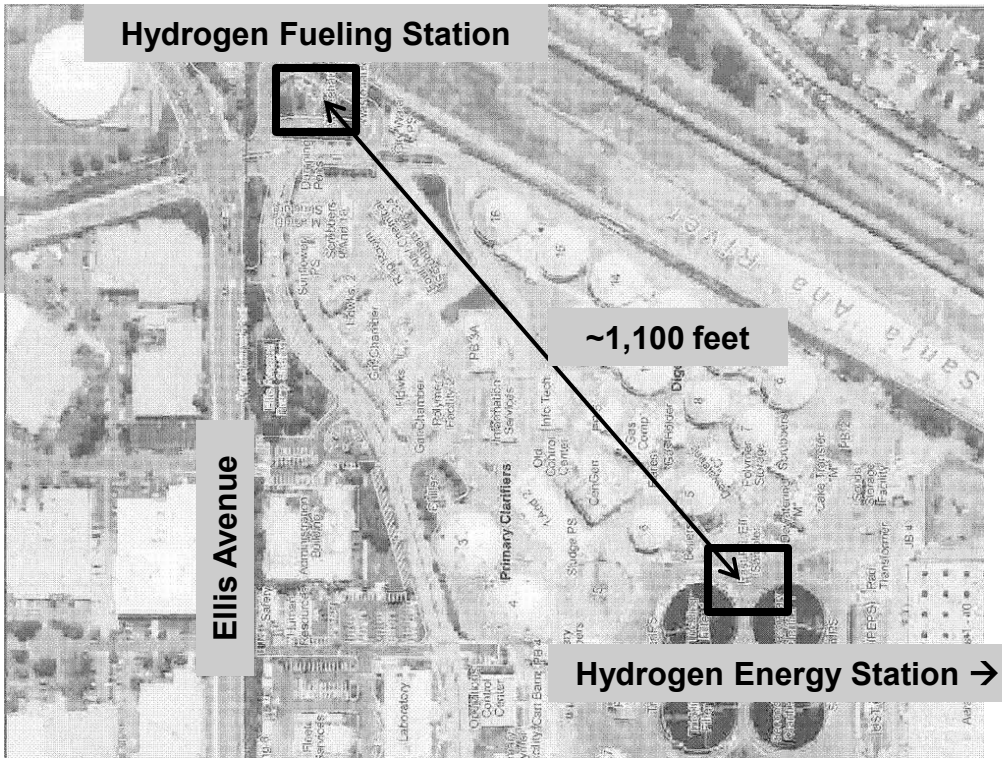
Orange County Sanitation District Site



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Collaboration

- University of California, Irvine
  - Host site and operator, UCI Fueling Station
  - Operations support and data analysis, Fountain Valley Renewable Station
  - Subcontractor: Life Cycle Assessment (LCA) of Hydrogen Infrastructure and Fuel Cell Vehicle Technologies (2008 co-presenter at AMR)
    - Develop a methodology to analyze the integration of technologies in a hydrogen infrastructure with respect to criteria pollutant emissions, GHG emissions, energy consumption, and water consumption.
    - Develop hydrogen infrastructure scenarios with a high level of geographic detail and utilize the capabilities of the Computational Environmental Sciences Laboratory at the University of California, Irvine to simulate the air quality impacts.

Future Work

- UCI Fueling Station – Continue operation
- Torrance Pipeline Fueling Station – Commission both 350 and 700 bar systems
- Fountain Valley Renewable Station – Install and commission both 350 and 700 bar systems
- Hydrogen Fuelers (HF-150) – Continue operation in Northern California
- Infrastructure Data Acquisition, Analysis and Delivery – Continue to report data to DOE

Summary

- **Demonstrate a variety of options for delivery of low-cost hydrogen in the deployment of hydrogen Infrastructure**
  - **First permanent CHIP station (350 and 700 bar gaseous hydrogen) in operation at UCI**
  - **Two mobile CHIP stations (HF-150) (Long Beach, Placerville)**
  - **New Delivery Concept (NDC) trailer deployed**
  - **Infrastructure Data Reporting at each station**
- **Near Term Activities**
  - **First pipeline supplied hydrogen station in commissioning phase**
  - **Renewable-supplied hydrogen station in construction phase**

Thank you

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