California Hydrogen Infrastructure Project

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Air Products and Chemicals, Inc.

17 May 2012

Project ID #TV007

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Overview

Timeline

- Start – Aug. 2005
- End – Dec. 2011
- 100% Complete

Barriers

- Cost of delivered hydrogen

Budget

- Total project funding
  - DOE $5.5 million share
  - Contractor $5.4 million share
- Funding received in FY11: $0
- Funding for FY12: $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 users' fueling experience

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Project Tasks

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

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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 to be expanded to 100 kilograms per day (California Energy Commission)
- Over 8,000 fills since station start-up (August 2006)

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
- Expandable with additional compression to 96 kg/day
- In fully deployed hydrogen economy, pipeline-supplied
- stations can dispense hydrogen at $4.50-5.00 per kg
- Funding support by Shell Hydrogen and South Coast Air Quality Management District
- Over 2,000 fills since April 2011

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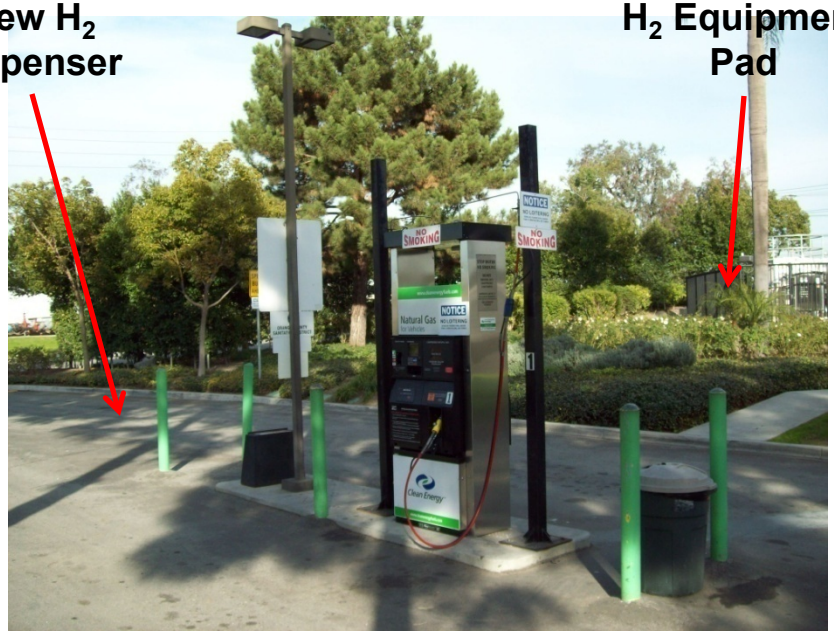
Fountain Valley Renewable Hydrogen

Fountain Valley Station

- 100 kg/day capacity
- 350 and 700 bar fueling capability
- SAE TIR-J2601 compliant
- 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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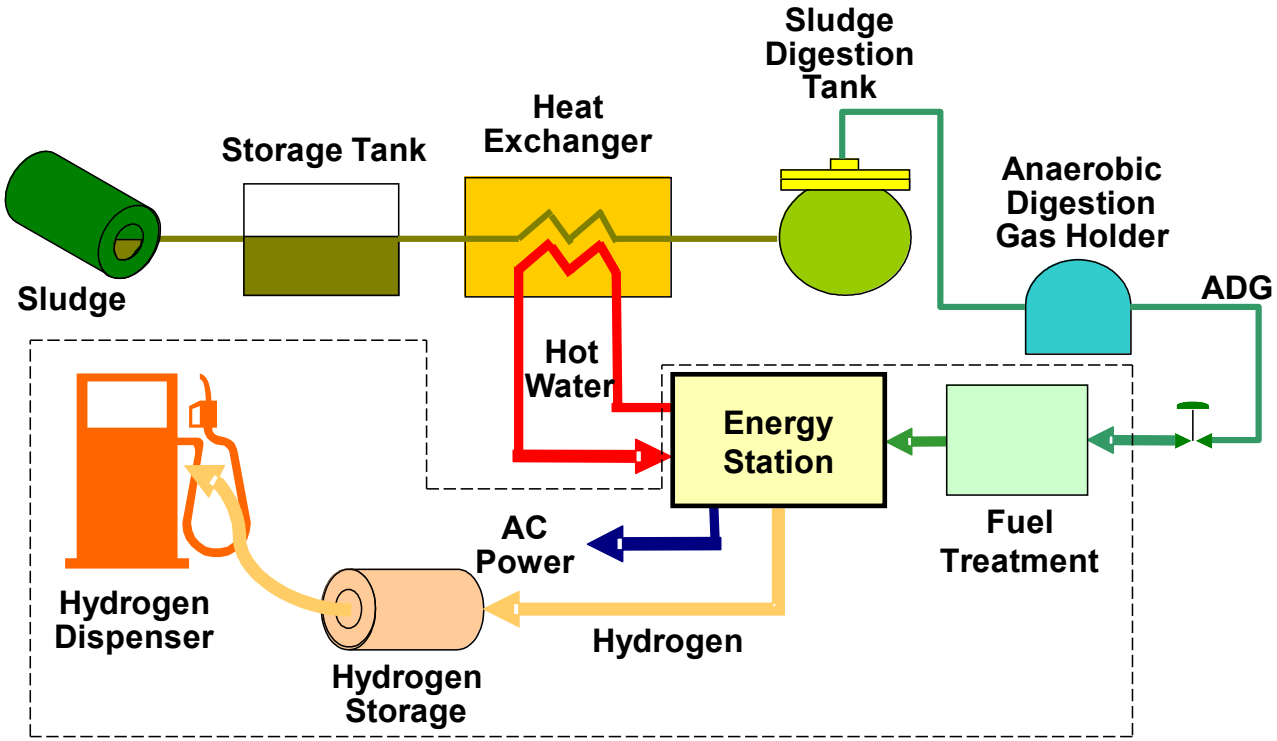
Hydrogen Energy Station



- Technology developed under second DOE Cooperative Agreement (No. DE-FC36-01GO11087)
- Continuing operation until 31 May 2014 under sponsorship of California Air Resources Board and South Coast Air Quality Management District

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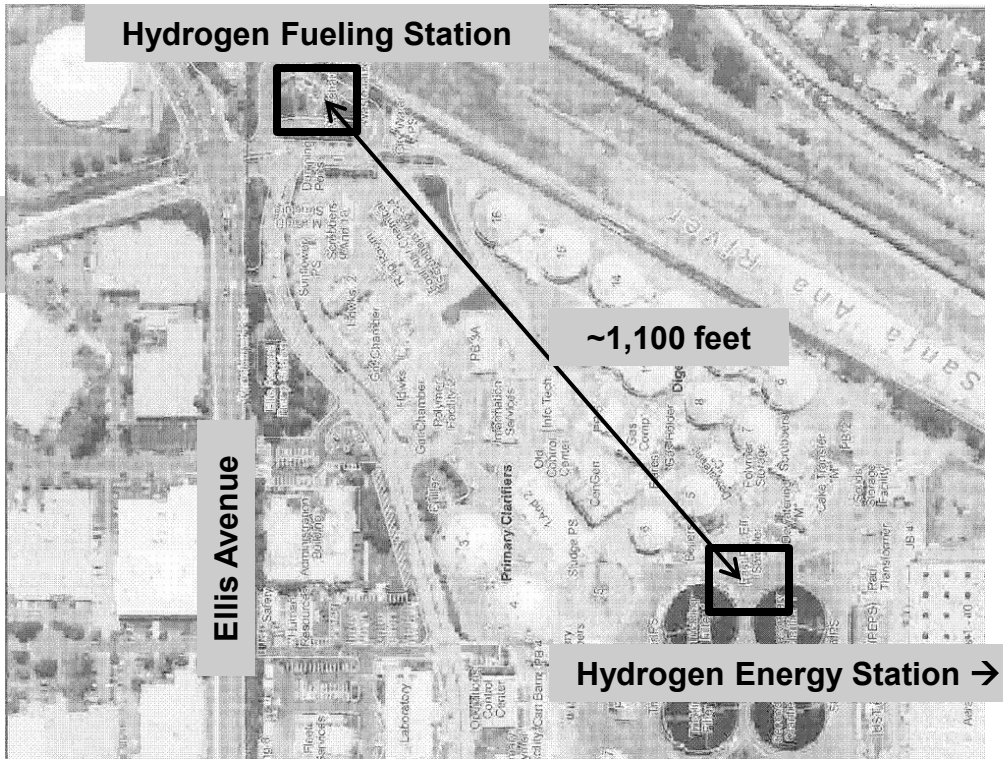
Orange County Sanitation District Site



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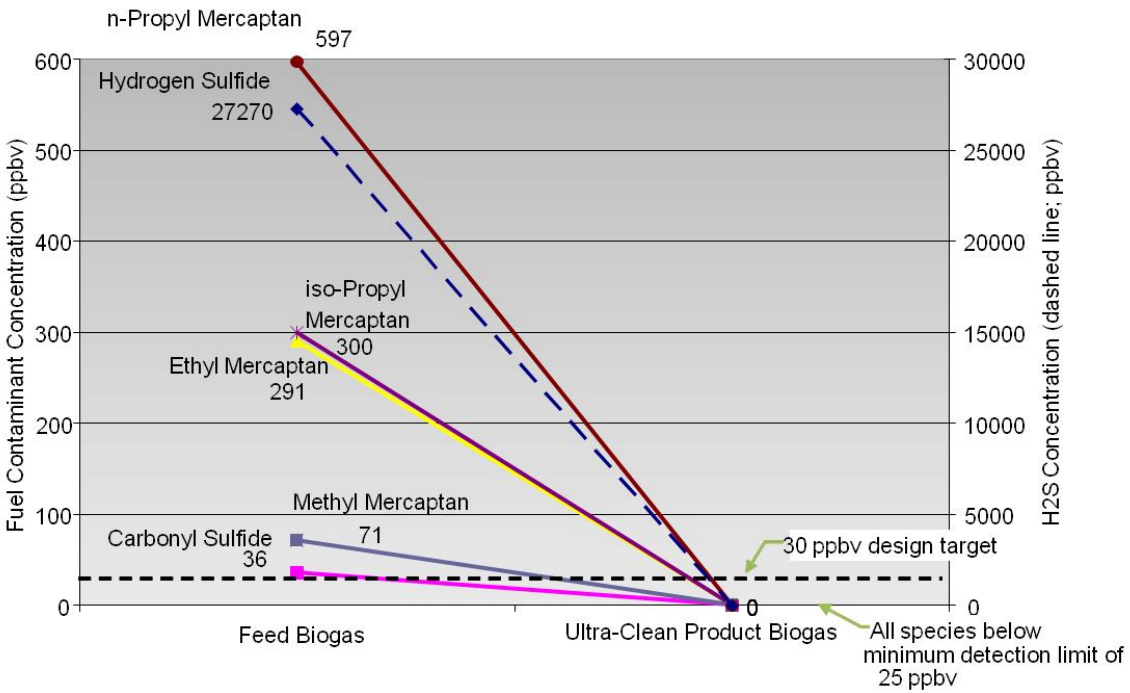
Hydrogen Energy Station Operation on Anaerobic Digester Gas



- **Clean-up system commissioned May 2011**
- **No breakthrough of contaminants detected**

Commissioning of Hydrogen Fueling Station

- November 2010: Mechanical completion of hydrogen fueling station
- 08-10 March 2011: Initial test fills of fuel cell vehicles
- Current Status: One automaker under agreement, two others finalizing fuel payment agreement

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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
  - Completed subcontract: Life Cycle Assessment (LCA) of Hydrogen Infrastructure and Fuel Cell Vehicle Technologies (2008 co-presenter at AMR)

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**
  - **First pipeline supplied hydrogen station in operation in Torrance**
  - **Renewable-supplied hydrogen station in operation in Fountain Valley**

Thank you

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