

# **California Hydrogen Infrastructure Project**

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Project ID  
#TV007

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# Overview

## Timeline

- Start – Aug. 2005
- End – Dec. 2011
- 91% Complete

## Budget

- Total project funding
  - DOE \$5.5 million share
  - Contractor \$5.4 million share
- Funding received in FY10: \$0
- Funding for FY11: \$0

## Barriers

- Cost of delivered hydrogen

## Partners

- Various collaborators and funding groups including:
- South Coast AQMD
  - OEM's
  - UC Irvine
  - Energy Companies
  - FuelCell Energy, Inc.

# 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
- Proposal by Air Products to expand station to 100 kilograms per day selected by California Energy Commission



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

# 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
- Vehicle test fills completed March 2011
- 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



# Recent Advances in Fueling Station Capabilities

- Station supplied from active industrial pipeline
- Meets SAE TIR-J2601
- Use of 15,000 psig ground storage, enabling 70 MPa cascade fueling
- Capable of 4 simultaneous vehicle fuelings (2 @ 35 MPa, 2 @ 70 MPa)
- Dual PLC dispenser (+ supervisory PLC)
- Vehicle identification system for OEM-specific fueling protocols (HVAS)





# Northern California HF-150

## Placerville Station

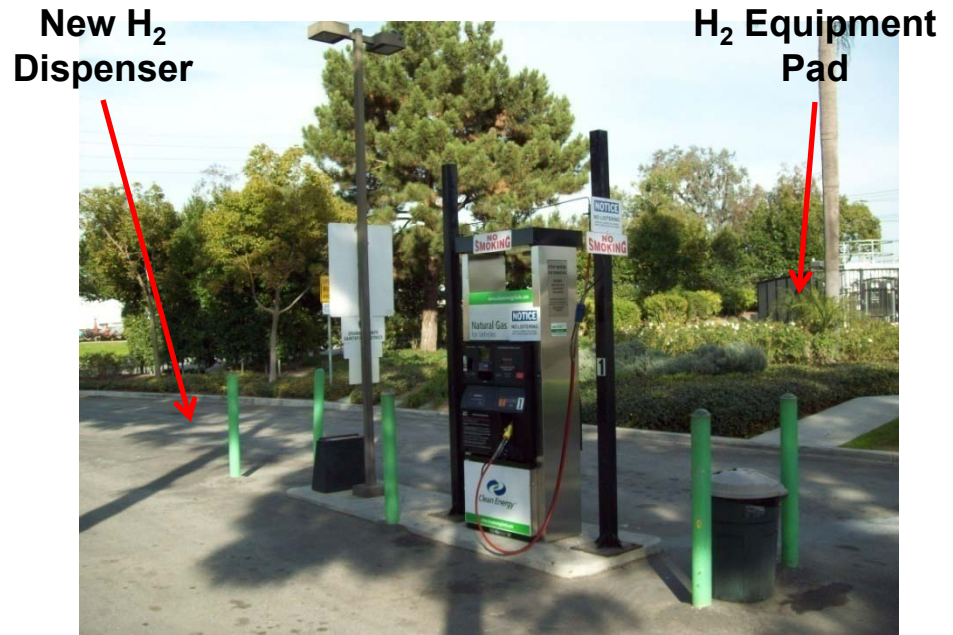
- Gaseous hydrogen supply
- 350 bar fueling capability
- Host site: U.S. Forest Service, Eldorado National Forest
- Installed March 2010
- Planned 6 month deployment extended to December 2010
- Funding support by Nissan



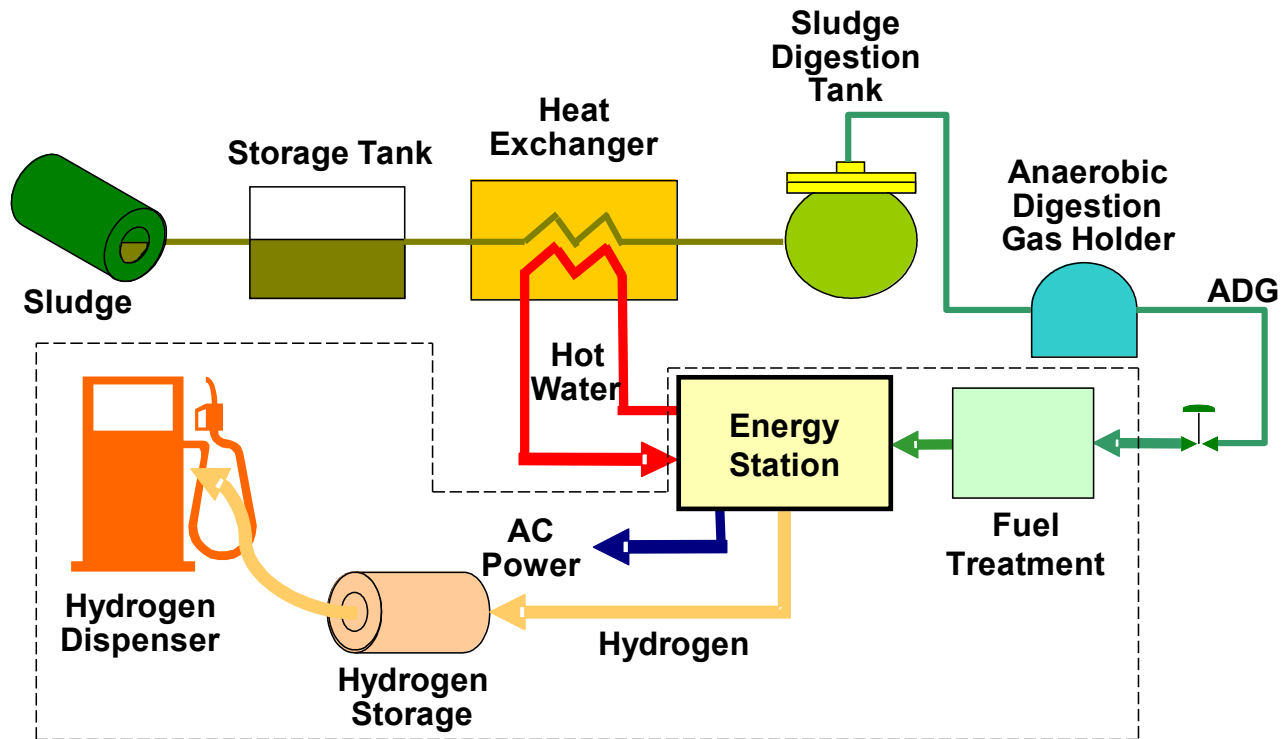
# Fountain Valley Renewable Hydrogen

## 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

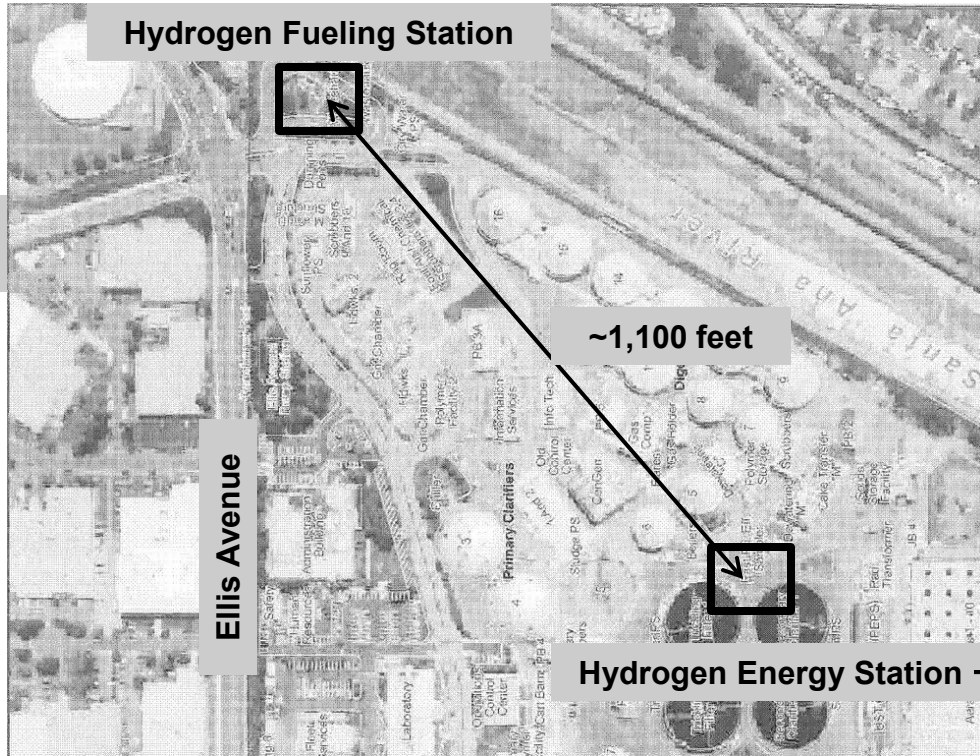


# Hydrogen Energy Station



- Technology developed under second DOE Cooperative Agreement (No. DE-FC36-01GO11087)
- Overall project (including 3 years of operation) selected for funding by California Air Resources Board and South Coast Air Quality Management District

# Orange County Sanitation District Site



# Commissioning of Hydrogen Fueling Station



- **November 2010: Mechanical completion of hydrogen fueling station**
- **25 February 2011: First hydrogen from Hydrogen Energy Station to hydrogen fueling station**
- **08-10 March 2011: Initial test fills of fuel cell vehicles**

# Ongoing Activities at Fountain Valley Renewable Station

- **March 2011: Obtain occupancy permit for hydrogen fueling station**
- **April 2011: Delivery and installation of clean-up system for anaerobic digester gas**
- **Spring 2012: Complete 1 year of refueling data reporting under DOE Cooperative Agreement**
- **Operation to continue for a total of 3 years under CARB/SCAQMD sponsorship**

# 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)**

# Future Work

- **UCI Fueling Station – Continue operation**
- **Torrance Pipeline Fueling Station – Continue operation**
- **Fountain Valley Renewable Station – Continue operation**
- **Infrastructure Data Acquisition, Analysis and Delivery – Continue to report data to DOE**
- **Extend DOE Cooperative Agreement to allow for 1 year of fueling data from Torrance and Fountain Valley stations**



# 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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# Acknowledgement & Disclaimers

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