

California Hydrogen Infrastructure Project

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Project ID #TV7

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Overview

Timeline

- **Start – Aug. 2005**
- **End – Sept. 2008**
- **70% Complete**

Budget

- **Total project funding**
 - **DOE \$5.5 million share**
 - **Contractor \$5.4 million share**
- **Funding received through FY06**
 - **Total \$2.2 million**
- **Funding for FY07**
 - **Total \$1.1 million (2/28/07)**

Barriers

- **Cost of delivered hydrogen**

Partners

- **Various collaborators and funding groups including:**
 - **SCAQMD**
 - **OEM's**
 - **UC Irvine**
 - **Energy Companies**

Objectives

- **Demonstrate a cost effective infrastructure model in California for possible nationwide implementation**
 - Design, construct and operate seven 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**
 - New Delivery Concept (NDC)
 - Hydrogen Based Unit (HBU)

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**

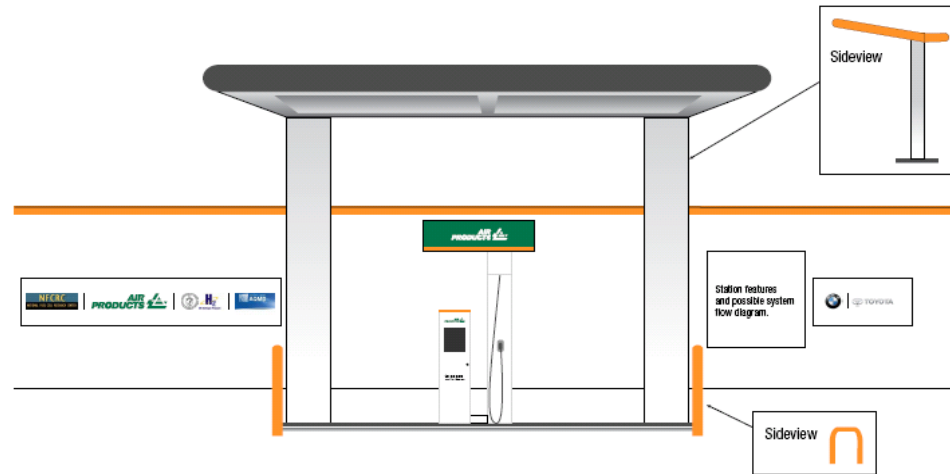
Project Tasks

- **UCI Fueling Station**
- **Torrance Pipeline Fueling Station**
- **Hydrogen Fuelers (HF-150) – 3 Units Planned**
- **New Delivery Concept (NDC) – 2 Trailers Planned**
- **Hydrogen Based Unit (HBU) – 2 Units Planned**
- **Infrastructure Data Acquisition, Analysis and Delivery (includes eRAM)**
- **Novel Compressor Development**
- **Hydrogen Infrastructure Study (UCI) – recently initiated work**

UCI Fueling Station

2006 Status:

- Design, permitting, equipment fabrication complete for 350 bar system
- Design and equipment fabrication started on 700 bar system
- Early design started on LHy system



2007 Status:

- 350 bar system in operation August 2006
- 700 bar system in operation February 2007
- LHy system in procurement phase



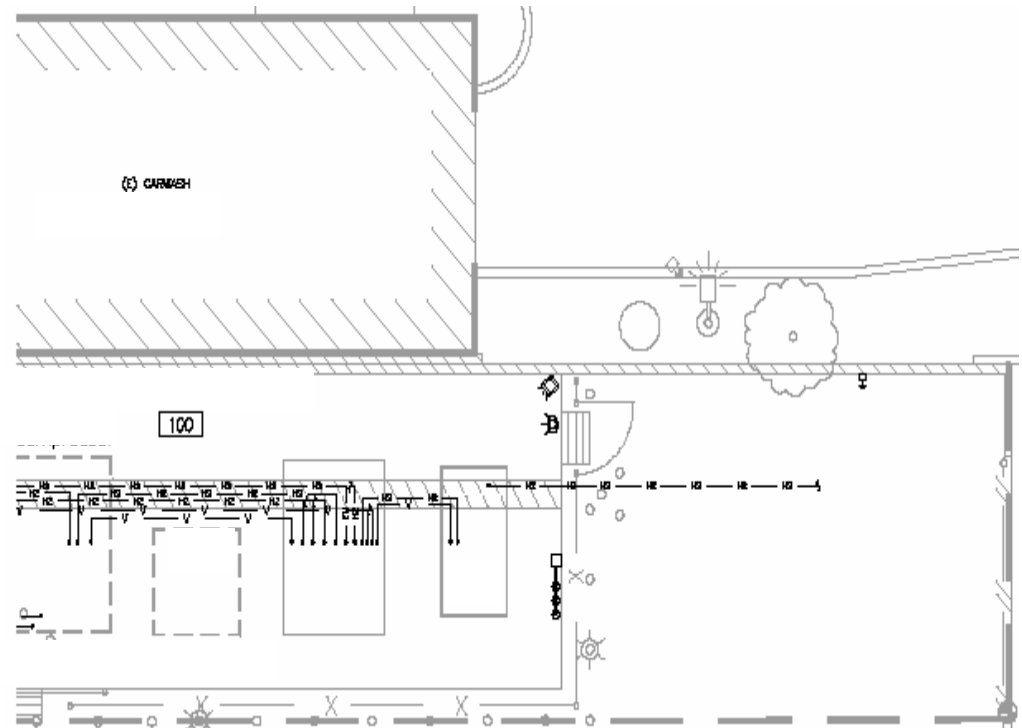
Torrance Hydrogen Fueling Station

2006 Status:

- Working on developing suitable location for station
- Equipment design completed for 350 bar system
- Equipment fabrication started for 350 bar system

2007 Status:

- Finalizing plans for station location
- Site permit applications submitted
- Equipment fabrication completed for 350 bar system
- Equipment fabrication started for 700 bar system
- Testing of pipeline hydrogen purifier underway



Hydrogen Fuelers (HF-150)

2006 Status:

- Equipment fabrication almost complete
- Location and Station Operator determined for one station
- Station Operators and locations not finalized for other stations



2007 Status:

- Equipment fabrication complete
- Lease agreement signed with Long Beach Gas and Oil
- Station Operators and locations not finalized for other stations



New Delivery Concept (NDC)

New method of hydrogen distribution capable of supplying low, medium, and high pressure systems using a single liquid hydrogen trailer. NDC trailer allows for increased integration of the merchant bulk hydrogen, hydrogen fueling stations, and liquid hydrogen supply chains, driving improved operating efficiency. Patents pending.

2006 Status:

- **Equipment design complete for NDC #1 and NDC #2**
- **Equipment on order**

2007 Status:

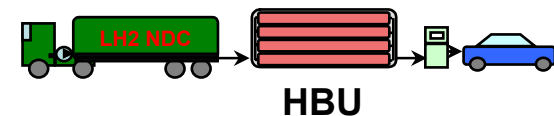
- **Equipment fabrication for NDC #1 complete**
- **Field trials of components underway**
- **Deployment to CA anticipated in coming months**

Hydrogen Based Unit (HBU)

New approach to reduce costs associated with stationary fueling stations. HBU product is deployed at customer sites in conjunction with New Delivery Concept (NDC) Liquid Hydrogen Trailer.

2006 Status:

- Equipment design complete for HBU #1 and HBU #2
- Equipment on order
- Station Operators and locations to be determined

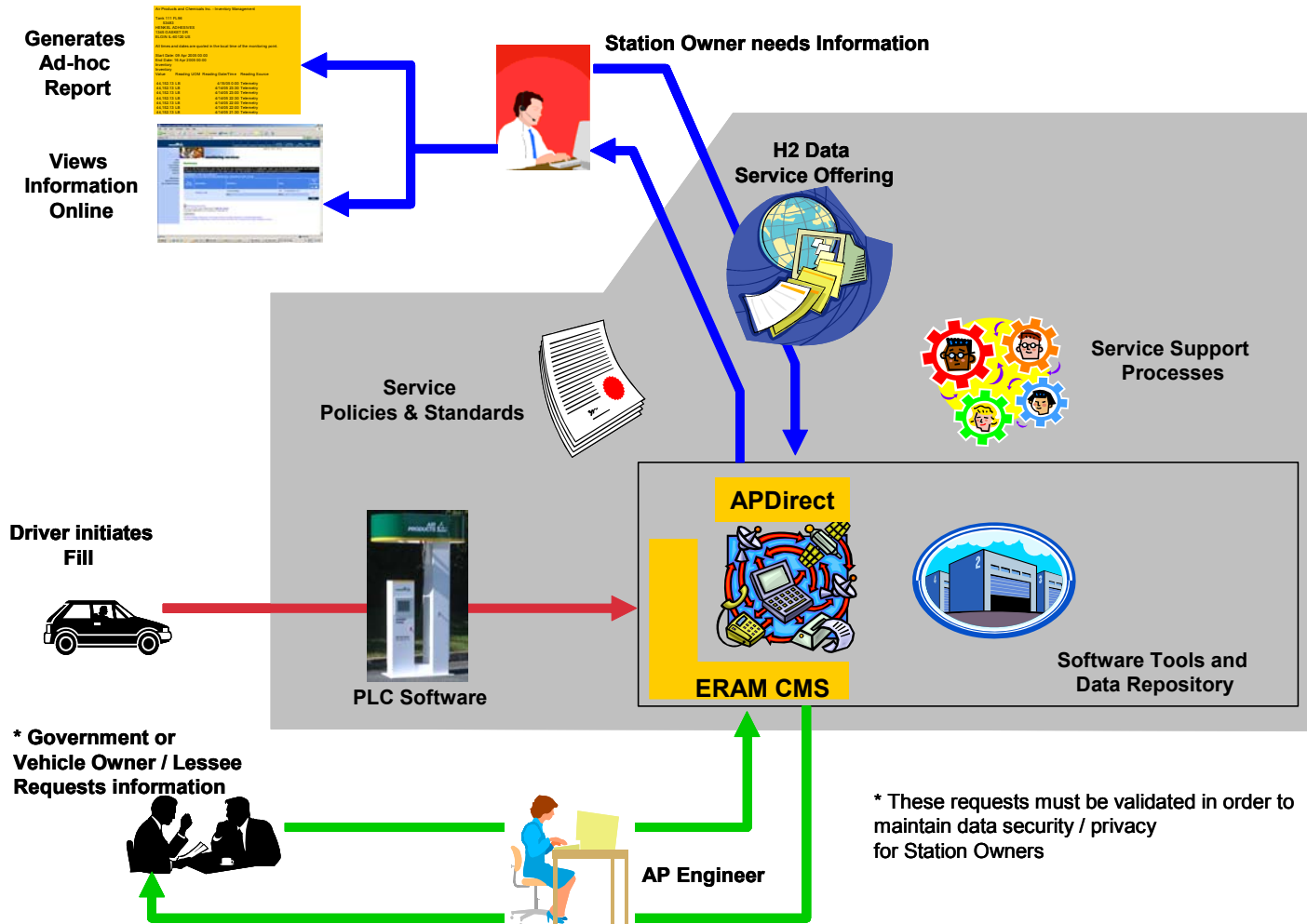


2007 Status:

- Equipment fabrication for HBU #1 complete
- Deployment to CA to follow roll-out of NDC



ERAM Hydrogen Data Service



Novel Compressor System

New equipment design which can compress hydrogen from 100 psi to 14,000 psi in one stage. If successful, capital cost will be 50-75% less than conventional systems. Patents pending.

Features:

- **Isothermal Operation – gas cooled during compression**
- **Single Stage**
- **Simple Fabrication – no exotic materials**
- **Liquid Pump – inherently lubricates all dynamic seals**
- **Small Footprint**
- **No External Cooling**
- **Dynamic Gas Seals Eliminated**
- **Low Maintenance Costs**

Novel Compressor System Status

Compressor Installation and Commissioning

- System leak-checked to 14,000 psi
- Function test performed at 4,000 psi
- Functional test completed on all major components
- System ready for next phase of operation



Future Work

- **UCI Fueling Station – Finalize LHy Dispensing System**
- **Torrance Pipeline Fueling Station – Complete Agreement with Station Operator; Install and Commission both 350 and 700 bar Systems**
- **Hydrogen Fuelers (HF-150) – Begin Operation at Long Beach; Identify Other Locations and Station Operators**
- **New Delivery Concept (NDC) – Complete Fabrication of NDC #1 and Deploy; Fabricate NDC #2 and Deploy**
- **Hydrogen Based Unit (HBU) – Fabricate HBU #2; Identify Locations and Station Operators**
- **Infrastructure Data Acquisition, Analysis and Delivery – Report Data to DOE**
- **Novel Compressor Development – Complete Operating Program**
- **Hydrogen Infrastructure Study by UCI – Perform Scope of Work**

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) opened at UCI**
 - **First mobile CHIP station (HF-150) opened in Long Beach**
 - **Commissioning of Novel Compression System**
 - **Infrastructure Data Reporting at each station**
- **Near Term Activities**
 - **First pipeline supplied hydrogen station in permit phase**
 - **Equipment fabrication nearly complete in most cases**
- **Continuing to develop site locations and Station Operators for other stations**
- **Initiating Hydrogen Infrastructure Study at UCI**

Thank you

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