SUSTAINABLE HYDROGEN FUELING STATION, CALIFORNIA STATE UNIVERSITY, LOS ANGELES

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Project ID TV014

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Overview

Timeline
- Start: 01/01/2010
- End: 12/31/2012
~90 % complete

Budget
- Total project funding
  - DOE $475,750
  - Contractor $475,750
- Funding received in full.

Partners
- California State University, Los Angeles— Project lead
- Funding Agencies
- California Fuel Cell Partnership
- GM Corp, Honda, Daimler, Hyundai, Toyota

Barriers

Hydrogen Production and Delivery
- Reduce the cost of compression, storage, and dispensing at refueling stations
- Research and develop low-cost, highly efficient hydrogen production technologies

Technology Validation
- Validate complete systems of integrated hydrogen and fuel cell technologies for transportation, infrastructure and electricity generation applications under real-world operating conditions.

Education
- Educate key audiences to facilitate near-term demonstration, commercialization, and long-term market acceptance.
PROJECT OBJECTIVES

- The College of Engineering, Computer Science, & Technology at California State University, Los Angeles as part of its energy curriculum is building a sustainable hydrogen station to teach and demonstrate the production and application of hydrogen as the next generation of fully renewable fuel for transportation.
- The requested funding will provide for the acquisition of the core hydrogen station equipment: electrolyzer, compressors and hydrogen storage.

PROJECT SCOPE

- The CSULA hydrogen station will deploy the latest technologies with the capacity to produce 60/kg/day. The station will be utilizing a Hydrogenics electrolyzer, first and second stage compressors capable of fast filling at 10,000psi (700bar), 60kg of hydrogen storage, water purification and equipment cooling system. The station will be grid-tied and powered by 100% renewables.
- The station will also be used as an applied research facility for equipment testing and verification, testing of fuel purity and dispensing accuracy. Another primary function of the station is to introduce hydrogen as a safe transportation fuel through public education and partnerships.
Approach: Tasks Under This Funding

Task 1.0 Hydrogen Station Equipment Acquisition

- The current funding provides for a single task of acquisition of the core hydrogen station equipment: electrolyzer, compressors and hydrogen storage.
  - **Subtask 1.1 Electrolyzer**
    - Order, receive and install station electrolyzer: HySTAT-A 1000D-30-10.
    - Quoted delivery time 32-36 weeks.
  - **Subtask 1.2 350 Bar Compressor**
    - Order, receive and install station 350 bar compressor: PDC-4-1000-6500.
    - Quoted delivery time 20-24 weeks.
  - **Subtask 1.3 700 Bar Compressors**
    - Order, receive and install station two (2) 700 bar compressors: Hydro-Pac C12-60-10500LX.
    - Quoted delivery time 16-18 weeks.
  - **Subtask 1.4 Hydrogen Storage Tanks**
    - Order, receive and install station three (3) 350 bar storage tanks:
    - Quoted delivery time 18-20 weeks.

**MILESTONES**

**Milestone 1.1 Ordering**
- Complete ordering equipment listed in Task 1 in Quarter 1 after receiving funds.

**Milestone 1.2 Receiving and Installation**
- Complete receiving and installing the equipment listed in Task 1 in Quarter 4 after receiving funds.
College Initiatives Relevance

• Building a hydrogen fueling station to serve the central Los Angeles area and become a focal point of research, educational and outreach activities.

• Redesigning the curriculum to implement an effective Alternative and Renewable Energy Technologies program including hydrogen economy and fuel cell applications.

• Conducting research in collaboration with the Center for Alternative and Renewable Energy and Sustainability. Funded by NSF programs and local partners.
Hydrogen Fueling Facility

- Establish a Sustainable Hydrogen Fueling Facility at Cal State L.A
  - CARB No. 06-618 $2,700,000
  - DOE Award #DE-09EE0000443 $475,750
  - AQMD, MSRC, Ahmanson Foundation, AAA
Design Options

Images are courtesy Leo A Daly
The Team and Equipment

- Cal State LA
  - Project management

- General Physics
  - major equipment

- Weaver
  - Leo-A-Daly - architect
  - EPC4H2 - engineering
  - Quantum Technologies - hydrogen dispensing
  - Others

- Major Equipment
  - Electrolyzer Hydrogenics HYSTAT 30—60 kg/day
  - 350 bar compressor PDC-4-1000/7500—0.044 kg/min
  - 700 bar compressor Hydro PAC C12-60-10500XL (2) —0.5 kg/min each
  - Storage tanks (3) CPI 8x16247—20kg/350 bar each
Equipment

350 bar compressor, 2 x 700 bar compressors and storage vessels
Electrolyzer Arrived

Hydrogenics electrolyzer

January 27-28, 2011
Construction and Equipment

http://www.calstatela.edu/faculty/vseaman/Hydrogen_Station.php
Equipment Layout and Hydrogen Flow

Walking tours
Future Work: Research Opportunities

- Performance Optimization, Hydrogen Fleet and Infrastructure Analysis
- Smart Grid: Load Following with Renewable Power Generation
  - Off-peak load
  - Load shedding
- Workforce, Public and Professional Education

Electrolyzers demonstrate quick start-stop without degradation

Intermittent wind exceeds load

Electrolysis (grid balancing and hydrogen fuel production)
Power, Energy and Transportation Emphasis
Department of Technology

- TECH 100  Introduction to Automotive Mechanisms
- TECH 370  Power, Energy and Transportation
- TECH 405  Advanced Engine Design
- TECH 470  Electric, Hybrid and Alternatively Fueled Vehicles
- TECH 474  Power Generation, Distribution and Utilization (+Smart Grid)
- TECH 476  Electronic and Computer Control Systems
- TECH 478  Fuel Cells, Emerging Technologies
- TECH 478  Photovoltaics, Emerging Technologies
- TECH 488  Fluid Power
Sempra Senior Project
MOBILE DISPENSED HYDROGEN CALIBRATION

• ECST senior project: 3 ME and 1 EE student.
• To create a calibration device for measuring the amount of H2 dispensed by a hydrogen station to an accuracy of +/- 2% per mass and serve as the official verification standard approved by the CA Dept. of Food and Agriculture, Measurement Standards Division.
• Needs a method analogues to conventional gasoline standards.
FCV: Hydrogen Super Eagle

System Energy Flow Diagram for a Zero Emission System

Summer REU program with support by CSULA Center for Energy and Sustainability (4 students)
Student Design

Home Hydrogen Refueling

Number of teams: 54
Number of Countries: 19
Number of Submissions 17
Placed 7
Collaboration: 2 students from East Los Angeles College
CSULA hosted Mercedes Benz F-Cell World Drive with Cristian Maier, March 8, 2011
Summary

• Program demonstrates high relevance to DOE Hydrogen and Fuel Cell program.

• Tasks proposed by the grant have been completed: equipment is purchased and transferred to the site.

• Future directions and plan for program growth beyond current funding is being developed.

• Public outreach, education and building partnerships opportunities are actively pursued.

• Students are learning about hydrogen infrastructure and fuel cell vehicle technologies.

• Project is a coherent effort among many collaborators and is a congruent element in the college’s Alternative and Renewable Energy initiatives.