XI.10 Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment

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Subcontractors:
- Plug Power Inc., Latham, NY
- Air Products and Chemicals, Inc., Allentown, PA

Project Start Date: September 15, 2009
Project End Date: September 14, 2013

Objectives

- Convert the entire class-3 lift truck fleet at a Greenfield distribution center in Houston, Texas to fuel cell use.
- Demonstrate the economic benefits of large fleet conversions of lift trucks from lead-acid batteries to fuel cell power units by measuring, analyzing and reporting on the performance, operability and safety of the systems.
- Demonstrate freezer operability.
- Provide affordable and reliable hydrogen.
- Spur further fuel cell lift truck fleet conversions.
- Establish a proving ground for hydrogen fueling technology that will promote the future adoption of fuel cells in other applications and help drive the use of fuel cell technology in the United States.

Technical Barriers and Goals

This project addresses the following technical barriers:

- Safe hydrogen use in high throughput distribution center.
- Full fleet conversion to Greenfield center.
- Operator productivity improvements.
- Fuel cell use in freezer setting.
- GenDrive fuel cell lifetime and reliability.

Accomplishments

- Converted the entire class-2 and class-3 lift truck fleet in a Greenfield distribution center to fuel cell use.
- Built permanent hydrogen fueling infrastructure.
- Trained over 100 employees on operation and safety of hydrogen use.
- Improved operator productivity due to elimination of battery degradation and charging time.
- Through life of project 5.5 jobs have been created.
- Completed 2,664 fills in first quarter 2010.

Introduction

This project addresses the DOE's priorities related to acquiring data from real-world fuel cell operation, eliminating non-technical barriers, and increasing opportunities for market expansion of hydrogen fuel cell technologies.

Sysco Houston's objectives are to support the American Recovery and Reinvestment Act goals of long-term economic growth by successfully demonstrating this new technology. Establishing a proving ground for expanded use of hydrogen fueling technology at Sysco promotes future adoption of fuel cells in other applications thereby driving their use in the U.S. Sysco also hopes to promote the economic and environmental benefits of hydrogen fuel cell technology.

To see these objectives to fruition, Sysco Houston has and is:

- Converted the entire class-2 and class-3 lift truck fleet to fuel cell use.
- Demonstrating the economic benefits of large fleet conversions of lift trucks from lead-acid batteries to fuel cell power units by measuring, analyzing and reporting on the performance, operability and safety of the systems.
- Demonstrating freezer operation.
- Obtaining affordable and reliable hydrogen.

Approach

The project involves replacing the batteries in a complete fleet of class-3 electric lift trucks at Sysco's new Houston, TX distribution center with 72 Plug Power GenDrive fuel cell power units (plus the rental of seven additional class-3 power units for 6-month use in rented lift trucks). Fuel for the power units involves on-

site hydrogen handling and dispensing equipment and liquid hydrogen delivery by Air Products.

The project builds on Sysco's previous field trial experience with more than 40 of Plug Power's GenDrive power units. Those trials demonstrated productivity gains and improved performance compared to battery-powered lift trucks. Full lift truck conversion at the Houston location allows improved competitiveness of operations and helps the environment by reducing greenhouse gas emissions and toxic battery material use. Success at this distribution center may lead to further fleet conversions at some or all of Sysco's 170 distribution centers.

Sysco Houston's hydrogen safety plan has been fully implemented and all National Environmental Policy Act forms have been submitted for review and approval.

Results

Milestones	Progress	% Complete
Fueling Station Installation	Big-D construction company completed preparatory work for hydrogen infrastructure installation. Air Products completed installation of hydrogen fueling system.	100%
GenDrive Build	Plug Power completed build of 26 class-2 and 79 class-3 power units.	100%
►Go/No-Go	1. Fuel station was fully tested and deemed operational. 2. Fuel cells passed factory acceptance testing.	100%
Annual Assessments Month 18, 30 and 48	Assess reliability of the fuel cells by measuring the time between failures and examining the cause of failure. Assess cost to maintain and operate the fuel cells, as well as overall operator experience.	0%

The entire class-2 and class-3 lift truck fleet in Sysco Houston's greenfield distribution center has been converted to fuel cell use. A permanent hydrogen fueling infrastructure has been installed and over 100 employees have been trained on operation and safety of hydrogen use. Due to the elimination of battery degradation and charging time operator productivity has been improved and the site completed 2,664 fills in the first quarter 2010. Through life of the project 5.5 jobs have been created.

Air Products commissioned the fueling station in December 2009, the first test fueling occurred January 2010, and in February fire marshal approval was received, 3.5 months ahead of schedule.

The liquid tank operates with a maximum allowable working pressure of 150 psig and the bulk high-pressure storage tanks operate at 6,000 psig. The indoor dispensers are 250 bar and capable of over 700kg/day. A pin code and badge scan is required for dispenser operation. Hydrogen gas detectors alarm at 25 percent of the lower explosive level and will shut down the system automatically.

Sysco Houston is successfully using hydrogen fuel cell technology for the first time in a fleet environment and the facility has proper safety, backup and operational procedures in place. Close monitoring and return on investment calculations have increased Sysco's involvement in fuel cell-powered lift truck operations.

Conclusions and Future Directions

Sysco Houston is successfully using hydrogen fuel cell technology for the first time in a fleet environment. The facility has proper safety, backup and operational procedures in place and a fully implemented hydrogen safety plan. Close monitoring and return on investment calculations have increased Sysco's involvement in fuel cell-powered lift truck operations. One hundred and five of Plug Power's GenDrive units are currently in use and hydrogen fueling is occurring regularly, Air Products providing the hydrogen support.

The majority of the project tasks have been completed at the front end of the project. The balance of the demonstration period will include:

- Monitoring GenDrive power units project performance, operability and safety.
- Monitoring liquid and gaseous hydrogen fueling equipment project performance, operability and safety.
- Monitoring and providing project performance, operability and safety reports to the DOE, including any safety and performance data and issues identified during operation of the power units. This encompasses maintenance and operation of the GenDrive units.
- Supporting DOE communication efforts.

FY 2010 Publications/Presentations

1. 2010 DOE Hydrogen Program Annual Merit Review (Presentation ARRAH2010), Washington, D.C. June 2010.

2. Kickoff Event, Houston, TX, May 2010.