

XII.6 GENCO Fuel Cell-Powered Lift Truck Fleet Deployment

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Subcontractors:

- Plug Power Inc., Latham, NY
- Air Products, Allentown, PA
- Linde North America, Murray Hill, NJ

Project Start Date: October 1, 2009
Project End Date: September 30, 2013

Objectives

The objectives of this project are to:

- Convert 357 electric-drive fork lift trucks from batteries to fuel cell power units in five large distribution centers and manufacturing facilities.
- Demonstrate the safe and reliable operation of hydrogen-fueled material handling equipment (MHE).
- Demonstrate the economic benefits of conversion to hydrogen fuel cell-powered MHE.
- Demonstrate operator acceptance of hydrogen fuel cell-powered MHE.
- Provide a cost effective and reliable hydrogen fuel supply.
- Spur further lift truck fleet conversions to hydrogen fuel cells.
- Establish a proving ground for hydrogen fuel cell-powered MHE.

Relevance to the American Recovery and Reinvestment Act (ARRA) of 2009 Goals

This project advances the goals of the American Recovery and Reinvestment Act (ARRA) of 2009 to create

new jobs, save existing jobs, and spur economic activity and investment in long-term economic growth by:

- Creating jobs at Plug Power to design, build and commission the fuel cell power units.
- Creating jobs at Air Products and Linde to design, install and commission hydrogen storage and fueling equipment.
- Creating jobs at Air Products and Linde to deliver hydrogen to GENCO facilities.
- Training lift truck operators in hydrogen safety, fueling procedures and fuel cell operation.
- Training lift truck maintenance personnel to service fuel cells.
- Improving the overall economic efficiency of material handling operations.

This project advances the DOE Fuel Cell Technologies' ARRA project goals of accelerating the commercialization and deployment of fuel cells and fuel cell manufacturing, installation, maintenance, and support services by demonstrating:

- Safe and reliable operation of hydrogen storage and fueling equipment and fuel delivery.
- Reliable and efficient operation of hydrogen fuel cells.
- Economic and environmental advantages of fuel cells over batteries.
- Practical operation and maintenance of fuel cells.

Technical Barriers

This project addresses the following technical barriers to the use of fuel cell-powered lift trucks:

- Represents a change in technology, which is often met with reluctance.
- Uncertain power unit reliability due to lack of widespread performance data.
- Safety and expense of hydrogen and fueling equipment.
- Difficulty in obtaining permits and approvals for hydrogen fueling stations.

Technical Targets and Milestones

The class and number of power units and the hydrogen supplier for five GENCO locations are shown in Table 1. All power units were installed and operating by September 2011.

TABLE 1. Summary of Power Units at Five GENCO Locations

	Wegmans	Whole Foods	Coca-Cola	Sysco Phil.	Kimberly-Clark	TOTAL
Class 1 GenDrive	0	45	40	0	25	110
Class 2 GenDrive	36	14	0	25	0	75
Class 3 GenDrive	100	2	0	70	0	172
TOTAL	136	61	40	95	25	357
Hydrogen Supplier	Air Products	Linde	Linde	Air Products	Air Products	

Accomplishments

The accomplishments of this project include:

- Commissioning hydrogen storage and fueling equipment at all sites (see Table 2 for completion dates).
- Commissioning power units at all sites by September 2011.
- Completing fueling, operation and maintenance training at all sites.
- Operating power units at all sites (ongoing).
- Some power units at Wegmans have accumulated over 9,000 hours of operation.



Introduction

The purpose of this project is to demonstrate that hydrogen fuel cells are a safe and economical alternative to lead-acid batteries for powering electric-drive lift trucks. The primary barriers to widespread use of hydrogen fuel cells for material handling equipment are concerns about the safety of hydrogen storage and fueling equipment, operating costs for fuel and maintenance, and the long-term reliability of fuel cells.

Approach

This project will evaluate the safety and economics of using hydrogen fuel cells to power over 350 lift trucks at five GENCO facilities. GENCO will supply the lift trucks, Plug Power will supply the GenDrive fuel cell power units, Air Products and Linde will supply the hydrogen storage and fueling equipment and the hydrogen fuel. The equipment will be maintained by GENCO personnel with assistance from Plug Power, Air Products and Linde personnel when necessary.

TABLE 2. Summary of Power Unit Operating Data at Five GENCO Locations (to March 31, 2012)

	Wegmans	Whole Foods	Coca-Cola	Sysco Phil.	Kimberly-Clark
Average operating hours per unit	5,300	3,800	n/a	n/a	n/a
Total operating hours	721,000	231,000	n/a	n/a	n/a
Total hydrogen dispensed (kg)	60,816	19,306	25,806	21,942	23,001
Average hydrogen dispensed per fill (kg)	n/a	0.89	1.28	n/a	n/a

Note: Some operating data not available at this time due to problems with data collection equipment

GENCO and the subcontractors will monitor the operation and maintenance of the power units and the hydrogen storage and fueling equipment over the duration of the project. This information will be reported to the DOE and NREL quarterly and summarized annually.

Results

This project has successfully demonstrated the safe and economical operation of 357 class-1, 2 and 3 fuel cell power units and associated hydrogen storage and fueling equipment at five GENCO facilities. Table 2 shows a summary of operating data collected for the power units and fueling equipment at these locations.

Conclusions and Future Directions

Based on the proven reliability and safety of current hydrogen fuel cell operations at GENCO facilities to date, future directions include:

- Ongoing operational and maintenance support for power units and hydrogen storage and fueling equipment.
- Ongoing data collection from power units and hydrogen storage and fueling equipment.
- Helping to reduce the overall costs of fuel cell power units and hydrogen fuel by supporting the conversion to fuel cells at other locations.

FY 2012 Publications/Presentations

1. GENCO delivered an American Recovery and Reinvestment Act merit review presentation in Washington, D.C. in May 2012.