

# **“Dedicated to The Continued Education, Training and Demonstration of PEM Fuel Cell Powered Lift Trucks In Real-World Applications”**

**Tom Dever – Program Director  
LiftOne Division  
Carolina Tractor & Equipment  
May 21, 2009**



**Project ID# : ed\_08\_dever**

**“This presentation does not contain any proprietary, confidential, or otherwise restricted information.”**

## Timeline

- Start - 9/1/2008
- Finish - 8/31/2011
- 14% Complete by May

## Budget

- Total project funding
  - DOE share: \$ 820,272
  - Contractor share: \$ 382,273
- Funding Received:
  - FY2008: \$ 386,000
  - FY2009: \$ 100,000

## Barriers

- Barriers addressed
  - A. Mixed Messages for Education
  - B. Gaining site approval for deployments
  - C. Infrastructure cost / justification

## Partners

- Hydrogenics:
  - "HyPx" Fuel Cell Power Pack Manufacturer, serving as subcontractor for FCPP and providing technical support



## **The LiftOne Program Objectives**

- To educate a broad group of stakeholders to the benefits of fuel cell and hydrogen technology by conducting daily “H2 Seminars” at all LiftOne branches on a rotating basis.
- To build upon LiftOne’s successful initial 2007 fuel cell powered lift truck demonstrations, by executing a new series of six (6) one-month long H2 fuel cell powered lift truck deployments at strategically selected large electric fleet locations.
- To further assist in the commercialization of fuel cell and hydrogen technology through these longer and more geographically diverse deployments in real-world applications.

# Milestones

Month / Year	Milestone or Go/ No-Go Decision
December - 08	<b>Milestone:</b> Completed design of the LiftOne Hydrogen Education lesson plan and submitted to the DOE. <b>Go/No Go Decision:</b> Delay/ coordinate start of Education sessions closer to arrival of equipment.
January - 09	<b>Milestone:</b> Qualification and Selection of first few deployment sites including UTi, Michelin Tire, Stanley Tool, Bausch and Lomb.
March - 09	<b>Milestone:</b> Arrival of Deployment lift trucks and HyPx fuel cell power packs.
April - 09	<b>Milestone:</b> Commissioning of the fuel cells and Participation / Demonstration of the HyPx Fuel Cell powered lift trucks at the National Hydrogen Association Conference in Columbia, South Carolina.
April - 09	<b>Milestone:</b> Start of first Deployment of the 2 lift trucks in South Carolina.

# Approach

- CAT model E5000, AC controlled, sit-down (Class I) electric lift trucks were selected for use in the deployments, allowing for optimum fuel cell performance.
- Hydrogenics model HyPx1-33 cells specified (latest generation) designed specifically for the applications selected.
- Use of the proven Air Products model HF-150 mobile fueler for on-site dispensing of the compressed hydrogen gas, with capability for all fueler related data compilation.
- Hydrogenics Fuel Cell Power Pack - Automatic Data Processing Tool, compliant with NREL format.
- Hydrogenics plug in for fuel cell data processing.
- Hydrogenics diagnostic harness / communication adaptor.

# Technical Accomplishments

## Task 1: The LiftOne Hydrogen Education Program

- Completed design of detailed H2 seminar, gathering information from a wide variety of sources for maximum effectiveness among attendees from industry, higher education and public servant segments of the community; recruitment of those attendees.
- Execution of the hydrogen education sessions, with working demonstration of fuel cell lift truck at LiftOne training facilities.
- Continual reinforcement of the safe practices theme associated with hydrogen use, stressing the viability in material handling.

## Task 2: Deployment Preparation

- Integration of fuel cell power packs into lift trucks for the deployments; incorporation of software, diagnostic and data gathering equipment into the project for measurement and analysis.
- Addressing each and every concern potential deployment site personnel brought forth regarding using hydrogen and storing it at their facility.

# Technical Accomplishments

## Task 3: Executing The Deployment

- Correct siting and placement of the mobile fueler at the deployment's facility. Compliance with all codes and safety regulations, working with site personnel and local officials.
- Full training for all deployment site personnel including: hydrogen awareness training, safety items, hands-on fueler training, lift truck and fuel cell training.
- Data gathering on site during deployment including: voltage readings, fuel cell run time, hydrogen consumption, fueling data.

## Task 4: Data Analysis

- Assimilation of the data, analysis by LiftOne and Hydrogenics project personnel. Comparative analysis of fuel cell performance vs conventional lead-acid battery performance.
- Post deployment meetings to present the results and offer cost-value proposals to the site's management. Objective justification process.

# Technical Progress: Equipment



CAT Model E5000  
Class I – 48v lift truck



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Hydrogenics Model  
HyPx1-33, Fuel Cell  
Power Pack



Air Products Model  
HF-150 Mobile Fueler



## LiftOne Sites – Scope of Education Segment

### 7 FACILITY LOCATIONS:

Charlotte, NC (185,000 Sq. Ft.)

Asheville, NC (50,000 Sq. Ft.)

Hickory, NC (23,000 Sq. Ft.)

Greensboro, NC (32,000 Sq. Ft.)

Greenville, SC (12,000 Sq. Ft.)

Columbia, SC (9,400 Sq. Ft.)

Roanoke, VA (25,000 Sq. Ft.)

### HYDROGEN EDUCATION ITEMS

- Sessions held monthly at LiftOne locations on a rotating basis
- Additional sessions at Central Piedmont CC and Midlands Technical CC
- Offered to all lift truck users
- Primary audience is electric lift truck users, also fossil fuel users
- 2<sup>nd</sup> phase to include individuals

## Activities For Next Fiscal Year

1. Continue with Education Seminars
  - Broaden scope of attendees to include fossil fuel lift truck fleet operators, and local technical - community colleges.
  - Continued revision of seminar content as fuel cell technology evolves, infrastructure and cost effectiveness develops.
2. Continue with the Deployments
  - As the deployments commenced in April, it has been determined that the 9 month duration to complete the 6 site schedule would run through December 2009.
3. Publicize The Program and The Successes
  - Utilize the local media intrigue and trade publications.

# Summary

- The LiftOne Education Seminars are comprehensive and have been effective in increasing hydrogen awareness among the commercial communities in the LiftOne geographic regions.
- This information is extremely relevant, as the deployments are being conducted at real-world applications. Fuel cell power for lift trucks is a near term commercial market.
- Invaluable data has been, and will continue to be obtained through the ongoing series of 2 lift truck deployments.
- Performance data of the fuel cell power packs and lift trucks, and subsequent analysis, will allow for mid-program improvements and provide user input for modifications.
- Public awareness of the hydrogen fuel cell powered lift trucks has been greatly increased through local media outlets and trade publication articles.