

Fuel Cell Hybrids for Materials Handling

November 8, 2010



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Plug Power Develops and Sells Hybrid Fuel Cells Products

GenDrive™ Products

GenDrive™

Class 1
Sit-down Lift Trucks



GenDrive™

Class 2
Stand-up Reach Trucks

GenDrive™

Class 3
Rider Pallet Trucks



Focused on GenDrive, a Family of Products for the Materials Handling Market.

GenDrive™

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GenDrive: Customer Tested, Proven Performance

- Units in Operation:
 - >700
- Hours of Operation:
 - Over 2,000,000
- Availability of Class 3:
 - 99%+
- Hydrogen Refueling:
 - > 600/day
 - > 250,000 fueling events to date without incident
 - >300,000 kg dispensed



Customer Value



Class 1 Sit-down Lift Trucks



Class 2 Stand-up Reach Trucks



Class 3 Rider Pallet Trucks

- Fuel cell products power an expanding range of OEM lift trucks
- Products deliver
 - Increased vehicle performance and productivity
 - Reduced labor costs
 - Reduction in carbon emissions and other environmental benefits

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Energy Storage and Generation Technology within GenDrive

- GenDrive is a hybridized DC power source
 - PEM based hydrogen fuel cells are coupled with advanced energy storage systems to deliver DC power to the forklifts



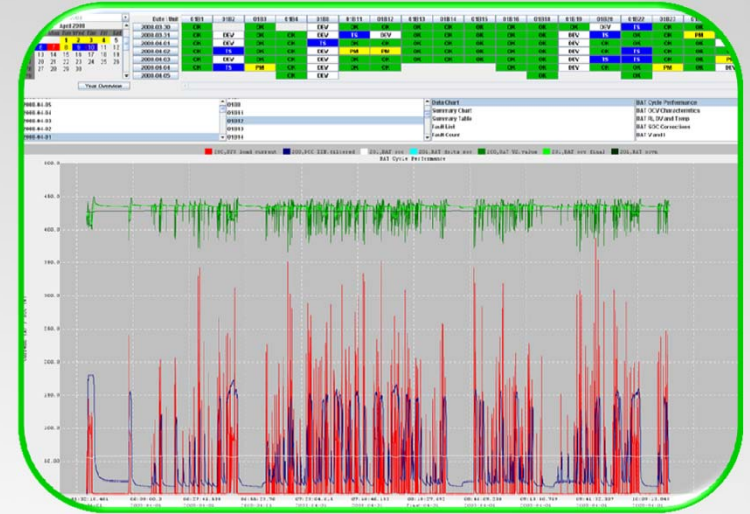
High Power Lithium Storage Battery System

- Plug Power has over 10 years experience in development of advanced battery systems.
- Development partnership in place with Citic Guoan MGL since 2008 for Lithium battery systems
- >800 lithium battery systems delivered to date for Plug Power GenDrive Systems
- Success of GenDrive Battery Pack Development has created interest from OEMs to development higher voltage pack for HD HEV applications.



Hybrid Strategy: Creates Value

- Coupling of high power lithium batteries with hydrogen fuel cells yields many advantages
 - Fuel cells maintain lithium SOC (output voltage) at optimum levels
 - Fuel cell dynamics are dampened
 - Performance of system not adversely affect by cold operating temperatures
 - Ability to run longer than a battery and refuel in 2 to 3 minutes



Impact of Deployment of GenDrive on US Electrical Grid

- Currently >700 GenDrive units deployed at 15 sites
 - ~2.0 million operating hrs
 - 350,000 kg hydrogen dispensed
 - 6.0 million kW-hr delivered to trucks
 - 10 Million kW-hr NOT supplied by grid.*
- By Dec 31, 2011
 - >2500 Systems installed
 - 13 MW generation capacity installed
 - ~125,000 MW-hr per day grid draw avoided
 - 17-20 MW peak capacity returned permanently to grid**

* Includes battery and charger losses

** Based on peak to average charger power consumption ratios



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Impact of Deployment of GenDrive on USA Electrical Grid

Long Term Impact on Grid

- 1.7 Million lift trucks in North America today
 - Combination of Electric and ICE
 - ~50% accessible to fuel cell conversion
- 4.5 GW installed FC output capacity
- ~22 GW-hr per day grid draw avoided*
- ~2.9 – 3.4 GW peak capacity returned to grid

Is This Significant?

- Current US capacity is **1,104,486 MW**
- 0.26% – 0.31% impact (Modest)
- But...impact on each customer can be significant

* Only includes electric trucks



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How Does a Customer Extract Value for Grid Impacts?

- Capital Incentive Programs for Energy Efficiency or Energy use reduction
 - Example: Power Smart, BC
 - Will pay up front for permanently removed loads
 - Customer with 100 trucks could received up to \$300,000 incentive to adopt
 - Similar programs exist regionally in US, ie California
 - Not as structured or generous. Some issues with perception of fuel switching
- Other programs exist for voluntary peak load shedding
 - Many variants, but opportunities likely exist for most industrial customers
- Reduction in Peak Energy Demand Charges
 - Significant component of most industrial electricity bills
 - Inclusion can change the economic decision of a customer with a marginal value proposition

Example of Impact to Illinois Customer

- Food Distributor operates 90 Class 3 and 35 Class 2 lift trucks
- Replacement of batteries and chargers with GenDrive results in
 - Reduction of 806 kW from peak demand (-47%)
 - Reduction of 160,000 kW-hr usage per month (-19%)
- Reduced demand has 2 positive benefits for this customer
 - Reduces demand portion of Electrical Bill by 47%
 - Lowers cost per kW-hr of electricity for remaining 81% of usage
 - Total Bill lowered by 29% compared to 19% reduction in usage
- Including the impacts of peak demand can make difference to outcome of Value Proposition analysis

We are just starting to understand the ways in which GenDrive adoption will positively impact the US grid and how customers will benefit.

THANK YOU!

HEADQUARTERS

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