DOE Hydrogen and Fuel Cells Program Record		
Record #: 18002	**Date:** 5/30/2018	
Title: Industry Deployed Fuel Cell Powered Lift Trucks		
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	DOE Funded[1] (ARRA) as of Record Date	DOE Funded[2-4] (Appropriations) as of Record Date	DOE Total	Industry-Funded Fuel Cell Shipments and Units On Order (U.S.)[2-9, 13-22] from 2009–Record Date	DOE and Industry Total from 2009–Record Date
Number of MHE Deployments (current and planned)	524	189	713	21,125	21,838

Fuel Cell Powered Lift Truck Deployment Data/Assumptions/Calculations:

Table 1: Number of fuel cell deployments (shipped and on-order) for applications in material handling equipment (MHE).

Cumulative MHE deployments (units shipped and on-order) though yearend 2017 total 21,838 units and equate to more than 140,000 kW of fuel cell systems.[i] The MHE deployments include 713 MHE fuel cell units cost shared by industry and U.S. Department of Energy (DOE) funds which led to 21,125 MHE fuel cell units with no DOE funding.

[i] Estimated total kW of fuel cell systems deployed assumes a capacity of 6.5 kW for each MHE unit. This is the average of 3 kW and 10 kW system sizes based on NREL analysis indicating that the distribution of MHE units is evenly split between Type I/II (10 kW) and Type III (3 kW) units. Information on system sizes is supported by NREL report, "An Evaluation of the Total Cost of Ownership of Fuel Cell-Powered Material Handling Equipment": https://www.energy.gov/sites/prod/files/2014/03/f10/fuel_cell_mhe_cost.pdf

Total DOE American Recovery and Reinvestment Act (ARRA) investment for the 713 fuel cell powered lift trucks is about $9.7M, with an industry cost share of $11.8M.[ii] The DOE Fuel Cell Technologies Office (FCTO) has estimated that the successful results demonstrated by the initial fuel cell powered lift trucks deployed with DOE cost-share has led to more than 21,000 orders/deployments with no DOE funding. As industry continues to place orders and deploy units, DOE will revise its records and determine actual orders filled/units commissioned as a result of initial DOE funding (Market Transformation and ARRA projects).

Deployment Highlights:

As of today, examples of companies that have purchased or ordered fuel cell powered lift trucks are as follows:

Ace Hardware	Golden State Foods	Stihl
Amazon	IKEA	Sysco Foods
BMW Manufacturing Co.	Kimberly-Clark/GENCO	Testa Produce
Canadian Tire	Kroger Co.	Unified Grocers
Central Grocers	Lowes	United Natural Foods, Inc. (UNFI)
Coca-Cola	Martin-Brower	U.S. Foodservice
CVS	Mercedes	Walmart
EARP Distribution	Nestle Waters	Wegmans
East Penn Manufacturing	Nissan North America	Whole Foods Market
FedEx Freight	Proctor and Gamble	WinCo Foods, LLC

Major developments during 2017 are highlighted by announcements by Plug Power involving agreements with Walmart and Amazon. Plug Power has announced a new collaboration agreement with Walmart to facilitate expansion of their relationship. Plug Power also has announced an agreement with Amazon to deploy fuel cells to power forklifts in their fulfillment centers, as well as a technology collaboration agreement.[iii]

[ii] ARRA funding supported deployments in MHE for: FedEx Freight East; GENCO with deployments at Coca Cola, Kimberly Clark, Sysco Philadelphia, Wegmans, and Whole Foods Market; Nuvera Fuel Cells with deployments at H-E-B Grocery. Funds included units as well as other aspects of the projects such as infrastructure, training, installation, data collection, analysis, and reporting.

[iii] http://s21.q4cdn.com/824959975/files/doc_financials/2017/Q4/investor-letter-fourth-quarter-2017.pdf

Fuel cell forklift deployments continue to grow in foreign markets. In Europe, French supermarket chain Carrefour, a global leader in food retail, is deploying fuel cells, adding 80 additional units during 2017. Plug Power and Toyota Material Handling Norway also announced a new agreement to deploy fuel cell lift tucks to Asko, a leading Norwegian grocery wholesaler.[iv] In Japan, Toyota Motor Corporation has increased its deployment of fuel cell forklifts at its Motomachi Plant, located in Toyota City, Aichi Prefecture, from 2 to 22 units. These fuel cell forklifts are manufactured by Toyota Industries. Toyota Motor Corporation has also built a hydrogen station for designated use by fuel cell forklifts at the plant.[v]

Hyster-Yale Materials Handling (Hyster), a leading provider of heavy-duty lift trucks, continues to be involved in fuel cell forklifts through its Nuvera subsidiary. In its 2017 annual report, Hyster has announced the transition of manufacturing from Nuvera to its Lift Truck business unit, including plans to move production of fuel cell power systems Nuvera's facility in Massachusetts to an existing Lift Truck facility in North Carolina. Nuvera will continue to focus on fuel cell systems for applications inside and beyond the lift truck market, including support of Hyster's announced heavy-duty lift truck electrification by developing fuel cell drivetrains for selected heavy-duty products.[vi] This promises the potential for fuel cell powered heavy-duty products to displace diesel-powered products at ports and heavy industrial sites.[vii]

Note that the federal fuel cell investment tax credit (ITC), which had expired in December 2016, was reinstated through the Bipartisan Budget Act of 2018, which was passed into law earlier this year. This law, in effect until 2022, allows qualified purchasers to receive a 30% tax credit on their purchases of fuel cell devices.[viii]

Based on OEM feedback, it was determined that their purchase orders for deployments were considered either directly or indirectly due to results of the DOE FCTO and ARRA demonstration projects of fuel cell MHE. In some instances, companies increased the number of purchases beyond those with DOE funding assistance. In other instances, the OEMs were able to show the business case using data collected from DOE projects and obtained purchase orders with no DOE funding. The list only includes deployments that can be traced to DOE FCTO involvement.

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[iv] http://s21.q4cdn.com/824959975/files/doc_financials/2017/Q3/investor-letter-third-quarter-2017.pdf
[v] https://www.automotiveworld.com/news-releases/toyota-accelerates-use-hydrogen-plants-2/
[vi] http: https://www.hyster-yale.com/news-room/news-releases/news-details/2018/Hyster-Yale-Materials-Handling-Announces-Fourth-Quarter-And-Full-Year-2017-Results/default.aspx
[vii] http://www.hyster.com/emea/en%E2%80%90gb/press/press%E2%80%90releases/hyster-to-electrify-big-trucks/
[viii] https://fuelcellsworks.com/news/budget-deal-reinstates-fuel-cell-investment-tax-credit

2. “State of the States: Fuel Cells in America 2012,” September 2012: http://www.renewableenergyfocus.com/view/27921/doe-issues-state-of-the-states-2012-report-on-fuel-cells-in-america/

3. “Direct Methanol Fuel Cell Material Handling Equipment Deployment,” May 15, 2013: http://www.hydrogen.energy.gov/pdfs/review13/mt004_ramsden_2013_o.pdf

4. “Beyond Demonstration: The Role of Fuel Cells in DoD’s Energy Strategy,” 2011: http://www.lmi.org/News---Publications/publications/publication-detail.aspx?id=371

5. “The Business Case for Fuel Cells 2012: America’s Partner in Power,” 2012: Footnote 5: https://www.energy.gov/sites/prod/files/2014/03/f11/business_case_fuel_cells_2012.pdf

6. “Plug Power Investor Presentation,” June 2013: http://s21.q4cdn.com/824959975/files/doc_presentations/2013/148744.pdf

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9. “HyGear delivers hydrogen system for forklift trucks,” October 3, 2013: http://www.gasworld.com/news/hygear-delivers-hydrogen-system-for-forklift-trucks/2002799.article

10. “Ballard Announces Commitment From Plug Power to Purchase 3,250 Fuel Cell Stacks Thru 2012,” July 19, 2011: https://www.prnewswire.com/news-releases/ballard-announces-commitment-from-plug-power-to-purchase-3250-fuel-cell-stacks-thru-2012-125829038.html

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