XII.0 American Recovery and Reinvestment Act Activities

INTRODUCTION

In April 2009, the U.S. Department of Energy (DOE) announced the investment of $41.6 million in American Recovery and Reinvestment Act (Recovery Act) funding for fuel cell technologies. These investments were made to accelerate the commercialization and deployment of fuel cells and to spur the growth of a robust fuel cell manufacturing industry in the United States, with accompanying jobs in fuel cell manufacturing, installation, maintenance, and support services. Twelve grants were awarded to develop and deploy a variety of fuel cell technologies, including polymer electrolyte membrane, solid oxide, and direct-methanol fuel cells in auxiliary power, backup power, combined heat and power (CHP), material handling equipment, and portable-power applications. The cost share provided by the project teams is about $54 million, more than 56% of the total cost of the projects.

All Recovery Act project teams submit quarterly reports, which are available to the public through the Recovery.gov website. These reports include technology and deployment status as well as data on jobs created and funds spent. Collection and analysis of operational data from the fuel cell deployments are being performed by the National Renewable Energy Laboratory's (NREL's) Hydrogen Secure Data Center (HSDC) to assess the performance and commercial readiness of the fuel cell technologies. Data are aggregated across multiple systems, sites, and teams, and are made available on a quarterly basis through composite data products (CDPs), published on NREL's website. Fifteen presentations containing all CDPs have been published thus far, with the latest CDPs including performance, reliability, maintenance, and safety data for material handling equipment and backup power.

GOALS & OBJECTIVES

The Recovery Act fuel cell projects are addressing the objectives stated above as well as the overall Recovery Act goals of creating new jobs and saving existing ones, spurring economic activity, and investing in long-term economic growth. These deployments have also required project teams to address key challenges, including siting and permitting, fueling infrastructure, and fuel cell lifetime and reliability (Figure 1). These deployments have also attracted significant attention, with media events taking place at three of the Recovery Act deployment sites.

FISCAL YEAR (FY) 2012 STATUS AND PROGRESS

As of October 2012, more than 500 fuel cell lift trucks and more than 690 fuel cell backup power systems for cellular communications towers and stationary backup power systems had been deployed—surpassing the original deployment goal of up to 1,000 fuel cells—and over 90% of the Recovery Act project funds had been spent by the projects. NREL's HSDC has established data reporting protocols with each of the project teams. CDPs and detailed data products showing progress to date have been prepared. The CDPs are available on the NREL HSDC website, http://www.nrel.gov/hydrogen/proj_fc_market_demo.html. Of the original 12 projects, four have been successfully completed.

The Hydrogen Safety Panel has made four deployment site visits with at least one more planned and has reviewed the safety plans for each project. In addition, Sandia National Laboratories (funded through the Safety, Codes and Standards sub-program) continues to perform testing and analysis on the material handling equipment hydrogen tanks to facilitate market entry for fuel cell powered lift trucks.[1] Results from these tasks

[1] "R&D for Safety Codes and Standards: Materials and Components Compatibility," Brian Somerday, Safety, Codes and Standards Chapter of this volume.

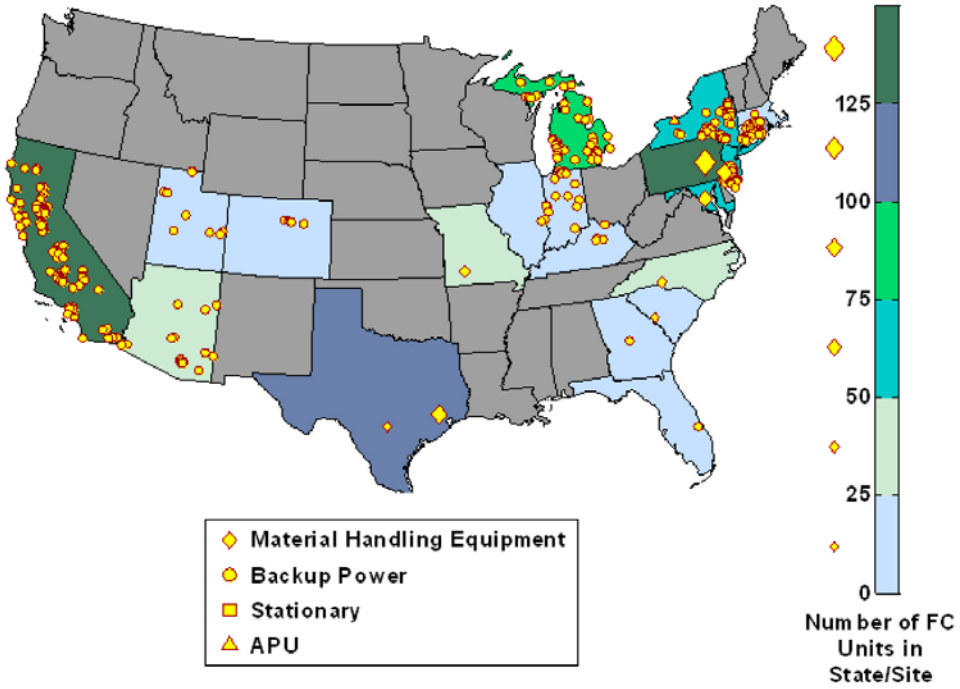


FIGURE 1. DOE Recovery Act–funded fuel cell deployment locations.

are being used to inform the Canadian Standards Association HPIT1 and SAE J2579 working documents for performance testing.

Auxiliary Power

Delphi Automotive (Troy, Michigan and Rochester, New York): Delphi is developing a 3- to 5-kW solid oxide fuel cell (SOFC) auxiliary power unit (APU) for heavy-duty commercial Class-8 trucks at their laboratory in Rochester, New York. Delphi will test and demonstrate the diesel APU in a high visibility fleet vehicle that will provide power for vehicle hotel loads and other vehicle needs under real-world operating conditions. The primary focus will be accelerating the development and acceptance of the APU by the Class-8 heavy-duty truck market. Delphi Automotive Systems has initiated the system and subsystem vibration analysis and has completed over 20% of their planned thermal cycle testing on their A-Level SOFC APU. They have also conducted initial road testing, driving >3,000 miles with the unit mounted on a Peterbilt Class-8 truck. A new stack with improved system efficiency and new endothermic reformer with improved heat transfer and lower cost have been integrated into the B-Level, next-generation system. Over the next year Delphi will begin monitoring the SOFC APU performance in an on-road, real-world demonstration.

Backup Power

Sprint Nextel Inc. (Reston, Virginia): Sprint is demonstrating the technical and economic viability of deploying 1- to 10-kW polymer electrolyte membrane (PEM) hydrogen fuel cells with 72 hours of on-site fuel storage (using a new Medium Pressure Hydrogen Storage Solution with on-site refueling) to provide backup power for critical code division multiple access cell sites on the Sprint Wireless network. Over 250 new hydrogen fuel cell systems will be deployed at sites in California, Connecticut, New Jersey, and New York. Sprint has completed over 670 site surveys at potential deployment sites for their fuel cell backup-power systems. They had installed and commissioned more than 310 new PEM backup-power fuel cells at 172 sites as of June 2012, with an additional 88 sites expecting fuel cells over the next year.

Plug Power Inc. (Latham, New York): Plug Power has been demonstrating the market viability of low-temperature, 6-kW PEM GenCore® fuel cells fueled by liquid petroleum gas to provide clean and reliable primary power and emergency backup power (72 hours or more). They will install and operate 20 fuel cell systems at Fort Irwin in Barstow, California, and Warner Robins Air Force Base (WRAFB) in Warner Robins, Georgia. These units will run continuously on liquid petroleum gas, providing power to the grid and will switch to emergency backup power during a grid failure. A small battery pack will be used to accommodate spikes in power demand. As of June 2012, the 10 GenCore® fuel cells installed at the Warner Robins Air Logistics Center at WRAFB have generated about 39 MWh of power at an average efficiency of approximately 24%. The units are providing backup power for lighting within the building. Plug Power plans to install 10 additional fuel cells at an engineering building at Fort Irwin in Barstow, California, in FY 2012.

Combined Heat and Power

Plug Power Inc. (Latham, New York): Plug Power has been evaluating the performance of high-temperature, natural gas-fueled, 5-kW micro-CHP fuel cell units (GenSys Blue®). The objective of the project is to validate the durability of the fuel cell system and verify its commercial readiness. Six units have undergone internal Plug Power testing to estimate failure rates, and three units were installed and tested in a real-world environment at the National Fuel Cell Research Center at the University of California, Irvine. These systems have logged over 34,000 hours in two years and have met their 30% electrical efficiency and 99% heat availability targets. Due to membrane electrode assembly supply and quality issues, Plug Power did not meet the durability target of >8,700 hours per unit. Plug Power has since transferred the role of deploying units at customer sites in California to ClearEdge Power, Inc. Over the next year, two additional fuel cell systems will be deployed.

Fuel Cell Powered Lift Trucks

FedEx Freight East (Harrison, Arkansas): FedEx deployed 35 Class-1 fuel cell systems as battery replacements for a complete fleet of electric lift trucks at FedEx's service center in Springfield, Missouri. Success at this service center may lead to further fleet conversions at some or all of FedEx's other 470 service centers. FedEx deployed their fleet of lift trucks in June 2010, at their 53,000-square-foot distribution center in Springfield, Missouri. Due to the favorable operational results, they purchased an additional five fuel cell lift trucks, *without any additional DOE funding.* As of June 2012, the lift trucks had accumulated over 90,000 hours of operation and used over 29,200 kilograms of hydrogen. FedEx has seen 125% more operating hours in between repairs for fuel cell lift trucks than for propane-powered internal combustion engine lift trucks. Over the next year FedEx will continue to monitor the performance of their fuel cell lift truck fleet.

GENCO (Pittsburgh, Pennsylvania): GENCO deployed 357 Class-1, Class-2, and Class-3 fuel cell systems as battery replacements for fleets of electric lift trucks at five existing distribution centers (Coca Cola in Charlotte, North Carolina; Kimberly Clark in Graniteville, South Carolina; Sysco Foods in Philadelphia, Pennsylvania; Wegmans in Pottsville, Pennsylvania; and Whole Foods Market in Landover, Maryland). Success at these distribution centers may lead to further fleet conversions at some or all of GENCO's other 109 distribution centers. Some of the fuel cell units at the Wegmans site have already accumulated over 9,000 hours of operation.

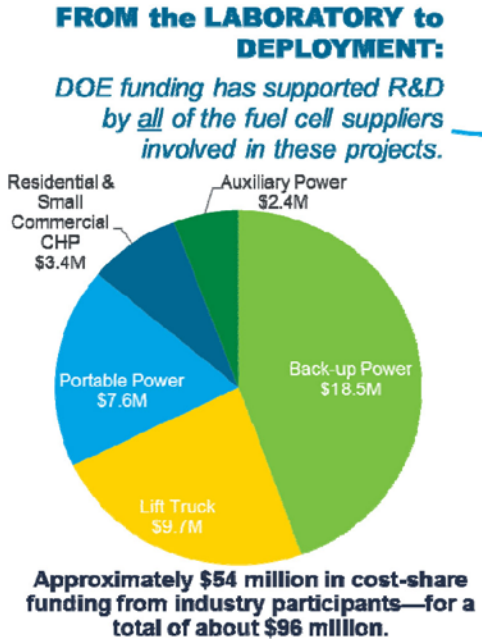
Sysco Houston (West Houston, Texas): Sysco Houston deployed 98 Class-2 and Class-3 fuel cell systems as battery replacements for a fleet of lift trucks at Sysco's new 585,000 square foot food distribution center in Houston, Texas, opened in March 2010. This installation was the first-ever greenfield installation without prior battery infrastructure for a pallet truck fleet. Success at this distribution center has led to further fleet conversions at some of Sysco's other 169 distribution centers. By the end of FY 2012, the lift trucks had accumulated over 790,000 hours of operation, and refueling operations had supplied the lift trucks with more than 66,000 kilograms of hydrogen. While Sysco Houston is currently not experiencing any difference in cost between charging batteries and fueling with hydrogen, they are saving nearly $100,000 annually in fewer

man-hours spent refueling lift trucks compared with swapping batteries. Based in part on the success of this deployment site, Sysco Corporate is planning to replace about 1,800 batteries with 900 or more fuel cells at seven sites over the next 24 months—*with no additional DOE funding.*

Data Collection & Analysis

National Renewable Energy Laboratory (Golden, Colorado): NREL is analyzing operational data (operation, maintenance, and safety) from the Recovery Act fuel cell deployments to better understand and highlight the business case for fuel cell technologies. Data collected by the project partners is being stored, processed, and analyzed in NREL's HSDC. Reports on the technology status are generated on a quarterly basis, while technical composite data products are published every six months. NREL has published nine deployment-focused CDPs and four cycles of technical CDPs—currently composed of 63 CDPs for material handling equipment and 13 CDPs for backup power. In addition, they have provided hundreds of detailed data results to the individual projects. NREL has created a website to host these published results and presentations. Over the next year, they plan to continue collecting and analyzing Recovery Act deployment data and publishing the results on their website.

BUDGET



COMPANY	AWARD	APPLICATION
Delphi Automotive	$2.4 M	Auxiliary Power
FedEx Freight East	$1.3 M	Lift Truck
GENCO	$6.1 M	Lift Truck
Jadoo Power	$2.2 M	Portable
MTI MicroFuel Cells	$3.0 M	Portable
Nuvera Fuel Cells	$1.1 M	Lift Truck
Plug Power, Inc. (1)	$3.4 M	CHP
Plug Power, Inc. (2)	$2.7 M	Back-up Power
Univ. of N. Florida	$2.4 M	Portable
ReliOn, Inc.	$8.5 M	Back-up Power
Sprint Nextel	$7.3 M	Back-up Power
Sysco of Houston	$1.2 M	Lift Truck

FY 2013 PLANS

Continued data collection on performance and productivity at the various deployment sites is a priority for FY 2013. In FY 2013, deployment of over 100 additional fuel cell systems for APUs, backup power installations, and CHP applications is anticipated. All projects will conclude by the end of FY 2013.

Finally, in FY 2013, DOE will continue to document the lessons learned associated with the Recovery Act projects, including strategies developed for market entry and management of risks relating to safety, environmental, and siting requirements. EERE will finalize its evaluation of early-stage "market change" impacts (for the period of 2010 through the end of 2012) of the Recovery Act fuel cell deployments.

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