X.0 American Recovery and Reinvestment Act Activities

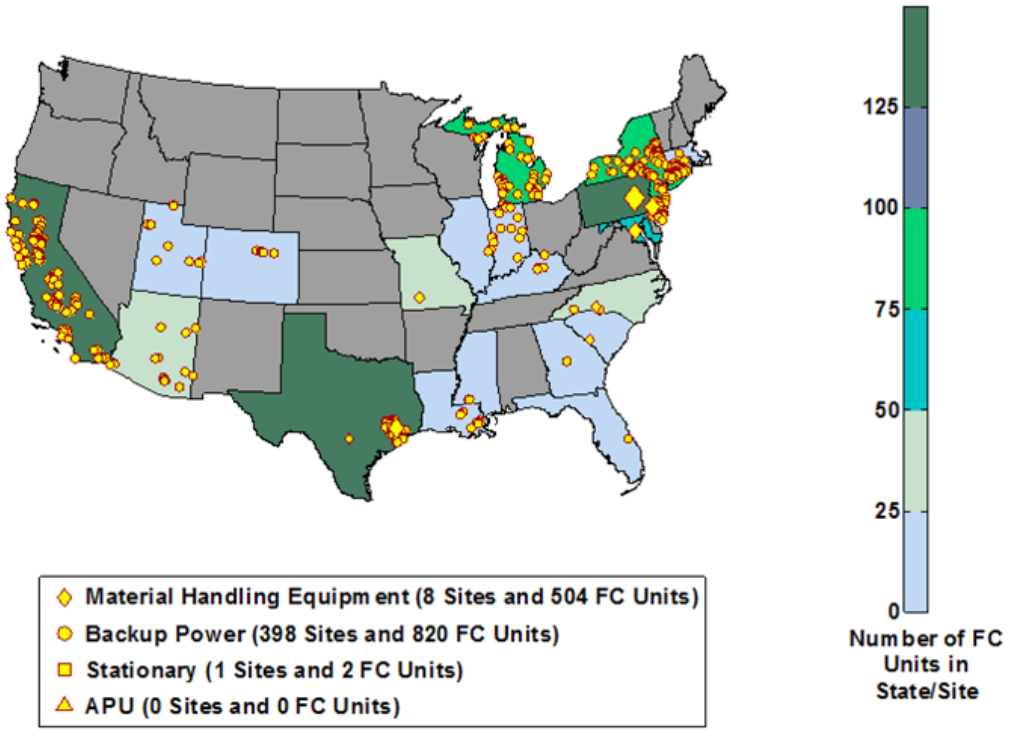
INTRODUCTION

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 (PEM), solid oxide, and direct-methanol fuel cells in auxiliary power, backup power, combined heat and power, material handling equipment, and portable-power applications. The cost share provided by the project teams is over $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) National Fuel Cell Technology Evaluation Center (NFCTEC), formerly the Hydrogen Secure Data Center, 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. Seventeen 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. These deployments have also attracted significant attention, with media events taking place at three of the Recovery Act deployment sites.



DOE Recovery Act-Funded Fuel Cell Deployment Locations

FISCAL YEAR (FY) 2013 STATUS AND PROGRESS

As of October 2013, more than 500 fuel cell lift trucks and a total of 820 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 95% of the Recovery Act project funds had been spent by the projects. NREL's NFCTEC 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 NFCTEC website, http://www.nrel.gov/hydrogen/proj_fc_market_demo.html. Of the original twelve projects, nine have been successfully completed.

Auxiliary Power

Delphi Automotive (Troy, MI and Rochester, NY): Delphi has been 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, demonstrating the potential of the SOFC APU as an anti-idle solution for truck manufacturers and their fleet owners. During SOFC APU testing, Delphi discovered a significant issue with the desulfurizer during repeated thermal cycles. As trials of alternative desulfurizer materials failed to meet requirements, Delphi opted to remove the desulfurizer from the system, providing a lower net power unit as designed with the volume for the desulfurizer bed not utilized. Delphi demonstrated 3.5 kW net power with zero sulfur fuel and 2.0 kW net power with ultra-low sulfur diesel fuel which is regulated to contain <15 ppm sulfur. Delphi completed vehicle demonstration testing with the APU operating in a typical driver usage scenario by providing power for rest stops and overnight cabin comfort and power demands. This project has been completed.

Backup Power

Sprint Nextel, Inc. (Reston, VA): Sprint is demonstrating the technical and economic viability of deploying 1- to 10-kW PEM hydrogen fuel cells with 72 hours of onsite fuel storage (using a new Medium Pressure Hydrogen Storage Solution with onsite refueling) to provide backup power for multiple access cell sites on the Sprint Wireless network. Deployments were planned for 260 new hydrogen fuel cell systems at sites in eight different states. Sprint has completed over 736 site surveys at potential deployment sites for their fuel cell backup-power systems. As of June 2013, Sprint had installed and commissioned 501 new PEM backup-power fuel cells at 260 sites.

Plug Power Inc. (Latham, NY): Plug Power has been demonstrating the market viability of low-temperature, 6-kW PEM GenCore® fuel cells fueled by liquid petroleum gas (LPG) to provide clean and reliable primary power and emergency backup power (72 hours or more). The objective of this project was to install and operate 20 fuel cell systems at Fort Irwin in Barstow, CA, and Warner Robins Air Force Base in Warner Robins, GA. These units run continuously on LPG, providing power to the grid and switching to emergency backup power during grid failure. A small battery pack is used to accommodate spikes in power demand. As of April 2013, the 10 GenCore® fuel cells installed at the Warner Robins Air Logistics Center at Warner Robins Air Force Base generated about 39 MWh of power at an average efficiency of approximately 25.4%. The units were providing backup power for lighting within the building. Plug Power has installed 10 additional fuel cells at an engineering building at Fort Irwin. These 10 additional systems should be operational in late 2013.

Combined Heat and Power

Plug Power Inc. (Latham, NY): Plug Power has been evaluating the performance of high-temperature, natural gas-fueled, 5-kW micro-combined heat and power 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 31,000 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. Two ClearEdge units were installed in California in 2012 and have completed the year of operation. Both units operated successfully with one achieving greater than 92% availability and one achieving greater than 95% availability. Combined, the two units produced 65.5 MWh of electricity and 74.7 MWh of heat. This project has been completed.

Portable Power

Acumentrics (Westwood, MA): Acumentrics is developing portable, propane-fueled SOFC generators as potential replacement for traditional gas/diesel generators. The project was originally led by Jadoo Power but was novated to Acumentrics in June of 2013. Two 1,000-W cart-mounted and two 250-W man-portable SOFC units fueled by propane will be demonstrated for three weeks at NASCAR events in Daytona, Florida in February of 2014. The demonstrations will include sufficient operating hours and start-up/shut-down cycles with data collection such that overall power, fuel efficiency, and noise of operation can be evaluated and compared with conventional technologies.

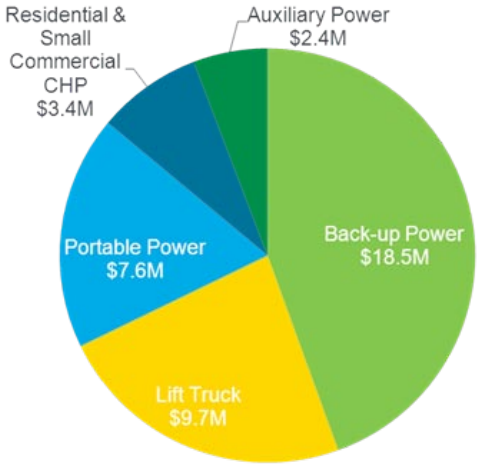
Data Collection & Analysis

National Renewable Energy Laboratory (Golden, CO): 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 NFCTEC. Reports on the technology status are generated on a quarterly basis, while technical composite data products are published every six months. NREL has published ten deployment-focused CDPs and seven cycles of technical CDPs—currently composed of 72 CDPs for material handling equipment and 21 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. Analysis and publication of Recovery Act deployment data will continue in FY 2014.

BUDGET

FROM the LABORATORY to DEPLOYMENT:

DOE funding has supported R&D by all of the fuel cell suppliers involved in these projects.



Approximately $54 million in cost-share funding from industry participants—for a total of about $96 million.

COMPANY	AWARD	APPLICATION
Delphi Automotive	$2.4 M	Auxiliary Power
FedEx Freight East	$1.3 M	Lift Truck
GENCO	$6.1 M	Lift Truck
Acumentrics	$2.2 M	Portable
MTI MicroFuel Cells	$3.0 M	Portable
Nuvera Fuel Cells	$1.1 M	Lift Truck
Plug Power, Inc.	$3.4 M	CHP
Plug Power, Inc.	$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 2014 PLANS

All on-going projects will complete deployment activities in 2013 or 2014.

Finally, in FY 2014, the Fuel Cell Technologies Office 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. The Office 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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