Fuel Cell Technologies ARRA Project:
Hydrogen Fuel Cells: Enabling Market Transformation and Manufacturing

Sara Dillich

2010 Annual Merit Review and Peer Evaluation Meeting
(8 June 2010)
Goals & Objectives

American Recovery and Reinvestment Act (ARRA) of 2009

Goals:

• Create new jobs as well as save existing ones
• Spur economic activity
• Invest in long-term economic growth
Goal:

Accelerate the commercialization and deployment of fuel cells and fuel cell manufacturing, installation, maintenance, and support services
Recovery Act Funding for Fuel Cells

More than $40 million from the 2009 American Recovery and Reinvestment Act to fund 12 projects to deploy up to 1,000 fuel cells

FROM the LABORATORY to DEPLOYMENT:

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

Approximately $51 million in cost-share funding from industry participants—for a total of about $93 million.

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>AWARD</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>Delphi Automotive</td>
<td>$2.4 M</td>
<td>Auxiliary Power</td>
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<tr>
<td>FedEx Freight East</td>
<td>$1.3 M</td>
<td>Specialty Vehicle</td>
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<tr>
<td>GENCO</td>
<td>$6.1 M</td>
<td>Specialty Vehicle</td>
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<td>Jadoo Power</td>
<td>$2.2 M</td>
<td>Backup Power</td>
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<td>MTI MicroFuel Cells</td>
<td>$3.0 M</td>
<td>Portable</td>
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<tr>
<td>Nuvera Fuel Cells</td>
<td>$1.1 M</td>
<td>Specialty Vehicle</td>
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<tr>
<td>Plug Power, Inc. (1)</td>
<td>$3.4 M</td>
<td>CHP</td>
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<tr>
<td>Plug Power, Inc. (2)</td>
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<td>Univ. of N. Florida</td>
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<tr>
<td>ReliOn Inc.</td>
<td>$8.5 M</td>
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<tr>
<td>Sprint Comm.</td>
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<tr>
<td>Sysco of Houston</td>
<td>$1.2 M</td>
<td>Specialty Vehicle</td>
</tr>
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ARRA Fuel Cell Units in Operation

DOE ARRA Funded Early Fuel Cell Markets: Units in Operation

Projected Operation Quantities

- APU
- Backup Power
- Forklift
- Stationary

Calendar Quarter

2009 Q4 2010 Q1 2010 Q2 2010 Q3 2010 Q4 2011 Q1 2011 Q2 2011 Q3

In Operation Quantity

0 200 400 600 800 1000 1200 1400

From National Renewable Energy Laboratory
Managing Risk

Risk Mitigation Strategies

• Completed initial NEPA review for all projects; site-specific NEPA reviews in progress for several projects.

• Developed and executed contingency plans for unexpected project terminations.

• Identified and are addressing safety concerns which may impact commercial acceptance of fuel cell systems.

• Identified and are tracking metrics needed to evaluate the performance of projects.
2010 Progress & Accomplishments

Fuel Cell Powered Lift Trucks Deployed First

- All 12 project grants in place
- Over 145 fuel cell powered lift trucks deployed*
- 36 jobs created or retained*
- Over 31% of funds costed*

- Siting and permitting activities initiated
- Safety Plans developed for all projects
- Review of Safety Plans and Site Visits by Hydrogen Safety Panel planned for 2010

* As of March 31, 2010
Addressing cyclic fatigue of steel tanks to provide technical basis for code language for H₂ powered industrial trucks (CSA HPIT1)

- Quantifiable data being collected for crack initiation, crack growth, leak before-burst, etc.
- Developing unified design methodologies for high cycle-life tanks

Next Steps: Risk analysis of indoor refueling and operation in support of NFPA-2 requirements development

More information in AMR progress report: “SCS005, Dedrick, SNL: Materials and Components Compatibility”
ARRA Hydrogen Fuel Cell Data

NREL Data Collection

Fuel Cell & Infrastructure Data to NREL’s Hydrogen Secure Data Center

Data includes operation, maintenance, safety, and hydrogen production

NREL Data Analysis - ARRA Deployments

- Independent technology **assessment**; focused on fuel cell system and hydrogen infrastructure: performance, operation, and safety
- **Leverage** data processing and analysis capabilities developed from the fuel cell vehicle Learning Demonstration project and DoD Forklift Demo
- Establish a **baseline** of real-world fuel cell operation and maintenance data and identify technical/market barriers
- **Support market growth** through analyses relevant to the **value proposition** and reporting on **technology status** to fuel cell and hydrogen communities and **stakeholders**

- Individual data analyses for each FC system and site
- Identify individual contribution to CDPs
- Only shared with partner who supplied data

**Composite Data Products (CDPs)**
- Aggregated data across multiple systems, sites, and teams
- Publish analysis results without revealing proprietary data

**Detailed Data Products (DDPs)**
Summary

**Off to a Good Start**

- Preliminary feedback suggests deployed fuel cell powered lift trucks already showing increases in productivity over batteries.
- Over 500 fuel cells for backup power in communication towers planned.
- Portable fuel cells for recharging consumer electronics have been redesigned for low-cost manufacturing and robust operations. Real-life field testing of units by end-users has been initiated.
- Potentially more than 1,000 fuel cells deployed in the market by 2012.

Left: MTI's portable fuel cell for recharging electronics such as a Blackberry or iPod.

Bottom: Communication tower with backup fuel cell power nearby.
Session Instructions

• This is a review, not a conference.
• Presentations will begin precisely at the scheduled times.
• Talks will be **20 minutes** and **Q&A 10 minutes**.
• Reviewers have priority for questions over the general audience.
• Reviewers should be seated in front of the room for convenient access by the microphone attendants during the Q&A.
• Please mute all cell phones, BlackBerries, etc.
Reviewer Reminders

• Deadline for final review form submittal is **June 18th**.

• ORISE personnel are available on-site for assistance. A reviewer lab is set-up in room 8216 and will be open Tuesday – Thursday from 7:30 AM to 6:00 PM and Friday 7:30 AM to 3:00 PM.

• Reviewer feedback session – **Thursday, at 5:45pm (after last ARRA Project)**, in this room.
ARRA Recovery Project Contacts

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