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## IX.0 Market Transformation Sub-Program Overview

### INTRODUCTION

The purpose of the Market Transformation sub-program is to spur market growth for domestically produced hydrogen and fuel cell systems. The Market Transformation sub-program is conducting activities to help promote and implement commercial and pre-commercial hydrogen and fuel cell systems in real-world operating environments and to provide feedback to research programs, U.S. industry manufacturers, and potential technology users. By supporting increased technology use in key early markets, this sub-program helps to identify and overcome non-technical barriers to commercial deployment and to reduce the life-cycle costs of fuel cell power by helping to achieve economies of scale. These early market deployments will also address other market acceptance factors resulting in further expansion of market opportunities.

The Market Transformation sub-program aims to replicate past successes in material handling equipment (MHE) (e.g., lift trucks) and emergency backup power applications that were part of the American Reinvestment and Recovery Act. For example, Market Transformation has new projects in applications including fuel cell-powered airport ground support baggage tractors and fuel cell electric medium-duty hybrid trucks for parcel delivery applications. These projects are highly leveraged, with an average of more than half of the projects' funds being provided by DOE's industry partners. Partners providing resources to these projects have shown a high level of interest in exploring these applications and markets, and this level of industry interest is very promising for the potential growth of the domestic fuel cell industry. Market Transformation also partners with other federal agencies and stakeholders to deploy fuel cell systems in applications such as marine cargo transport operations. Affordable hydrogen fuel in accessible locations is another key goal; Market Transformation is supporting this by a landfill-gas-to-hydrogen project at a working manufacturing facility and using renewable power to electrolyze water on another project.

### GOAL

Market Transformation activities provide financial and technical assistance for the use of hydrogen and fuel cell systems in early market applications, with the key goals of achieving sales volumes that will enable cost reductions through economies of scale, supporting the development of a domestic industry, and providing feedback to testing programs, manufacturers, and potential technology users.

### OBJECTIVES

The objectives of the Market Transformation sub-program are to:

- Evaluate performance against target metrics for emergency backup power, MHE, and light commercial/residential power systems and provide feedback to component suppliers regarding cost reduction opportunities.
- Test emerging approaches to grid management using renewable hydrogen.
- Advance the knowledge and expertise of waste-to-energy fuel, shipboard and truck auxiliary power units, fuel cell electric truck parcel delivery, and aviation ground support applications through targeted testing and evaluation efforts in coordination with the Technology Validation sub-program, and in partnership with the U.S. Navy, the U.S. Marine Corps, and civilian agencies such as the U.S. Department of Transportation's Maritime and Federal Aviation Administrations.
- Identify lessons learned from commercial use performance and promote the development of the most effective and applicable practices for hydrogen and fuel cell technologies.
- Conduct market transformation deployment projects to enable total life-cycle cost and performance of fuel cell-powered lift trucks and emergency backup power systems to be on par with conventional technologies by 2020.

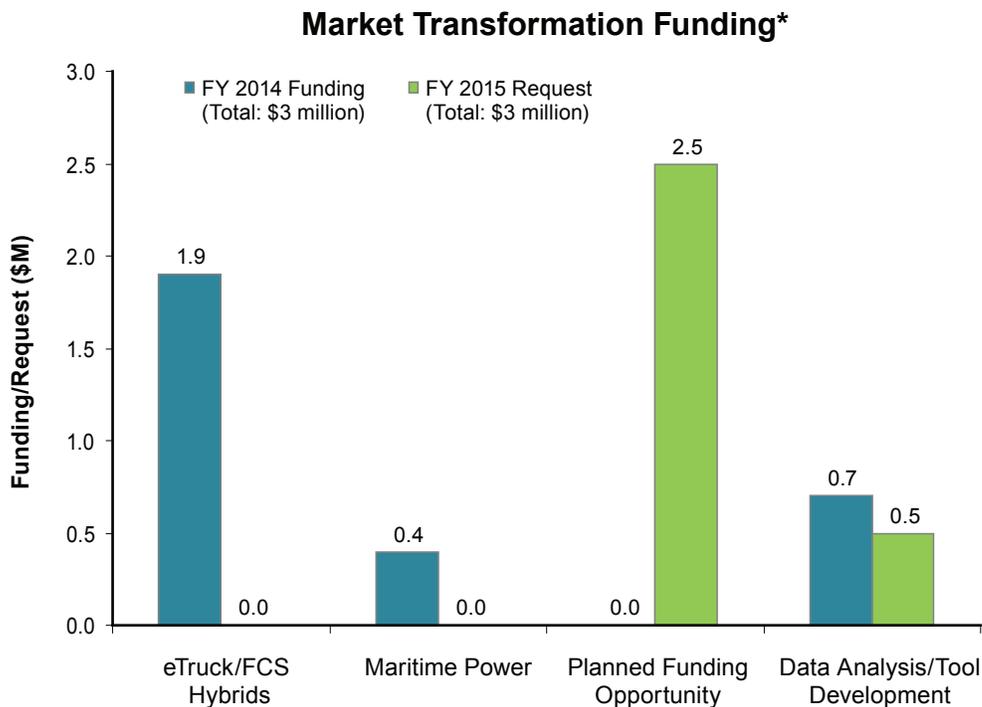
## FISCAL YEAR (FY) 2014 TECHNOLOGY STATUS AND ACCOMPLISHMENTS

Fuel cells have been enjoying growing success in key early markets, particularly in MHE (e.g., lift trucks) and backup power applications. The sub-program's early market deployment efforts—including Market Transformation funding and Recovery Act funding—have successfully catalyzed a significant level of market activity in these areas, which has been accompanied by substantial reductions in the price of fuel cells. The sub-program is actively pursuing additional opportunities for effective stimulation of market activity. Ongoing activities and additional areas of interest include the following:

- **Micro-CHP (combined heat and power):** To evaluate the market viability of fuel cells for small facilities, the sub-program is working with fuel cell developers and system users to demonstrate micro-CHP systems at five commercial facilities with 10 fuel cells deployed. Performance data was collected and analyzed for an average of 3,000 hours per system. Fuel cell technology changes were made specifically using phosphoric acid in place of high temperature polymer electrolyte membrane fuel cells. Also, a business case analysis was completed and reported. (Pacific Northwest National Laboratory, PNNL)
- **Hydrogen Energy Storage:** This project is supporting the demonstration of a hydrogen energy storage system as a grid management tool. While hydrogen produced from the system could be used in a variety of value-added applications, the initial phase of the project will use the hydrogen in fuel cell buses operated by the County of Hawaii Mass Transportation Agency and the National Park Service. This year partnering arrangements were finalized in preparation for installing and operating the system. (Naval Research Laboratory and the State of Hawaii)
- **South Carolina Landfill Gas Purification:** The sub-program has completed the demonstration of the business case and technical viability of using landfill gas as a source of renewable hydrogen production, using BMW's assembly plant in South Carolina as the host site. This project represents a first-of-its-kind landfill gas-to-hydrogen production project in the nation and is expected to serve as a model for future adoption of renewable biogas as a feedstock for hydrogen production. (South Carolina Hydrogen and Fuel Cell Alliance)
- **Ground Support Vehicles Demonstration:** This project is demonstrating the value proposition of using fuel cell-powered tow tractors as a cost-competitive and more energy-efficient solution compared to incumbent internal combustion engine-powered ground support vehicles. This effort will address concerns regarding the weatherproofing of fuel cell-powered ground support vehicles and enable end users at an operator terminal to accomplish their daily tasks while reducing consumption of gasoline and diesel fuels. This project was kicked off in Latham, New York, in March of 2013 and has completed systems design developments and prototype testing in preparations for building 15 units, and installing refueling equipment, and operating ground support vehicles at the Federal Express site in Memphis, Tennessee. (Plug Power)
- **Refrigerated Truck Auxiliary Power Units:** This project is demonstrating the use of fuel cell-powered refrigeration onboard food delivery trucks to reduce petroleum use and greenhouse gas emissions. Design development has been accomplished and a prototype unit has been assembled and is being tested. (PNNL)
- **Fuel Cells in Hybrid Electric Trucks:** The sub-program modeled the cost-benefit tradeoffs of adding a fuel cell to double the range of in production battery electric vehicles. A solicitation resulted in two projects being selected for demonstration of the parcel delivery transportation service application. (FedEx Express and United Parcel Service)

## BUDGET

FY 2014 appropriation for Market Transformation was \$3 million, and \$3 million was requested in FY 2015.



\* Subject to appropriations, project go/no-go decisions, and competitive selections. Exact amounts will be determined based on progress in each area.

## FY 2015 PLANS

In FY 2015, the sub-program will continue to document lessons learned associated with previously funded projects, including the strategies developed for market entry and for risk management with respect to safety, environmental, and siting requirements. Business analyses and case studies will be developed for new applications. Collection and evaluation of data from these projects will provide the basis for verifying the business cases for various early market fuel cell systems, as well as providing an assessment of the performance of these integrated systems. Data will be made publicly available so that more potential customers will become aware of the benefits of integrated hydrogen and fuel cell systems. In addition, a near-term priority will be to continue collaborating with other federal agencies—in accordance with existing interagency cooperative agreements such as the DOE-Department of Defense memorandum of understanding—to increase the use of fuel cells in market-ready applications and to increase awareness of the benefits of these deployments. A potential new activity that could be initiated subject to Congressional appropriations is the development and deployment of fuel cell and battery-powered hybrid light-duty vehicles for parcel delivery or passenger transportation applications.

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