Market Transformation

Market Transformation is based on the concept that federal support can catalyze a market to achieve economic and environmental benefits that can reduce costs through economies of scale. Adoption of fuel cells in emerging markets expands the growth of green jobs, with new opportunities in manufacturing, fuel cell maintenance and support systems, and domestic hydrogen fuel production and delivery. By providing reliable field operations data and increasing user confidence, early market deployments help overcome non-technical challenges like developing appropriate safety codes and standards and reducing high insurance costs.

Strategies

Market Transformation's primary goal is to accelerate the expansion of hydrogen and fuel cell use by lowering the life cycle costs of hydrogen and fuel cell technologies and identifying and reducing the barriers impeding full technology commercialization. The strategy is to:

- Use government as a test bed for early adoption of hydrogen and fuel cells
- Demonstrate the value proposition of hydrogen and fuel cells through collection and analysis of performance and cost data
- Develop models, tools, and templates for users to provide best practices in real-world implementation

Market transformation is built on forming partnerships with stakeholders throughout the country. These partners include technology project developers, vehicle manufacturers, federal, state and local government organizations, academia, and fuel cell users in industry. The collaborations have resulted in the deployment of thousands of fuel cells that are now demonstrating the use of these clean energy technologies to reduce greenhouse gases, reduce our Nation's use of petroleum, and increase our energy security.

Class III fuel cell powered lift truck at Sysco Houston distribution center in Houston, Texas. Sysco Houston.

Material Handling Equipment

Many leading American businesses are choosing fuel cells to power their material handling equipment (MHE) because of the productivity gains, lower cost, and performance advantages of fuel cell-powered lift trucks. When compared to typical battery-powered units, fuel cell lift trucks provide 80% lower refueling labor costs and require 75% less facility space for refueling, based on preliminary data collection and analysis by the National Renewable Energy Laboratory.[1] Fuel cell-powered lift trucks offer longer runtimes, constant power between refueling, rapid refueling time, and the opportunity for increased productivity. In high-throughput, multiple shift MHE operations, fuel cells can lower the total cost of ownership and provide a positive return on investment.

Fuel cell-powered MHE is already being used at dozens of warehouses, distribution centers, and manufacturing plants across the country. DOE funding supported fuel cell MHE operated by Sysco Foods, FedEx Freight, GENCO (at Wegmans, Coca- Cola, Kimberly Clark, and Whole Foods), and H-E-B Grocers. Combined, these projects have completed over 1.2 million hours of operation[2] and almost 200,000 refuelings.[3] ***Successful DOE-supported MHE projects have led to more than 3,500 additional fuel cell lift truck installations or orders by industry without any DOE funding.[4]***

Emergency Backup Power

Fuel cells are a viable option for emergency backup power, particularly for mission critical operations and telecommunications. Traditional backup power technologies used during power grid outages employ batteries or generators that operate on diesel, propane, or gasoline. Although these systems are well-established, concerns about noise, pollution, maintenance, and reliability are motivating many customers to seek alternatives that provide high reliability and durability at reasonable cost.

Currently there are over 2,000 telecommunication systems using fuel cells for backup power in the United States.[5] Fuel cells can offer significant cost advantages over battery-generator systems or battery-only systems when shorter run-time capability of three days or less is sufficient. In a study for the DOE, Battelle

A fuel cell CHP system provides primary power, heating, and cooling for Verizon's Central Office.

Memorial Institute analyzed lifecycle costs of backup power for wireless towers, comparing fuel cell power with 2 kW battery-only backup power of 8 hours and 5 kW battery-generator backup of 52, 72, and 176 hours.[6] On a lifecycle basis, fuel cells can provide service at lower total cost than batteries or battery-generator systems for all 4 runtime lengths when the current Federal tax incentive is included.

Other fuel cell advantages include the ability to remotely monitor the equipment, reduced space and weight requirements, longer lifetimes, and consistent power in extreme temperature conditions. Backup power fuel cells are modular and scalable from 1 to 10 kW and easily adaptable to different power needs unlike generators that have fixed power ranges. Fuel cells are quieter than generators and have no polluting air emissions.

PlugPower fuel cells provide reliable backup power to cell phone towers.

Increasingly, companies are installing fuel cells to generate onsite primary or backup power to buildings, data centers, and cell phone towers, because of their high reliability and no harmful emissions. To date, close to 700 fuel cells have been deployed to provide backup power. These successful projects have more than 800 hours of operation and have led to over 1,300 additional industry installations and on-order units without any DOE funding.[5]

DOD-DOE MOU

As part of an interagency partnership to strengthen American energy security and develop new clean energy technologies, the DOE and U.S. Department of Defense are testing how fuel cells perform in real world operations, identifying improvements manufacturers could make to enhance the value proposition, and highlighting the benefits of fuel cells for various applications.

Mobile Lighting and Mobile Generators

Mobile light towers are commonly used for road maintenance, general construction, and other industrial applications. Traditional diesel-based systems release harmful air contaminants and greenhouse gases that pollute the air and contribute to global warming. These incumbent technologies are also comparatively inefficient, noisy (creating potentially hazardous working conditions), and contribute to U.S. dependence on imported oil. In comparison, the fuel cell mobile light tower doesn't produce harmful emissions at the point of use, operates at nearly twice the efficiency of diesel systems with minimal noise, and reduces the nation's dependence on diesel fuel.

DOE has facilitated a collaboration of private companies spearheaded by Sandia National Laboratory to commercialize a clean technology alternative to incumbent diesel-powered equipment. The group's objective was to demonstrate fuel cell-powered mobile light towers in real world operating environments, including road construction, airports, and entertainment industry deployments. The

Fuel cell backup power at Fort Sumter National Monument in South Carolina.

light tower has been successfully used at many high-profile events, including the Academy Awards, the Golden Globe Awards, the Screen Actors Guild Awards, and the Grammy Awards. Stakeholders supporting the project include Multiquip Inc., Altergy Systems, Boeing, the Caltrans Division of Research and Innovation, Stray Light Optical Technologies, and Luxim Inc.

Renewable Hydrogen Energy Storage Project

DOE and the Naval Research Laboratory are collaborating with the University of Hawaii's Hawaii Natural Energy Institute on a project to demonstrate hydrogen energy systems as a grid management tool to mitigate the impacts of renewable energy generation variability on an electrical grid. The program will analyze and demonstrate the use of water electrolysis as a control tool to provide grid services such as off-peak load leveling thereby relieving curtailment of renewable energy. The hydrogen produced will be used to fuel hydrogen-powered buses operated by the County of Hawaii Mass Transportation Agency and the National Park Service. This integrated system has the potential to optimize use of renewable energy resources while reducing barriers to the introduction of hydrogen infrastructure in Hawaii.

Landfill Gas Purification Project

Supported by the Fuel Cell Technologies Office, South Carolina's Advanced Technology Institute project is validating

Fuel cell mobile lighting tower at the 2011 Golden Globes Awards ceremony.

the commercial business case and demonstrating the technical viability to use landfill gas as a cost-effective source of renewable hydrogen production that could be scaled up and deployed to fuel a significant number (>300) of fuel cell-powered material handling equipment. The host site of this project is the BMW assembly plant in Greer, South Carolina.

Small Combined Heat and Power (CHP)

Pacific Northwest National Laboratory (PNNL) is collecting data from 5 kW CHP systems at 10 business locations in California and Oregon. Host sites include a grocery store, a greenhouse retailer, a hotel, and a community college. The CHP systems are manufactured by ClearEdge Power of Hillsboro, Oregon. PNNL will monitor the systems and measure the energy savings the systems are expected to provide. Small CHP systems have the potential to provide significant energy savings for light commercial buildings with high energy demands, potentially reducing the fuel costs and carbon footprint of a commercial building by 40 percent compared with conventional electricity and heat use. The electricity provided by the natural gas-fueled systems is used to power the building, and the excess heat generated by the fuel cell is released into heating and ventilation systems to provide space heating. Alternatively, the heat can be used for hot water or other needs for the facility. Excess electricity produced by the CHP system can be sold back to the local utility company.

The Fuel Cell Technologies Office's Market Transformation activities are aimed at accelerating early market adoption and advancing pre-competitive technologies. As these near-term technologies reach maturity and full commercialization, federal RD&D efforts will transition to industry to make ongoing refinements and improvements. A longer-term effort in RD&D for hydrogen fuel technologies is envisioned to enable the fullest realization of the benefits of fuel cell technologies.

For More Information

For more information, visit http://www.hydrogenandfuelcells.energy.gov.

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