Market Transformation

Market Transformation is based on the concept that federal support can catalyze a market to achieve economic benefits that can reduce lifecycle 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 applying appropriate safety codes and standards and reducing operating 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 2.6 million hours of operation[2] and 350,000 refuelings.[3] ***Successful DOE-supported MHE projects have led to more than 11,000 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.

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, National Renewable Energy Laboratory analyzed lifecycle costs of backup power for wireless towers, comparing fuel cell

power with diesel and battery backup power. On an annual cost of ownership basis, fuel cells are now becoming competitive with these incumbent technologies.[5]

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.

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. Close to 700 fuel cells were deployed by DOE with industry support to provide backup power. These successful projects have more than 800 hours of operation and have led to over 6,900 additional industry installations and on-order units without any DOE funding.[6]

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.

Sprint uses fuel cells to provide backup power to their cell phone towers.

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 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.

Maritime Fuel Cell Generator Project

Fuel costs and emissions in maritime ports are an opportunity for transportation energy efficiency and emissions reduction efforts. For example, a 2004 study showed the Port of Los Angeles had average daily emissions exceeding that of 500,000 vehicles.[6] Diesel fuel costs continue to rise as low-sulfur limits are imposed, making power generation more

Fuel cell power generator for maritime refrigeration.

expensive for fleets. Hydrogen fuel cells have the potential to meet the electrical demands of vessels in the port as well as supply power for other port uses such as yard trucks, forklifts, and other material handling specialty equipment. Validation of the commercial value proposition of both the application and the hydrogen supply infrastructure is the next step towards widespread use of hydrogen fuel cells in the maritime environment, and is determined by meeting necessary equipment and operating costs and customer expectations such as reliability, form and function.

A recent Sandia National Laboratories' report identified several opportunities for demonstrating technical and commercial viability of a fuel cell in the maritime environment.[7] One identified opportunity is in Honolulu Harbor at the Young Brothers (YB) wharf. YB provides barge transport of goods between Oahu and the Hawaiian neighbor islands and is an ideal demonstration location because of their high fuel costs and corporate interest in low emission, low environmental impact solutions. YB uses refrigerated containers ("reefers"), which keep perishable goods cold while on the dock and on the barge by using dedicated diesel generators mounted inside mobile 20-foot containers. Sandia's report concluded that it is technically feasible to build a containerized hydrogen fuel cell generator to replace the diesel generator in YB operations.

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

Fuel cell ground support equipment at the FedEx Express hub at the Memphis Airport

Ground Support Equipment (GSE)

PlugPower is demonstrating a fleet of 15 fuel cell powered cargo tractors for ground support equipment at the FedEx hub at the Memphis, Tennessee airport. Plug will monitor technical performance and measure energy savings, comparing to the energy savings the systems are expected to achieve. Ground support equipment has the potential to provide significant energy savings at airports while reducing their carbon footprint.

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*.

References and Notes

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