

Massachusetts Fuel Cell Bus Project

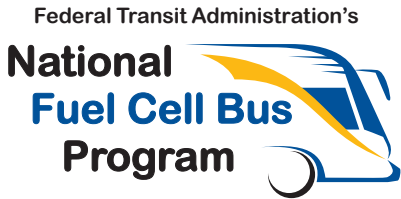


Photo from BAE Systems

Demonstrating a Total Transit Solution for Fuel Cell Electric Buses in Boston

The Federal Transit Administration's (FTA) National Fuel Cell Bus Program (NFCBP) focuses on developing commercially viable fuel cell bus technologies. Nuvera is leading the Massachusetts Fuel Cell Bus project to demonstrate a complete transit solution for fuel cell electric buses (FCEB) that includes one bus and an on-site hydrogen generation station for the Massachusetts Bay Transportation Authority (MBTA). A team consisting of Eldorado National, BAE Systems, and Ballard Power Systems built the FCEB, and Nuvera is providing its PowerTap on-site hydrogen generator to provide fuel for the bus.

Massachusetts Fuel Cell Bus Project Details

The project team is led by Nuvera, a company that develops fuel cell systems and hydrogen generation and dispensing products. Nuvera's PowerTap hydrogen generation appliance is being used to provide hydrogen to fuel the bus. The PowerTap is a high efficiency steam methane reformer that uses natural gas to produce hydrogen. The hydrogen station at MBTA includes the reformer, a compressor, hydrogen storage tubes, and a dispenser. The station is capable of producing up to 50 kg of hydrogen each day and can store 120 kg of hydrogen. This is sufficient for a small fleet of FCEBs, but the station's modular design is scalable and can be expanded to supply larger-size fleets. Nuvera has teamed up with BAE Systems, Ballard Power Systems, Eldorado National, and MBTA to demonstrate the station with an FCEB in a transit application to show how this total transit solution for FCEBs will work in real-world service.

Fuel Cell Electric Bus Development Team

The FCEB design for this demonstration was originally developed under an earlier NFCBP project, the American Fuel Cell Bus Project. The development team used the

demonstration experience for that bus to modify and optimize the design for new demonstrations. The bus for this project is one of as many as 20 FCEBs that will be operated in several transit fleets around the country. Eldorado National, based in Riverside, California, built the bus using its 41-foot, low-floor Axxess heavy-duty bus model chassis. BAE Systems of Endicott, New York, provided the hybrid electric propulsion system for the bus. The propulsion system is based on BAE Systems' HDS200 series hybrid drive, but the system is powered by a 150 kW Ballard Power Systems FCvelocity-HD6 fuel cell instead of a diesel engine.

FCEB Demonstration Site

MBTA is the fifth largest transit agency in the United States, providing public transit to Boston and 77 other cities and towns in an area that encompasses more than 3,400 square miles. MBTA is the only U.S. transit agency that serves the public through six modes including bus, trolley, light rail, heavy rail, commuter trains, and ferry service. MBTA adopted an Environmental Sustainability Policy in 2004 with the goals of lowering energy use, reducing emissions, conserving water, and minimizing waste. The agency's bus fleet includes compressed natural

gas and diesel hybrid buses that contribute to meeting those goals. The agency is participating in the FCEB demonstration to determine how the technology might fit into its fleet.

Over the next year, MBTA plans to operate the FCEB out of its Charlestown Garage on a variety of routes to test its capabilities. The location in the Northeast will allow the team to test the bus in a climate that includes cold, wet winters.

Massachusetts Fuel Cell Bus Facts

Bus chassis	EIDorado National, Axess
Length/width/height	41 ft/102 in./139 in.
Curb weight	35,000 lb
Passenger capacity	39 seated or 33 seated with 2 wheelchairs; 19 standees
Hybrid system	BAE Systems, series hybrid propulsion system, HDS200, 200 kW peak
Fuel cell	Ballard, FCvelocity-HD6, 150 kW
Energy storage	Nanophosphate Li-Ion, 200 kW, 11 kWh
Accessories	Electrically driven
Fuel/storage	Gaseous hydrogen, 8 tanks, 50 kg at 350 bar

In-Service Evaluation

To evaluate the technology, FTA has enlisted the help of the National Renewable Energy Laboratory (NREL). NREL will collect and analyze data from all of the NFCBP bus demonstrations to ensure consistency. Additionally, NREL will collect and analyze performance and operations data from a selection of diesel and diesel hybrid buses in similar service at MBTA for a baseline comparison. Consistent data collection and analysis will ensure fair and accurate information and comparisons, document the status and progress of fuel cell buses toward commercialization, and provide information to the transit industry to aid in purchasing decisions. The results will also be fed back into the research and development process to appropriately focus future resources.

More Information

FTA: www.transit.dot.gov

Nuvera: www.nuvera.com

MBTA: www.mbta.com

BAE Systems: www.hybridrive.com

Ballard: www.ballard.com



Photo from NREL

EIDorado: <http://eldorado-ca.com/>

NAVC: www.navc.org

NREL fuel cell bus publications:
www.nrel.gov/hydrogen/proj_fc_bus_eval.html

This project is managed by the Northeast Advanced Vehicle Consortium (NAVC), one of three non-profit consortia chosen to manage projects competitively selected under the NFCBP.

Headquartered in Boston, Massachusetts, NAVC is a non-profit, public-private partnership that conducts research and technology analysis and fosters information sharing and collaboration on advanced vehicle technology projects.



**U.S. Department of Transportation
Federal Transit Administration**

FTA's National Fuel Cell Bus Program (NFCBP) is a cooperative research, development and demonstration program, established in 2006, to advance the commercialization of fuel cell electric buses. The program is part of a broader FTA research effort designed to improve transit efficiency and deliver environmentally sustainable transportation solutions. Conducted in close partnership with industry, the program has secured matching funds from local and private commitments, bringing the total funding to nearly \$180 million. The teams and projects were competitively selected and are managed by three non-profit consortia. The project portfolio includes development and demonstration projects, component projects, and analysis and coordination efforts.