



U.S. Department of Transportation
Federal Transit Administration



Zero-Emission Bus Evaluation Results: Orange County Transportation Authority Fuel Cell Electric Bus

Background

The Federal Transit Administration (FTA) is collaborating with the U.S. Department of Energy (DOE) and DOE's National Renewable Energy Laboratory to conduct in-service evaluations of advanced technology buses developed under its programs. Orange County Transportation Authority (OCTA), based in Santa Ana, California, has been operating a Fuel Cell Electric Bus (FCEB) developed through FTA's National Fuel Cell Bus Program. The FCEB was built by EIDorado National-California with a BAE Systems electric propulsion system and a Ballard fuel cell. This report presents evaluation results for the FCEB in comparison to baseline buses in similar service. The focus of the analysis is on the most recent year of service from June 2017 through May 2018.

Objectives

The objectives of the research effort are to evaluate zero-emission buses (ZEBs) funded under the various FTA programs, compare the ZEB performance to baseline conventional buses in similar service, and disseminate results to the transit industry and other stakeholders. Key performance metrics tracked for the buses include fuel/energy efficiency, availability, reliability, and operational cost.

Findings and Conclusions

OCTA's FCEB averaged 6.46 kg of hydrogen per mile (equal to 7.3 miles per diesel gallon equivalent (mpdge), an average fuel economy 1.9 times higher than the CNG fuel economy.

During the evaluation period of the report (June 2017 through May 2018), the FCEB accumulated more than 20,000 miles. The report compares the FCEB to that of a fleet of 10 CNG (compressed natural gas) buses. Overall, the FCEB averaged 6.46 kg of hydrogen per mile, which equates to 7.3 miles per diesel gallon equivalent (mpdge). The average fuel economy of the FCEB is 1.9 times higher than the CNG fuel economy of 3.9 mpdge. During the data period, the FCEB had an overall availability of 70% compared to 86% for OCTA's CNG buses. Early in the data period, an issue with the balance of plant for the fuel cell resulted in the bus being down for an extended period. Since returning to service the bus has averaged 80% availability. Access to inexpensive hydrogen fuel has been a significant challenge for OCTA. With no hydrogen station at its facility, the agency needed to fuel the bus at nearby public stations at retail

costs. This has added significant costs to the project, which also includes added labor for staff to drive the bus to and from the station for fueling. The agency is moving forward with a new project to procure 10 more buses and build its own fueling station, which will eliminate the need to fuel outside the facility.

Benefits

This report documents the performance of a FCEB that can meet the needs of U.S. transit agencies. These evaluations have proved useful for a variety of groups including transit operators considering the technology for future procurements, manufacturers needing to understand the status of the technology for transit applications, and government agencies making policy decisions or determining future research needs.

Project Information

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This research project was conducted by Leslie Eudy and Matthew Post of the National Renewable Energy Laboratory. For more information contact FTA Project Manager Sean Ricketson at 202-366-6678, sean.ricketson@dot.gov. All research reports can be found at <https://www.transit.dot.gov/about/research-innovation>.