



U.S. Department of Transportation
Federal Transit Administration



FTA National Fuel Cell Bus Program: Proterra HD 30 Fuel Cell Bus Demonstration

Background

The Center for Transportation and the Environment (CTE) led a team in the development of a fuel cell hybrid bus for demonstration as a part of the Federal Transit Administration's (FTA) National Fuel Cell Bus Program (NFCBP). CTE, Proterra, and Hydrogenics designed and built a bus powered by two 30 kW fuel cell modules. The technology is being evaluated by the National Renewable Energy Laboratory (NREL) as part of the NFCBP. This addendum to the August 2017 project final report summarizes efforts to evaluate the costs of large-scale infrastructure for zero-emission buses and documents outreach conducted.

Objectives

Goals of this project were to analyze large-scale zero-emission bus fleet infrastructure costs and to document coordination of communications and outreach work conducted by CTE on behalf of the NFCBP.

Findings and Conclusions

At today's prices, BEB fleets appear to be less expensive overall than FCEB fleets, depending on agency characteristics, as FCEB fleet infrastructure, even at today's prices, may be less expensive than BEB infrastructure.

The analysis explored several different facets of ZEB fleet costs, including fleet sizing, vehicle cost, infrastructure sizing, infrastructure cost, and regional variations in fuel costs. CTE established a methodology for determining infrastructure and operational costs for large-scale electric bus deployments with an eye toward evaluating the variables that impact cost-competitiveness between fuel cell electric bus (FCEB) and battery electric bus (BEB) fleets.

Initial evaluation found that infrastructure costs are a small portion of the overall costs for zero-emission bus fleets. However, site-specific constraints play a significant role in determining costs. Fuel costs are the biggest differentiator between FCEBs and BEBs; even when comparing hydrogen costs of \$4/kg and applying a rate structure from California, fuel costs for the BEBs are much lower than for FCEBs. An updated analysis incorporated revised cost estimates for BEB infrastructure based on a larger sample size of costs observed by CTE on BEB deployment projects. On average, these revised estimates increased infrastructure costs by 50% and overall project costs increased 3–4%. These results aligned with the initial findings regarding the role of infrastructure in overall project costs.

At today's prices, BEB fleets appear to be less expensive overall than FCEB fleets, depending on agency characteristics. If FCEB-related costs drop more rapidly than BEB costs, FCEB fleets may be cost-competitive, if not less expensive than BEB fleets. Part of this is because FCEB fleet infrastructure, even at today's prices, may be less expensive than BEB infrastructure. Many early reports of electrical charging infrastructure costs are for small-scale installations, and the costs do not scale linearly with size. However, these costs are very difficult to predict in the rapidly-evolving ZEB industry.

As part of this effort, CTE led a number of outreach and education events from 2011 through 2019, including execution of six national and international workshops/conferences, development and maintenance of the gofuelcellbus.com website, two rider surveys, two webinars, results dissemination at external events, and facilitation of the Zero Emission Bus Resource Alliance (ZEBRA).

Benefits

Completion of this work required deep collaboration across US and international partners. This globally-engaged network of zero-emission bus stakeholders is a legacy of CTE and FTA's successful partnership. CTE's coordination of the NFCBP's communication and outreach activities brought harmony to the zero-emission bus industry's group conscience on the state of the technology. Project activities resulted in a generally-shared understanding of the key barriers and best practices for zero-emission bus commercialization amongst industry stakeholders. Results from this project will serve as a source of information to be used by organizations in the industry for future projects.

Project Information

FTA Report No. 0172

This research project was conducted by the Center for Transportation and the Environment (CTE). For more information, contact FTA Project Manager Terrell Williams at (202) 366-0232 or Terrell.Williams@dot.gov. All research reports can be found at <https://www.transit.dot.gov/about/research-innovation>.