FTA RESEARCH
FEDERAL TRANSIT ADMINISTRATION

REPORT SUMMARY

U.S. Department of Transportation
Federal Transit Administration

UTA Paratransit Vehicle Accessory Electrification Project: Eparc System Deployment and Validation Study

Background

This project was funded as part of FTA's Bus Efficiency Enhancements Research and Demonstration (BEERD) Program to promote the development and demonstration of targeted energy efficiency-enhancing technologies, specifically enhanced Electrification of Accessories and improvements in Thermal Management of Bus Bodies, for buses used in public transportation.

FTA awarded funding to six project partners to design, build, and test an auxiliary power unit (APU)-driven idling reduction system to improve fuel efficiency of the vehicle. Paratransit vehicle operations include long periods of standstill operations due to transporting passengers that require additional assistance. During this time, the driver will idle the engine to maintain passenger comfort on the vehicle. At the Utah Transit Agency (UTA), these paratransit buses can idle for 20–25% of their daily use. The diesel exhaust from idling can result in long-term health effects for the driver, passengers, and passersby, and idling also causes unnecessary strain on the engine, making these vehicles more expensive to maintain. Powering standstill auxiliary use with an auxiliary battery has the potential to reduce or eliminate this wasteful and harmful idling.

The Eparc system tested in this study was expected to improve fuel efficiency and maintainability by eliminating the idling load on the engine and, instead, powering the HVAC load from a high-voltage battery. When the bus restarts and is underway, the high-voltage battery recharges using power supplied by a high-voltage alternator.

Objectives

The stated objectives for this project were as follows:

- Define design criteria for a mild-hybrid paratransit bus through the use of detail vehicle and route models and input from the team's transit agency.
- Design and fabricate an aftermarket paratransit bus with a high-voltage alternator, an electrified air conditioning and heating system, and improved vehicle fuel economy.
- Test and evaluate two paratransit buses through detailed power systems tests by a third-party evaluator.
- Demonstrate the enhanced efficiency of the paratransit bus through in-service operation, with daily data collection and assessment by a third-party evaluator.

Findings and Conclusions

The Eparc system reduced engine run time by 19%, which can reduce maintenance costs and increased service intervals, and emissions were reduced to zero during passenger pick-ups and drop-offs.

This project experienced frequent technical delays and interruptions. One of the two test vehicles was inoperable for much of the demonstration period due to the alternator failing to charge the auxiliary battery. Although the other bus exhibited the same error, this issue was overcome by deploying the vehicle on shorter service trips and recharging the battery via the plug-in charger at the depot. More development and testing are required to refine the design to correct this issue, but the test still provided promising conclusions.

The expected fuel consumption reduction was not observed in the demonstration results, but engine idle time reduced engine run time by 19%. Reducing engine idling reduces maintenance costs and increased service intervals. Since fuel economy was unaffected, overall emissions were not reduced, but emissions were reduced to zero during passenger pick-ups and drop-offs—a welcome relief to paratransit passengers.

Benefits

Further development and testing of this concept could help to result in fuel efficiency and emission improvements by as much as 10% based on the demonstration periods in which the vehicles were reliably available for use. However, this demonstration resulted in reduction in time spent idling the engine, which is expected to reduce maintenance costs and could have positive health impacts for those who would otherwise be directly exposed to harmful emissions.

Project Information

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This research project was conducted by Matt Boothe and Alexis Hedges of the Center for Transportation and the Environment along with project partners from the Utah Transit Authority, the University of Texas at Austin Center for Electromechanics, Transworld Associates, Mobile Climate Control, and the University of Utah. For more information, contact FTA Project Manager Samuel Yimer at (202) 366-1321, Samuel.Yimer@dot.gov. All research reports can be found at **https://www.transit.dot.gov/about/research-innovation**.