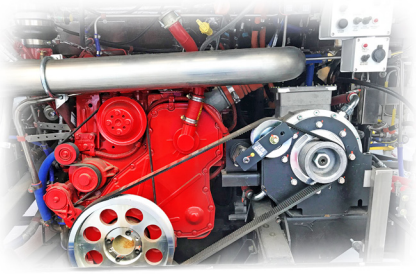
FTA RESEARCH
FEDERAL TRANSIT ADMINISTRATION

REPORT SUMMARY

U.S. Department of Transportation
Federal Transit Administration



Reduced Engine Idle Load (REIL) System for Conventional Propulsion Diesel & CNG Buses: Development, Validation & Market Study Program

Background

Conventional propulsion buses account for nearly 80% of the 3,000–4,000 new transit bus and nearly 100% of the 2,000–3,000 new OTR coach purchases in North America annually, with the European market being 3–5 times larger. Yet these huge numbers of diesel- and CNG-fueled transit buses cannot take full advantage of "more-electric" benefits enjoyed by the hybrid-electric buses. What is needed is a lower-cost, lower-complexity, more-electric system for conventional propulsion diesel & CNG passenger bus markets. FTA awarded funding to the Center for Transportation and the Environment and project partners BAE Systems, New Flyer, and MARTA to study, develop, and demonstrate a Reduced Engine Idle Load (REIL) system.

Objectives

The REIL system is expected to improve the fuel efficiency of a vehicle by replacing the traditional mechanical linkages between the engine crankshaft and non-propulsion parasitic loads with a belt-driven electric generator, accessory power system (APS), electric accessories, and an optional energy storage system (ESS). The REIL system replaces the unmanaged mechanical loads of conventional diesel or CNG engines, with managed electrically-driven vehicle accessories, such as the HVAC system, power steering pump, air compressor, 28V supply, and cooling fans. The system architecture also allows periods of engine-off accessory operation, such as engine stop/start (with properly featured transmission), and also more extended engine-off periods, which is especially beneficial on routes with long layovers and dwell periods.

Findings & Conclusions

The design, build, and test phase proved that a REIL system can be built and operate as expected, including demonstrating stability during various transitions and loads that would be expected in transit service.

The REIL system has a number of potential benefits associated with electrifying vehicle accessories and in accordance with its design, including the following:

- Efficiency (mpg) improvements, most notably with systems that include an ESS, and associated emissions reductions dependent on duty cycle.

- Reducing or eliminating the need to idle/load the engine in order to run the accessories while the bus is not in motion.
- Reduced operating and maintenance costs for accessory systems.
- Reduced internal and external noise and vibration.
- Relatively small footprint within the structure of current diesel and CNG powered buses, including just one accessory belt drive.

Simulation and analysis of test data verified that the system does provide efficiency gains, especially the variant that includes an energy storage system (ESS). The ESS version provides the additional operational benefit of engine-off operation during stop/start conditions. The fuel efficiency gains also result in associate emissions reductions. Finally, there is a place in the market for such a system. Based on current technology and anticipated pricing, REIL provides the best return on investment when including an ESS, and especially when coupled with applicable and available subsidies. Independent evaluation of the project findings was conducted by The University of Texas, Austin–Center for Electromechanics.

The team considers the project to be a first-of-its-kind effort to bring a multimode electric accessory "power system" to the conventional propulsion bus market, taking advantage of both the efficiency and environmental benefits of accessory electrification, proven on hybrid buses over the past decade.

Benefits

This project is a successful first step in evaluating the technical feasibility and realization of benefits for a REIL system in an effort to increase the efficiency and maintainability of accessory systems for buses with traditional diesel- and CNG-fueled propulsion systems. Through the specification and build-out of an actual system, testing to validate technical robustness and readiness, simulation to estimate benefits using actual route data, and a market and financial assessment, the team has established that a REIL system is both a feasible and beneficial technology to further develop and prepare for the marketplace.

Project Information

FTA Report No. 0157

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