Deploying Hybrid Electric School Buses in Iowa

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ABSTRACT

There are over 450,000 school buses in the United States transporting 24 million children, resulting in 4 billion miles of travel per year. School children spend an average of one and a half hours per day on a school bus (1,2) that is primarily diesel powered. These buses consume 1.1 billion gallons of diesel fuel annually and emit thousands of tons of pollutants per year (Ewan et al. 2004). One source measured onboard emissions in Connecticut school buses and found that PM2.5 emissions were 5–10 times higher on school buses than at fixed site monitoring sites (3). Diesel exhaust affects children with respiratory problems, such as asthma and bronchitis. Additionally, rising fuel costs are a large concern for school districts.

Options to decrease fuel costs and emissions include using different fuels such as biodiesel or natural gas and adding on-emission control devices such as particulate filters and oxidation catalysts. Hybrid electric technology is another option. Hybrids are available in the passenger vehicle market as well as the transit bus market. Until recently, however, there have not been any commercially available hybrid-electric school buses.

Hybrid-electric school buses have the potential to reduce emissions and to reduce the overall life cycle cost when compared to conventional diesel buses. The technology has been demonstrated in passenger vehicles and transit buses. A study found that hybrid transit buses had a 10% higher in-service fuel economy than regular buses. Results of chassis dynamometer tests suggested that fuel economy could be 23% to 64% higher. They also reported results of a chassis dynamometer tests which indicated that CO emissions were 56% to 98% lower than for regular buses, NOx emissions were 36% to 44% lower, hydrocarbon emissions varied from 43% lower to 88% higher, PM emission were 50% to 99% lower, and CO2 emissions were 19% to 40% lower. Results varied based on test cycle used. Bus operators also indicated that hybrid buses had better acceleration, better traction in bad weather, and had smoother braking than conventional transit buses (4).

Although hybrid-electric school buses are promising, until recently, the technology was not widely available. The Hybrid Electric School Bus (HESB) Project is a program designed to bring these vehicles to market by creating the demand among school districts required for a manufacturer to invest in the
development of the technology (5). One phase of the project is to demonstrate that hybrid school buses can provide an economically viable alternative for school districts seeking to reduce emissions from their fleets. However, to penetrate the school bus market, there must be a demonstration of the technology (2).

As part of a national coordinated effort, 14 school districts in the United States, including two school districts in Iowa, have stepped forward to join a national consortium to encourage the demand for hybrid electric school buses. The Center for Transportation Research and Education (CTRE) at Iowa State University (ISU) is conducting the evaluation for the two Iowa school buses. This paper discusses the Iowa program and provides early results.

**Key words: diesel fuel—emissions—hybrid electric school bus**