

DEVELOPMENT OF A DIMETHYL ETHER-FUELED SHUTTLE BUS

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Dimethyl ether (DME) is a potentially ultra-clean diesel fuel; however, its unique characteristics require special handling and accommodation of its low viscosity and low lubricity. In this project, DME was blended with diesel fuel to provide sufficient viscosity and lubricity to permit operation of a 7.3-liter turbodiesel engine in a campus shuttle bus with minimal modification of the fuel injection system. A pressurized fuel delivery system was added to the existing common rail injection system on the engine, allowing the DME-diesel fuel blend to be circulated through the rail at pressures above 200 psig to keep the DME in the liquid state. Fuel returned from the rail is cooled with heat exchangers and recirculated to the rail using a gear pump. A modified LPG tank (for use on recreational vehicles) stores the DME-diesel fuel blend onboard the shuttle bus, and a small cylinder of helium is used to provide a blanket of inert gas above the fuel mixture to keep the DME in the liquid state and to push the mixture to the fuel rails.

A significant challenge is posed by the rapid increase in DME vapor pressure with increasing fuel temperature. As the fuel mixture passes through the rail, it is heated by the surrounding surfaces in the cylinder head. The target for maximum fuel rail temperature was set at 50°C, which corresponds to a DME vapor pressure of 150 psig. Refueling is accomplished by mixing the diesel fuel and DME onboard the bus, with diesel fuel delivered from the existing diesel tank and DME delivered by 1000-lb cylinders at a small refueling station. The shuttle bus operates on the Faculty/Staff Loop at the University Park campus of the Pennsylvania State University.