Phased Introduction of Fuel Cells into a Class 8 Tractor

Program Capabilities:

This project introduces fuel cells to a class 8 tractor in a phased approach, with the ultimate goal of demonstrating a diesel fuel reformer/fuel cell/hybrid electric drivetrain. While fuel cells and fuel cell ancillary systems are evolving rapidly, there are no liquid fuel reformer/fuel cell systems currently available to fully power the propulsion needs of a class 8 tractor.

The project takes a multi-year approach to this challenge by procuring a state-of-the art Peterbilt 385 class 8 tractor and utilizing a Hydrogenics 20 kW hydrogen-fueled PEM fuel cell as an auxiliary power unit (APU) for the tractor. The program assesses diesel engine parasitic loads (including water pump, cooling fan and others) and begins to electrify these loads, with the goal of increasing overall system efficiency. Currently the fuel cell APU powers an electric water pump, air conditioning compressor, air conditioning condenser fan, engine cooling fans and scroll air compressor. Future phases include plans for a larger or liquid–fueled fuel cell, and ultimately, based upon equipment availability, integration and testing of a full diesel reformer/fuel cell hybrid electric tractor design.

The U.S. Army is interested in fuel cells for many reasons. Fuel cells offer clean, quiet, and potentially very durable systems. For the Army, one of the key technologies necessary for utilizing fuel cells is a diesel reformer/fuel cell system. Earlier work, evaluating diesel reformer technology, indicated that diesel reformers are still 1-3 years away from being able to reliably produce enough high-quality reformate to power a fuel cell for class 8 tractor propulsion and integrate well with the fuel cell. The program takes a stepped approach to achieving this goal and achieves electrification of diesel engine loads as well.

The U.S. Army is interested in electrification of diesel engine loads in order to improve efficiency and exhaust emissions, achieve enhanced silent watch capability, ease cooling loads to tightly packed radiators and decrease the space claim of a bare engine by moving loads to off-engine locations. It may be possible to increase component life by running them only when needed, or at lower speeds. This technology has the capability of reducing engine idling as well.

Throughout the program SwRI is using computer models to assess the baseline truck systems and examine the impact of each phase of the changes. A strong technology assessment task runs throughout the program in order to keep pace with technological developments and assure that the program utilizes state-of-the art systems. In addition to JP-8 fuel, we have examined diesel fuel, ultra-low sulfur diesel fuel, Biodiesel (B20) and GTL fluids as diesel engine and reformer fuels. In this program, Southwest Research Institute is a subcontractor to SunLine Services Group, who, in turn, receive their funding from the National Automotive Center, a group within The U.S. Army Tank-Automotive Research, Development and Engineering Center. The program takes input from, and feeds information to, the 21st Century Truck Program.

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