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NATIONAL RENEWABLE ENERGY LABORATORY

NREL Evaluates Performance of Hydraulic Hybrid Refuse Vehicles

Highlights in Research & Development

Initial results indicate that the hydraulic hybrids offer substantial fuel savings compared to similar conventional vehicles.

The National Renewable Energy Laboratory (NREL) is evaluating the in-service performance of hydraulic hybrid vehicles (HHVs) and comparable conventional diesel vehicles operated by Miami-Dade County's Public Works and Waste Management Department in Florida.

Launched in March 2015, the study aims to improve understanding of the overall usage and effectiveness of HHVs in refuse operation. The study was designed to help Miami-Dade County determine the ideal routes for maximizing the fuel-saving potential of its HHVs, and the results could also help other fleet managers around the country as they explore the fuel-saving technology options available today.

With 530 hybrid vehicles ranging from light-duty sedans to refuse trucks and transit buses, Miami-Dade County boasts the third largest municipal hybrid fleet in the nation. As part of the county's overall strategy to reduce emissions and fuel use, it recently added 29 new hydraulic hybrid refuse vehicles to its fleet, bringing the total to 64. Photo courtesy of Parker Hannifin, NREL 32783

The fuel economy of heavy-duty vehicles, such as refuse trucks, largely depends on the load carried and the drive cycles on which they operate. In the right applications, HHVs can offer a substantial fuel-cost advantage over similar conventional vehicles. The extent of this advantage is contingent on driving behavior and drive cycles with high kinetic intensity (such as with stop-and-go traffic) that take advantage of regenerative braking.

The HHVs under study—Autocar E3 refuse trucks equipped with Parker Hannifin's RunWise Advanced Series Hybrid Drive systems—reportedly recover as much as 70% of the energy typically lost during braking and reuse that energy to power the vehicle. The system features a two-speed hydrostatic drive combined with a mechanical direct drive, which optimizes vehicle performance at both low and high speeds.

The on-road portion of NREL's evaluation focuses on validating the technology benefits by collecting and analyzing vehicle performance data—fuel economy, maintenance costs, and drive cycles—from the HHVs and the conventional diesel vehicles. Based on the field data, NREL will develop a validated vehicle model using the Future Automotive Systems Technology Simulator, or FASTSim, to study the impact of route selection and other vehicle parameters. NREL is also analyzing fueling and maintenance data to support total-cost-of-ownership estimations and forecasts.

In addition to the on-road testing, NREL will conduct chassis dynamometer testing of the HHVs and baseline conventional vehicles to determine the fuel economy and emissions impact of the hydraulic hybrid technology in a controlled laboratory setting.

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References: "Miami-Dade County Hydraulic Hybrid Refuse Truck Testing," National Renewable Energy Laboratory, accessed August 2015, http://www.nrel.gov/transportation/fleettest_hydraulic_truck.html

Key Research Results

Achievement

NREL designed a study to increase understanding of the overall usage and effectiveness of HHVs in refuse operation and to provide unbiased technical information to fleets interested in reducing fuel costs and improving energy efficiency.

Key Result

Initial results indicate that the HHVs under study offer significant fuel-saving opportunities compared to similar conventional vehicles. The final results will help Miami-Dade County optimize the energy-saving potential of its HHVs.

Potential Impact

More than 136,000 refuse trucks operate in the United States today, consuming more than 1.2 billion gallons of fuel a year. By matching the appropriate technology to the right drive cycle, hydraulic hybridization can help refuse fleets reduce fuel use, operating costs, and emissions.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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