DOE'S R&D SUPPORT FOR CLEAN DIESEL ENGINES

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The Department of Energy's Office of Transportation Technologies/Office of Heavy Vehicle Technologies (OTT/OHVT) sponsors work, primarily with the diesel engine manufacturers, their subcontractors, the national laboratories, and academia, to improve diesel engine efficiency while reducing emissions and enhancing engine durability. Typically, achieving one of these goals incurs a penalty in the other two. Diesel engines are essential to the lifestyle we currently enjoy, and this role of the diesel engine has similar influence on the rest of the world. As there is nothing on the horizon that can replace the diesel, diesel engine emissions will have to be reduced.

OHVT has supported the logical progression of diesel engine high efficiency (46 percent efficiency) and incredible durability (engines warranted for 500,000 miles) of today's Class 7 and 8 truck engines to the light trucks, i.e., sport utility vehicles, pick-up trucks, and minivans, which are predominately powered by spark ignition gasoline engines. Replacing the current gasoline engines with the advanced clean diesels will improved fuel economy by 62 percent while reducing CO_2, the primary greenhouse gas, by about 50 percent. The new computer-controlled fuel injection system make these diesel engines installed in similar vehicles to have nearly indistinguishable noise levels, smell, acceleration, and visual emissions as the gasoline engines.

The big challenge is to comply with Tier 2 regulations that go into effect in 2007. Work is underway investigating reducing NO_x by using urea coupled with either an SCR catalyst, a heater in the exhaust stream or hydrogen, non-thermal plasma or NO_x adsorber catalyst systems. Particulates are reduced using particulate traps or non-thermal plasma. Locomotives, marine, agricultural, and other off-highway equipment, which use diesel engine power, will also require emission reduction technology.

The major improvement in diesel engine efficiency involves utilization of the available energy in the exhaust gas. Motor/alternators are being installed on the turbocharger shafts, which are compatible with the trend towards using electric motors to drive engine accessories. Thermoelectrics are being used to replace the current generator. Quantum well thermoelectrics are demonstrating about a factor of 5 improvement in conversion efficiency compared to current bulk semi-conductor devices.