THE FUTURE OF THE DIESEL ENGINE IN PASSENGER CARS

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1. Why do we need the Diesel?

The diesel engine is the most efficient user of fossil fuels for passenger vehicles, with significantly lower fuel consumption than its gasoline counterpart. Decreased fuel consumption not only leads to lower fuel costs for consumers but it also helps to conserve the Earth's limited fossil fuel resources.

Diesel technology also constitutes one of the best options currently available to achieve even greater fuel efficiency. With new direct-injection technology, a small (four-person capacity) diesel car with a fuel consumption of 3 liters for 100 km (78 mpg) under the European Test Cycle is now feasible.

The diesel is distinguished by its low emissions of carbon monoxide and hydrocarbons. In addition, unlike gasoline engines, diesel engines do not emit evaporative volatile organic compounds (VOCs), which contribute to the production of ozone in the atmosphere. The advantage of the diesel also includes very low cold-start emissions.

In Europe and elsewhere, the diesel engine is relied upon to meet greenhouse gas emission reduction commitments and, particularly, to reduce carbon dioxide emissions. A comparison of vehicles equipped with a three-way catalyst gasoline engine versus a diesel engine meeting the same performance standards evidenced overall reduced greenhouse gas emissions of 45 percent for the diesel, with even better performance under real driving conditions. Diesel engines also can run on new bio-diesel fuels, making further greenhouse gas reductions possible.

Environmental benefits of the diesel also include lower emissions of greenhouse gases in the fuel production and distribution process, as well as smaller refueling and evaporation losses at the pump.

Like other countries, the United States will need diesel technology to further its goals to reduce greenhouse gases and increase fuel economy and save resources. A fundamental tenant of the administration's climate policy has been the need for technological solutions to reduce emissions without negatively impacting the U.S. economy. The diesel engine is an important part of the solution for the transportation sector.

2. The Future of Diesel Engine Technology

Technological improvements, such as improved fuel injection, combustion chamber modifications, the oxidation catalyst and turbocharger with charge air cooling, have converted the diesel engine of the past to a clean and powerful machine for vehicle propulsion. Indeed, over the last 10 years, emissions from diesels have been reduced by more than 75 percent. The modern diesel engine offers superior fuel efficiency, reduced greenhouse gas emissions, and other environmental benefits without sacrificing performance or price. Notwithstanding the existing benefits of diesels there are opportunities for even more efficient and cleaner engines through technological innovations to come.

An advanced technology lean-burn TDI vehicle will incorporate further improvements of the diesel engine combustion process (e.g. assisted by four-valve technology), high-pressure fuel injectors known as unit injectors, a NO_x catalyst, and a particulate trap.

Advanced lean-burn engine concepts incorporating sophisticated emission control technology require extremely clean fuel (i.e., near zero sulphur content). High levels of sulphur in the fuel will require enrichment of the mixture to control NO_x and particulate emissions and will increase fuel consumption.

Further, the presence of sulphur in fuel results in deteriorated performance of after-treatment devices. For example, sulphur has a deleterious effect on NOx catalysts and particulate filters. In the case of NO_x catalysts, sulphur has the tendency to accumulate on the catalyst and reduces the conversion efficiency

of the catalyst. Similarly, in the case of particulate filters, sulphur has the tendency to increase the temperature required to maintain a balance between the mass of particulates accumulated on the trap and the mass of soot oxidized for a continuously regenerating particulate trap.

3. Conclusion

Lean-burn direct-injection diesel technology is highly efficient and can provide a valuable contribution to the energy conservation solution. Advanced lean-burn direct-injection diesel technology will improve upon the current fuel saving characteristics of such vehicle. These improvements will also enable compliance with future Federal Tier II emission standards. Additional development and the availability of low sulphur fuels will make this technology a reality.