

# Diesel Ripe for U.S. Market

Diesel engines have always offered fuel efficiency and long engine life. But new advances in diesel technology, along with high gasoline prices, could mean expanded use in the near future.

**A**dvances in diesel engines and fuels make them ripe for expanded use in the United States, according to market analysts.

Volkswagen of America Inc., based in Auburn Hills, Mich., is virtually the only maker of diesel passenger cars in the United States. Other manufacturers say there simply isn't enough market interest to justify them, although the same companies often are strong diesel contenders in Europe.

We're bullish on the future of high-tech diesel engines," Volkswagen spokesman Tony Fouladpour said, although they make up only 25,000 of the 390,000 Volkswagens sold in the United States each year.

For 2001, "The demand for diesel engines (among Volkswagen customers) is about 13 percent," he said. That's about 4 percent more than VW can fulfill at the moment.

The reasons for the popularity of diesel engines, Fouladpour says, are fuel efficiency and reliability. For example, the Jetta, Volkswagen's top-selling U.S. model, gets about 50 miles per gallon on the freeway and runs about 600 miles between fill-ups. A new Jetta wagon will be introduced for the 2002 model year, according to Fouladpour, boasting 34 cubic feet of cargo space.

Volkswagen already meets 2004 EPA requirements-including the stringent emission standards for California and New York-and is attempting to develop the world's most efficient diesel engine. How it



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plans to do that, so far, is still a closely guarded company secret.

## GM Offers Heavy-Duty Diesel Pickup Trucks

General Motors Corp.'s new line of heavy-duty diesel pickup trucks – like the three-quarter ton and one-ton versions of the Chevy Silverado and the GMC Sierra – also boast an expected engine life of 200,000 miles.

According to Jack Blanchard, assistant chief engineer for diesels at GM Powertrain in Pontiac, Mich., "These engines run quieter. We inject a small of fuel, and then, when it starts to burn, inject the rest of the fuel charge." Therefore, the notorious

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**The Chevy Silverado 2500 HD is one of GM's newest diesels. This three-quarter-ton truck features the Duramax engine.**

Diesel knock is eliminated.

The new trucks include aluminum cylinder heads, which lower engine weight to 835 pounds and dissipate the engine heat. As a result, "We can keep the valve seats 200 degrees Centigrade cooler than with cast iron heads, without compromising durability," Blanchard said.

These trucks already meet the EPA's 2004 emission standards. For the more rigorous 2007 standards, Blanchard said they are developing "more specific controls of air in/air out – including more precise injectors and a new turbo device to better regulate air flow – as well as after-treatment concerns."

### **Older Engines Have Options for Improvements**

Older engines, once known for belching soot, have some options for improvements, too. At Clean Air Systems in Santa Fe, N.M., diesel particulate filters and catalytic oxidation converters, retrofitted to engines five years old or older, offer a 90 percent reduction in carbon monoxide, hydrocarbons and particulate matter. The do not, however, remove nitrous oxide (NO<sub>x</sub>), according to Michael Roach, president of Clean Air Systems.

Fuel additives offer another performance boost, although

They can't improve engine performance beyond the original specifications. "Transient tests using federal testing procedures," are their gauge of effectiveness, said Patricia Charbonneau, vice president of engine engineering at International Truck and Engine Corp., in Chicago, "and many fail."

That said, additives can eliminate carbon buildup in older engines and thereby provide improvements in mileage and engine performance.

**For example, SoyShield by Schaeffer Oil, St. Louis, MO., converts soybean oil, added to methanol, into a biodiesel that when used as an additive, provides the same lubricating capabilities as premium diesel fuel without the sulfur content. Its inventor, Hoon Ge, Ph.D., says lubricity is increased by as much as 30 percent and that the additive cleans injectors and inhibits corrosion.**

**Likewise, U.S. Soy Diesel by Koch Performance Fuels in Wichita, Kan., offers 5 percent improvements in fuel efficiency and reduced NO<sub>x</sub> by about 7 percent, carbon monoxide by 20 percent and particulate matter by 15 percent when compared to No. 2 diesel fuel.**

### **Diesel Engines Offer Fuel Efficiency, Long Life**

Traditionally, "Diesel engines offer up to a 50 percent increase

in fuel efficiency," over comparable gasoline engines according to Bob Carling, Ph.D., deputy director of the combustion research facility at Sandia National Laboratory's Livermore, Calif., office.

Additionally they have an engine life that is nearly twice that of gasoline engines. Those facts, coupled with new, cleaner emissions technologies, just may give diesel fleets the edge in the United States.

### **Advanced Systems On the Horizon**

"Advanced fuel systems are making the engines cleaner and quieter and the availability of ultraclean diesel fuel for central-fueling fleets now and for the public in the second half of 2006 will allow sophisticated after-treatments," Charbonneau said.

A dual system that relies on plasma and a new catalyst is succeeding in reducing "virtually all" nitrous oxide (NO<sub>x</sub>) and reducing particulate matter by about 90 percent, according to Chuck Pedan, Ph.D., senior chief scientist, Pacific Northwest National Laboratory in Richland, Wash.

"In a normal catalytic converter, all pollution reduction reactions occur on a precious-metal based material, but that material is ineffective in lean conditions," Pedan said.

To remedy that situation, Dr. Pedan and his team have developed a system that converts the gas into plasma upstream of the converter and uses a new material as the catalyst. As Dr. Pedan explains, putting an electrical charge across the gas changes it into plasma.

As plasma, it reacts more effectively with the catalyst,

easily changing the NO<sub>x</sub> in the fuel into di-nitrogen (N<sub>2</sub>), "the major component of air." The catalyst is a commercially available Y zeolite (a mineral consisting mainly of hydrated silicates of aluminum), to which barium is added. This version is used for light-duty diesels.

A similar catalytic converter system is available from PNNL research partner Delphi Automotive in Troy, Mich. A version for heavy diesel engines also is in development, according to Delphi.

RSET Inc., in Austin, Texas, is developing rotating liner technology for heavy- and medium-weight vehicles. According to founder Dimitrios Dardalis, the system is expected to improve engine life by 300 percent and improve fuel efficiency by 3-4.5 percent at full load capacity and 25-27 percent at idle, thereby reducing overall emissions by reducing fuel consumption.

The rotating liner technology creates a constant, evenly distributed lubrication film between the piston and the inner cylinder wall by rotating the cylinders themselves throughout the cycle.

By eliminating the metallic contact of the piston rings and piston skirt with the cylinder liner, wear is minimized. Unlike the sleeve valve engines used in World War II aircraft, the rotating liners' motion is independent of valving, and EPA emission standards are met. **BF**

*Editor's note: Gail Dutton is a science writer whose articles have appeared in Popular Science, Genetic Engineering News and World Trade magazine.*