

VW TOUAREG VS. SEVEN OTHER FAT-CAT SUVs!

CAR AND DRIVER



JANUARY 2003 • CANADA \$4.99 UK £2.95 US \$3.99

BMW

44

From Retro
to Techno

10 Best Cars!

5.4 to 60!



First Drives:



• 444-hp Porsche Cayenne Turbo



• \$300,000 Maybach 57



• 9000-rpm Mazda RX-8

www.CARandDRIVER.com

TESTED: Infiniti G35 coupe, Saab 9-3 Vector, Saturn Ion, M2 WRX.

10BEST: Winners and Losers, Reader Stories, Best and Worst Performers.

PLUS: Selecting the next American Grand Prix star in secret French trials.



CSERE

CSABA

Will
Dr. Diesel's
turn ever
come?

Other than big-rig drivers, Americans haven't worked up much affection for the engines without spark plugs that Rudolf Diesel invented in 1897. Except for a brief burst of popularity during the fuel crisis in the early '80s, when gasoline prices suddenly doubled to about \$1.30 a gallon, we've been indifferent to the diesel's ability to squeeze about 30-percent more mileage from a gallon of fuel over a gasoline engine. When fuel is cheap, Americans have had little use for the diesel's traditionally rougher and noisier operation, its smoky exhaust, sluggish cold starts, and smelly, messy fuel.

Environmentalists don't much like them, either. Even though diesel engines achieve about the same fuel-economy bump as gasoline-electric hybrid powertrains, the tree huggers are upset by the greater emissions of oxides of nitrogen (NO_x) and particulates from diesel engines.

NO_x is one of the major precursor emissions to smog. The federal Tier 2 emissions standards, which begin their five-year phase-in in 2004, will cut allowable NO_x emissions by 75 percent to 0.05 gram per mile per vehicle. NO_x is created during peak combustion temperatures and pressures, and since diesels run compression ratios roughly double those of gasoline engines, they have trouble meeting this standard. This lofty compression ratio, however, is also one of the key factors behind the diesel's high efficiency. Another component of diesel efficiency is lean combustion, which precludes

the use of the three-way catalysts that control NO_x so effectively in gasoline engines.

Particulate emissions are the black haze that we see in diesel exhaust, especially from heavy trucks operating at full power. The color comes from tiny particles of soot produced during combustion. It's a problem inherent with diesels because the fuel is injected directly into the combustion chamber at the end of the compression stroke and has very little time to mix with the air in the cylinder. By contrast, in a gasoline engine, the fuel is injected while the air is rushing into the cylinder during the intake stroke and can disperse even farther during the compression stroke. Even though diesels burn lean overall, without this opportunity for thorough mixing, there are invariably tiny pockets of rich mixtures, which generate soot.

Modern diesel injection systems—similar to gasoline electronic fuel injection except that they operate at a fuel pressure of 20,000 psi rather than 50 psi—have greatly reduced this soot generation. Still, the Tier 2 standards mandate a maximum particulate emissions level of 0.01 gram per mile, which no current diesel can meet. To solve this problem, the industry has been fooling around with particulate traps for years. These devices sift the soot from the exhaust and periodically burn it off. But getting these filters to operate for 100,000 miles has been a major challenge.

Furthermore, environmentalists have been calling for even stricter particulate standards. The current Tier 2 limit applies to particles of soot larger than 10 microns. That's four ten-thousandths of an inch, or about one-fifth the thickness of human hair. But there's talk of including particles as small as 2.5 microns. This would exacerbate the particulate problem exponentially.

This utter rejection of diesels by U.S. environmentalists is in stark contrast to attitudes in Europe, where the diesel has been accepted with open arms.

About one-third of the new cars and light trucks sold in Europe are purchased with diesel engines—a choice undoubtedly motivated by the fuel costs in Europe of \$4 to \$5 a gallon. Moreover, upcoming European NO_x and particulate limits are four to ten times higher than ours will be. European diesel fuel is also better, with significantly lower sulfur content and higher cetane (a measure of a fuel's affinity for ignition, it's the opposite of octane).

European environmentalists, who are numerous enough to support powerful Green parties in several countries, seem to accept these concessions for diesels. They feel the diesel's benefits in reduced fuel consumption, and the associated CO₂ emissions, outweigh the potential health effects of their particulate emissions. Then again, the Europeans have barely discovered no-smoking sections in restaurants.

The fact that modern diesels perform vastly better than their predecessors hasn't hurt their European popularity, either. The current variety is invariably turbocharged and intercooled, producing a bit less power but vastly more torque than gasoline counterparts. Last summer, I drove Opel's new Vectra in Britain in both gasoline and diesel 2.2-liter versions. Not only did the diesel run smoothly and quietly, but with 123 horsepower and 207 pound-feet of torque, it felt substantially more responsive than the 145-hp gas engine that could muster only 150 pound-feet of torque.

This type of old-fashioned low-end grunt would be perfect for America's growing fleet of trucks and SUVs. Imagine getting a 30-percent boost in fuel economy with more responsive performance in urban and suburban use with only a modest price increase—much less than required to install a less peppy hybrid powertrain.

Even some American environmentalists are starting to see merit in this approach. Alan Lloyd, the head of California's notorious Air Resources Board, was quoted in the *Wall Street Journal*. "We will have light-duty diesel in the U.S. and California." Lloyd had apparently experienced a "Come to Jesus" meeting with California governor Gray Davis, who recently signed the state's global-warming-reduction legislation. True to form, Davis wants to meet the law without imposing any pain on his constituents and sees that diesels promise the best approach to achieving that end.

For *Car and Driver* readers, this would not be a bad solution. Not only do modern turbo-diesels work remarkably well in heavy vehicles such as SUVs and pickups, but they also have amazing tuning potential. Gale Banks, who made his name applying his turbocharging expertise to gasoline V-8s, has focused his energies on diesels over the past decade. Last October, a Dodge Dakota he built, powered by a heavily modified Cummins V-6 diesel, ran a two-way average of 217.314 mph at Bonneville, setting a speed record for pickups. With 52 psi of boost pressure, the 5.9-liter diesel was developing 735 horsepower and 1300 pound-feet of torque.

I can imagine worse things than an automotive future based on such engines. •



THE STEERING COLUMN