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THE BIG STORY / FEBRUARY 2017

A close-up photograph of a diesel engine's glow plug assembly. The glow plugs are glowing with a bright red-orange light, and the surrounding metal components are illuminated with a green light. The background is dark, making the glowing parts stand out.

DIESEL MARKET *facing* **COMPRESSION**

HAS THE ENGINE WITH NO SPARKPLUGS LOST ITS SPARK?

BY TOM MURPHY



Nissan introduced a 5.0L Cummins diesel V-8 in the Titan XD pickup a year ago.

Mazda
Enthusiastic;
FCA Less So

9

CARB Wants
Clean Diesels

15

GM 'Bullish'
on Diesels

19

Cover: FCA
3.0L EcoDiesel
cutaway

DIESELS JUST KEEP MOTORING ALONG – FOR NOW.

Saddled with generally more expensive fuel, costly equipment to scrub emissions, high regulatory hurdles and an outdated reputation for being smoky and loud, light-duty diesel engines in the U.S. market have been treated for decades like the red-headed stepchild of the powertrain family.

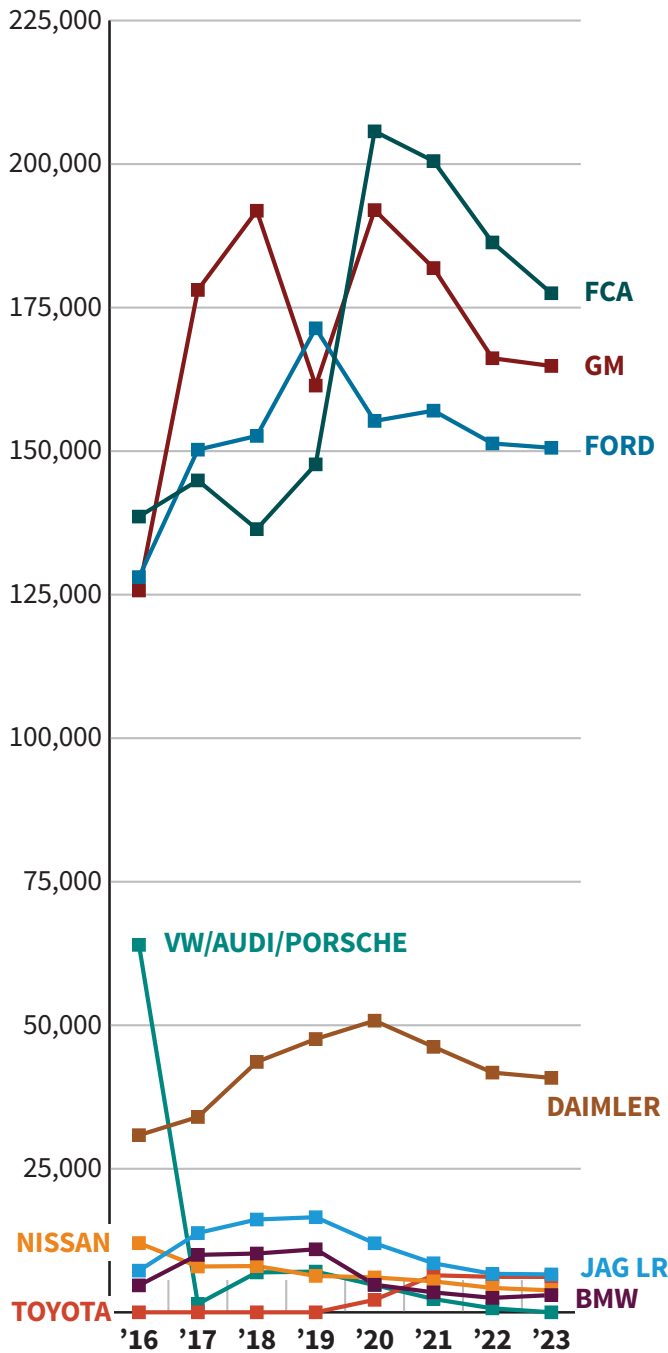
Volkswagen's ploy to sidestep regulators – uncovered in 2015 – by intentionally rigging 4- and

6-cyl. diesel engines to treat emissions only when vehicles were on government test benches gave compression-ignition powerplants the kind of black eye that never quite heals.

Regulators also are investigating whether diesel engines from Fiat Chrysler were not properly limiting emissions, but the automaker insists its 3.0L diesel V-6 in Ram and Jeep vehicles is in full compliance. PSA, Renault, Nissan and Jaguar Land Rover diesel engines also are under scrutiny by authorities.



U.S. Light-Vehicle Sales Forecast for Diesel Cars and Trucks by Company



Source: WardsAuto/AFS

The long-term future may be questionable, particularly as the migration toward electrified powertrains applies more pressure on diesel engines than their gasoline counterparts.

Many insiders say diesels already have peaked in the U.S. and worldwide and that diesels will begin disappearing in 2025 or 2030 as electrification takes over.

“There’s a trend downward for diesel and a trend upward for electrification of the powertrain,” Valeo Chairman and CEO Jacques Aschenbroich says at – of all places – the Consumer Electronics Show in January, when describing the French supplier’s strategy to emphasize components for electrified powertrains and 48V electrical systems.

French consumers have had a long love affair with diesel engines, but more and more they are looking for alternatives, partly in response to higher taxes on diesel fuel.

In December, the mayors of Paris, Athens, Madrid and Mexico City announced plans to combat climate change and air pollution

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BMW X5 filler cap.



Valeo's Jacques Aschenbroich: Downward trend for diesel, upward for electrification.

by moving to ban diesel-powered vehicles in their city centers.

Aschenbroich says governments are just as important to the future of diesel engines as are the automakers building and selling them and the consumers who buy them.

“Don’t underestimate those new stakeholders in the game,” he tells *WardsAuto*.

But don’t entirely count out diesels in the near term either, because automakers continue investing in their development and even the activist California

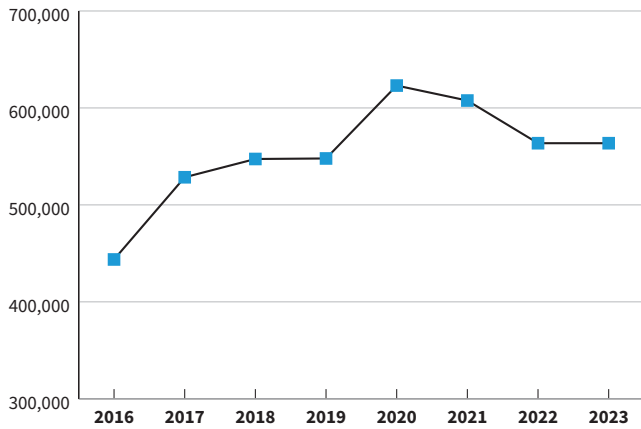
Air Resources Board wants them around.

General Motors, Mazda and Ford are confident enough about the engine’s future that they are in the process of rolling out new diesels for the U.S. Ford will expand its powertrain portfolio in the F-150 by offering a 3.0L Power Stroke V-6 next year. Nissan introduced a 5.0L Cummins diesel V-8 in the Titan pickup a year ago, although the truck has been a slow seller.

A BMW executive, insisting diesels play an important role in the automaker’s overall strat-

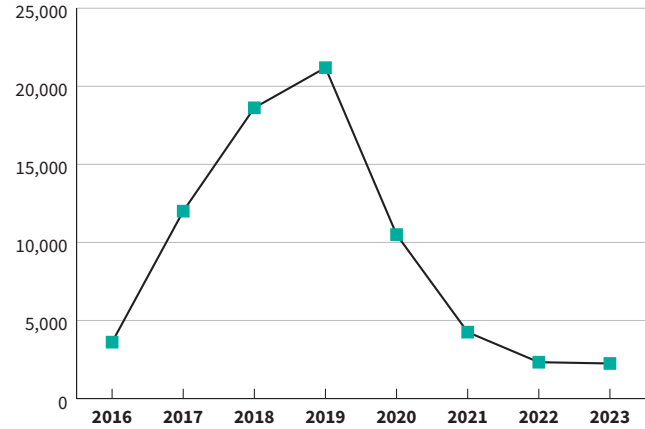


U.S. Light-Vehicle Sales Forecast for Diesel Trucks



Source: WardsAuto/AFS

U.S. Light-Vehicle Sales Forecast for Diesel Cars



Source: WardsAuto/AFS



VW's Hinrich Woebcken: Shifting from diesels to hybrids, electric cars.

egy to reduce fuel consumption and carbon-dioxide emissions, tells *WardsAuto* the brand's next-generation diesels will come to American shores in future years.

A WardsAuto/AFS forecast suggests light trucks (including unibody utility vehicles) will continue driving the volume for U.S. diesels, growing from 447,317 units in 2016 to more than 623,000 in 2020 before beginning to dip.

Meanwhile, the market for diesel cars has fallen off a cliff, thanks to Volkswagen, which is barred from selling new diesels in the U.S. VW brand chief Herbert Diess told a German newspaper in November

the automaker will never sell diesels in the U.S. again.

Volkswagen North America CEO Hinrich Woebcken tells *WardsAuto* the automaker is shifting its powertrain investments from diesel to hybrids and electric cars, with plans to launch 30 electrified cars by 2025.

"If you look at electric driving, it has a lot of similarities with diesels," Woebcken says. "Electrification has a lot of torque, so we believe electric driving is the future for the genes of this brand."

In 2014, U.S. customers bought 101,865 diesel cars from all brands; last year, only 3,612. Far and away



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the segment leader, VW (along with Audi) owned about 40% of the light diesel market in the U.S.

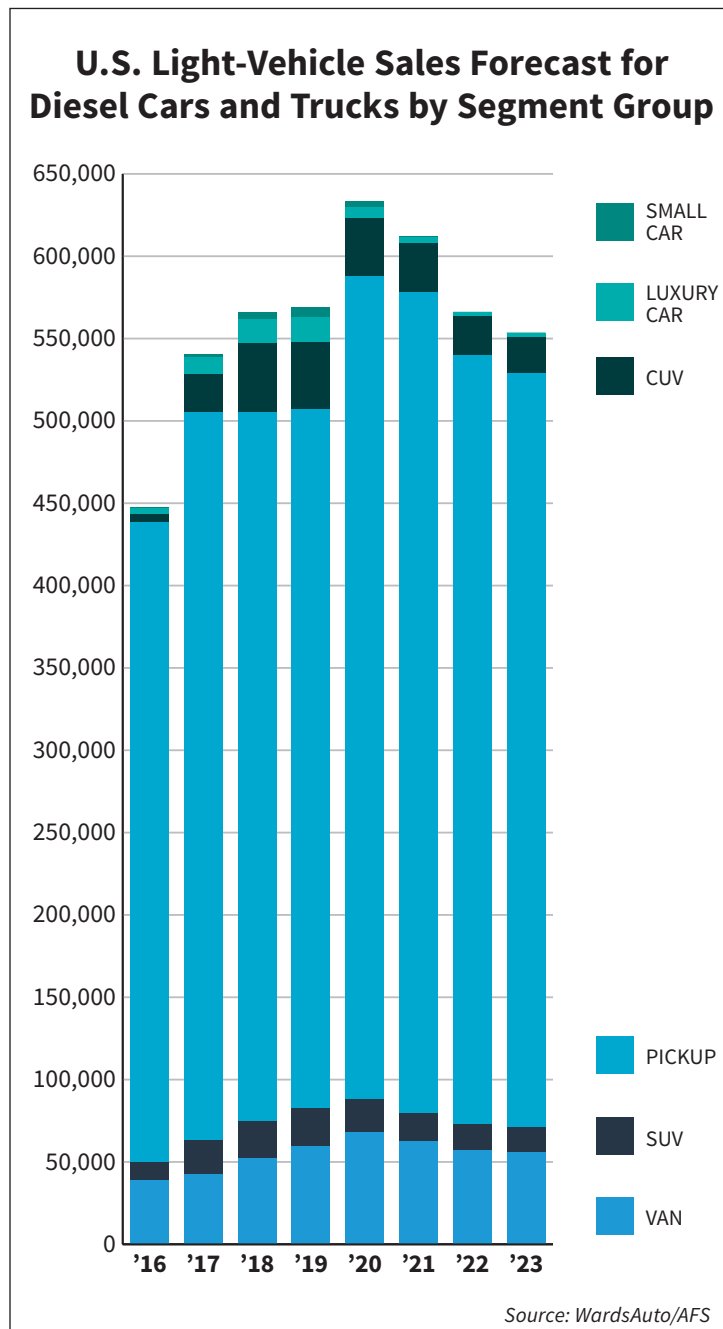
That explains why certain

automakers see an opportunity to fill the VW void. With these new players, diesel car sales are expected to regain some momen-

tum, topping 21,000 units in 2019, before beginning to trail downward, according to the WardsAuto/AFS forecast.

The wildcard is President Trump, who is no fan of regulations and has raised questions about climate change and the true impact of tailpipe emissions. In his short tenure, he already has had dust-ups with the EPA, which enforces emissions standards.

If Trump unravels years of legislation and incentives geared to promote hybrids and electric vehicles, it could make diesels more attractive – and set up a battle with California over pollution controls.



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Mazda Enthusiastic; FCA Less So

Sixteen months after Dieselgate was uncovered, environmentalists continue fuming over the impact on air quality, and VW could spend more than \$25 billion in fines and paybacks to placate customers who owned the non-compliant vehicles.

It's been a long slog since the 1970s to convince Americans that torque-rich, fuel-sipping diesel engines with the endurance of a marathon runner are the ideal powertrain choice for a nation

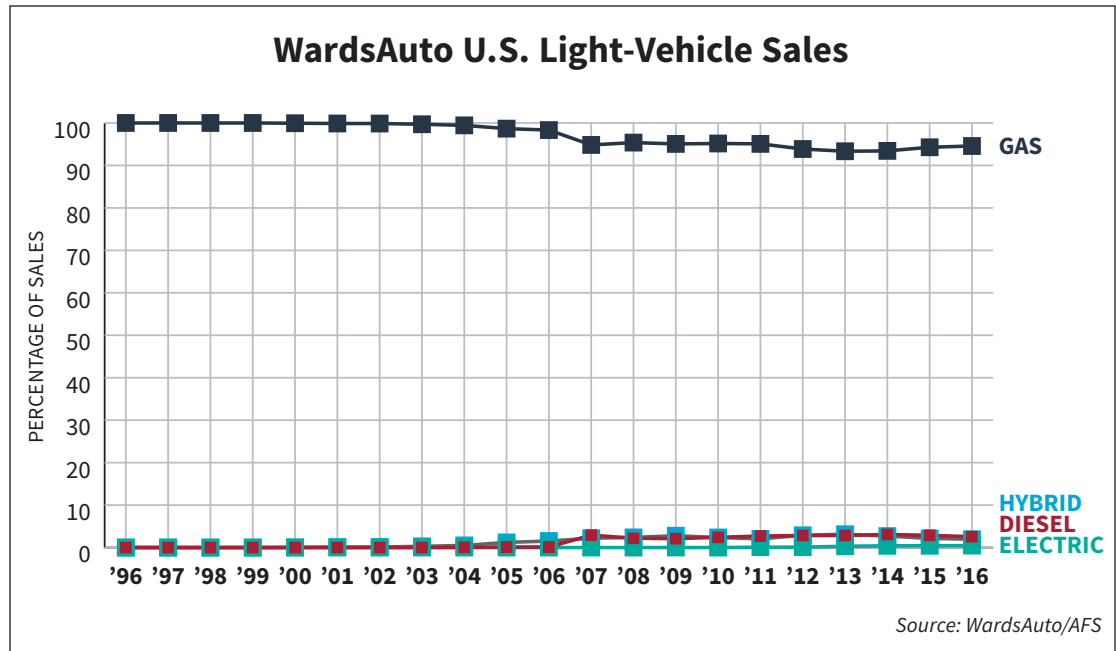
with 164,000 miles (263,925 km) of highways. In their best year, 2014, a mere 3.1% of new light vehicles in the U.S., or about a half-million units, were sold with diesel engines.

Those half-million Americans who bought diesel-powered vehicles in 2014 are among the most learned shoppers around.

They seek out the handful of models available with compression ignition and don't mind paying more – sometimes thousands



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of dollars more – for their diesels.

VW TDI diesel engines were beloved by this die-hard core of enthusiasts, and GM, Ford and Mazda are reaching out with new products to draw them in.

In this year’s second half, Mazda will offer the CX-5 with the brand’s first modern diesel in the U.S. – a 2.2L Skyactiv engine that has been available in Japan, Europe and Australia for several years.

Mazda manage-

Mazda’s first modern diesel in the U.S. will be available in the new CX-5.

ment repeatedly delayed the U.S. launch until the engine could meet emissions requirements while reinforcing the brand’s “zoom-zoom” character.

“We would love to have the car in the marketplace now while those (VW) customers are transitioning out,” says Robert Davis, senior vice president-special assignments for Mazda North





Ford will adapt “Lion” 3.0L diesel V-6 assembled at Dagenham, UK, for use in F-150 next year. Pictured is version used in Land Rover Discovery.

ing of the SCR system and necessary sensors. That work will prove important as stricter emissions rules in other parts of the world begin to require SCR.

“Now we can spread that cost over all the diesel cars we make instead of just the ones we sell in the U.S.,”

American Operations.

Mazda diesels offered in other parts of the world did not incorporate urea-based selective catalytic reduction (SCR) to filter out nitrogen-oxide emissions.

During these years of preparation for the U.S. launch, Davis says engineers did very little to the engine, but instead focused intently on vehicle structure, noise abatement and packag-

Davis says.

Mazda has been America’s most fuel-efficient brand four years in a row, achieving a fleet average of 29.6 mpg (7.9 L/100 km) in ’15, and that’s without a hybrid or plug-in electric vehicle.

Davis sees diesels, which generally are about 25% more efficient than their gasoline counterparts, as an important part of Mazda’s push for even greater fuel effi-



FCA's Sergio Marchionne: Diesels carry a steep cost premium.

ciency in the future.

Mazda's new low-compression (14.0:1) 2.2L diesel engine achieves a thermal efficiency of 42%, and Davis says 60% is within reach for internal-combustion engines, including gasoline. (BMW says some of its current diesels achieve 44% thermal efficiency.)

"Until you get that (internal-combustion) technology better, then why electrify it?" Davis asks.

"Why add the packaging that can't be spread around every car line? Let's focus on the 20% improvement you can put on every car, instead of worrying about one car that might be 40% more efficient that will cost \$10,000 more."

Despite Davis' assertions, FCA CEO and Chairman Sergio Marchionne insists diesels also carry a steep cost premium, especially to install SCR on new diesels in Europe to meet impending emissions requirements.

"The cost of the technology is going to push diesels right to the edges of what is (economically possible)," he says, adding they will be more expensive than a

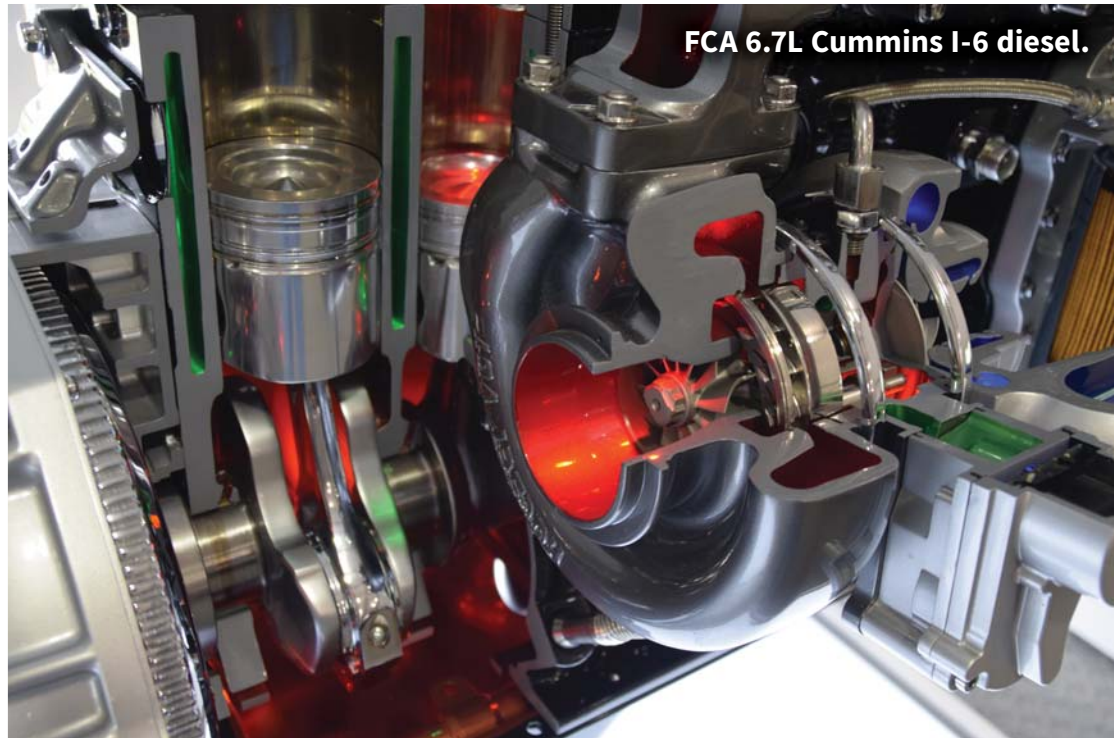
gas-electric hybrid powertrain.

Marchionne says FCA would have to spend €500 million (\$532 million) to bring the remaining 80% of its diesel engines into Euro 6 emissions compliance.

"These are not variable costs," he says. "These are base technology injections and the development of all the strategies to comply with Euro 6 in the final form in Europe. That's a big number. That's something that we don't carry with gasoline engines."

Marchionne says diesels have a bright future in trucks, tractors and construction equipment because the outstanding torque characteristics make the engines ideal for heavy loads and towing. "But on the passenger-car side, if you ask me 10 years out, I think (diesel) will have limited use," he says.

In Europe, where diesels have made up half the new-car market for years, Daimler CEO Dieter Zetsche is convinced automakers will not meet future CO2 emissions standards without diesel, and that Mercedes will continue investing in them.



“The diesel engine basically can be just as clean as a gasoline engine, and we are just proving that with the E-Class with our new generation of diesel engines,” Zetsche says, referring to Mercedes’ new 3.0L inline 6-cyl. turbodiesel (codename M256) unveiled last year.

The automaker is hoping to bring that engine to the U.S. in the GLS SUV, but a launch date has not been confirmed.

The regulatory process poses a major hurdle as automakers need emissions certification from both

U.S. EPA and CARB. In the wake of the VW investigation, powertrain engineers tell *WardsAuto* the certification process for a diesel that used to take six weeks now often takes six months.

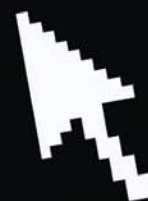
This bureaucratic logjam probably has a lot to do with Mercedes not offering any diesel vehicles in the U.S. at the moment and why the planned 4-cyl. C-Class diesel won’t reach American shores anytime soon. In model-year ’16, Mercedes showrooms had diesel versions of the GLE, GL and E-Class.

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Cummins plant in Columbus, IN, assembling 5.0L diesel V-8 for Nissan Titan XD.

CARB Wants Clean Diesels

An administrator with CARB, which has an ambitious goal to populate California roads with 1.5 million zero-emission vehicles by 2025 in a bid to reduce greenhouse gases, says he sees diesel playing a role in the state’s low-carbon future.

“From our perspective, we were betting very heavily on clean diesel being part of the solution,” CARB Deputy Executive Officer Alberto Ayala tells *WardsAuto*. “When we began to see the light-duty automakers bringing to market some of the clean-diesel

technology that was emerging at the time, we tried to do what we could to be supportive.”

VW may have tainted the regulatory waters for diesel, but Ayala says the good relationship between automakers and agencies such as CARB can be restored.

“With respect to the scandal, one of my biggest worries is the issues we’ve uncovered with VW – and now FCA – could become somewhat of a scarlet letter for the entire clean-diesel industry. I don’t think that would be fair. It



In wake of Dieselgate, VW's Herbert Diess lays out crucial brand strategy for 2017 at Detroit auto show in January.



CARB's Alberto Ayala: "From our perspective, we were betting very heavily on clean diesel."

would not be good for anybody," he says. "There's a lot of good non-cheating clean technology out there that applies to diesel, and we're very much interested in doing what we can to promote that technology."

Although VW has said it won't sell diesel vehicles in the U.S. again, Ayala says CARB would be open if the automaker changed its mind and wanted to bring diesels back to California.

"Why wouldn't we?" he asks.

"If they came back, they know the (regulatory) thresholds will be higher for them and for everyone else. Certification will evolve and improve. If in the future they see clean diesel as part of the solution, we are here ready to hear them out and consider their ideas."

Although the car market share for diesel is minuscule in the U.S., the global picture is quite different, as WardsAuto/AFS forecasts diesels making up at least 15% of



BMW's Fritz Steinparzer: BMW needs diesel as part of its powertrain picture.

the world's light-vehicle engines through 2023.

That comes as no surprise to Fritz Steinparzer, head of diesel engine development for BMW Group. In Europe, close to 80% of BMWs on the road are diesel, and the mix is up to 60% in South Korea and 50% in Japan, he says.

BMW began migrating its entire European fleet to SCR in 2011, and the transition will be complete in two years, he says. Clearly, the cost problem that vexes Marchionne is less an issue at the Bavarian price point.

With new Euro 6d legislation calling for Real Driving Emissions testing, Steinparzer says nearly every new vehicle with a diesel engine, no matter the size or price, will need SCR to pass the test. Once that's achieved, "there is no reason from an emissions side to be against diesel in the future," he says.

Steinparzer says BMW needs diesel as part of its powertrain picture, along with electrification, to meet European CO2 fleet standards.

"For us, it's very important to

have diesel supporting this target, so we will further invest in diesel development," he says. "We want the conventional gas and diesels, and clearly we need electrification."

This year, Steinparzer says BMW will launch redesigned detuned 3- and 4-cyl. diesels that will improve fuel economy 4%. (Europe will get the engines first, and the 2.0L 4-cyl. is slated for the U.S.) A second phase of this development in the future will upgrade diesel efficiency another 4%, he says.

As part of the electrification bid, BMW is working on 48V electrical systems to pair with both gasoline and diesel engines. "This will bring another 6% to 10% on top of the 8%," Steinparzer says.

Amid his excitement about diesel, Steinparzer is sheepish when asked if the BMW exhibit, positioned right next to VW at the recent North American International Auto Show in Detroit, displayed any diesel vehicles. "Not a one," he says with a weak smile.

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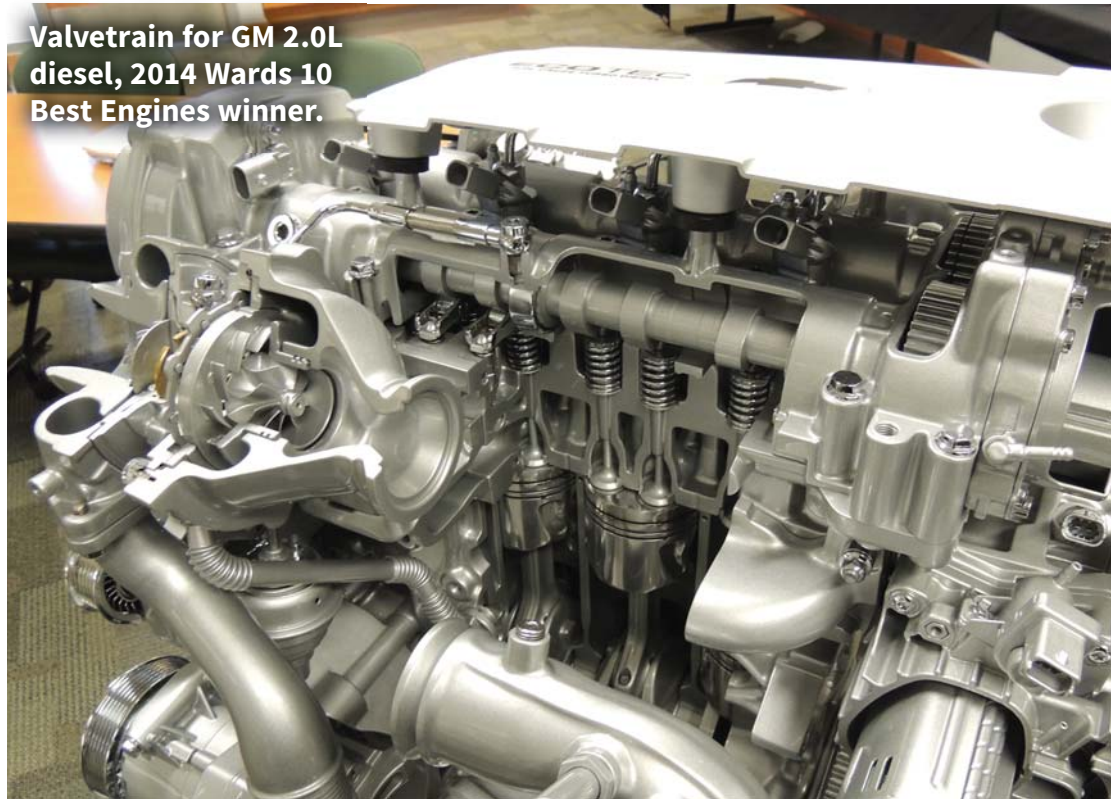
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Valvetrain for GM 2.0L diesel, 2014 Wards 10 Best Engines winner.



GM 'Bullish' on Diesels

Dan Nicholson, vice president-global propulsion systems at General Motors, declares the automaker "bullish" on diesels.

"I can almost guarantee that you will see new diesel engines in the market in the U.S. in the future," he says. "If you drive 12,000 miles (19,311 km) a year – half in the city, half on the highway, a diesel won't pay off. But if you drive 20,000-plus miles (32,186 km) a year and you're

going to keep your car four, five or more years, there's a payoff."

Besides the 6.6L Duramax diesel engine that has been a mainstay in GM's heavy-duty pickup trucks for years, the automaker launched a small 2.0L 4-cyl. diesel in the Chevrolet Cruze that won a Wards 10 Best Engines award in 2014.

It was intended to compete with VW diesel engines, which had amassed a loyal following in the Golf, Beetle, Jetta and Passat.



GM's Dan Nicholson: "Bullish" on diesels.

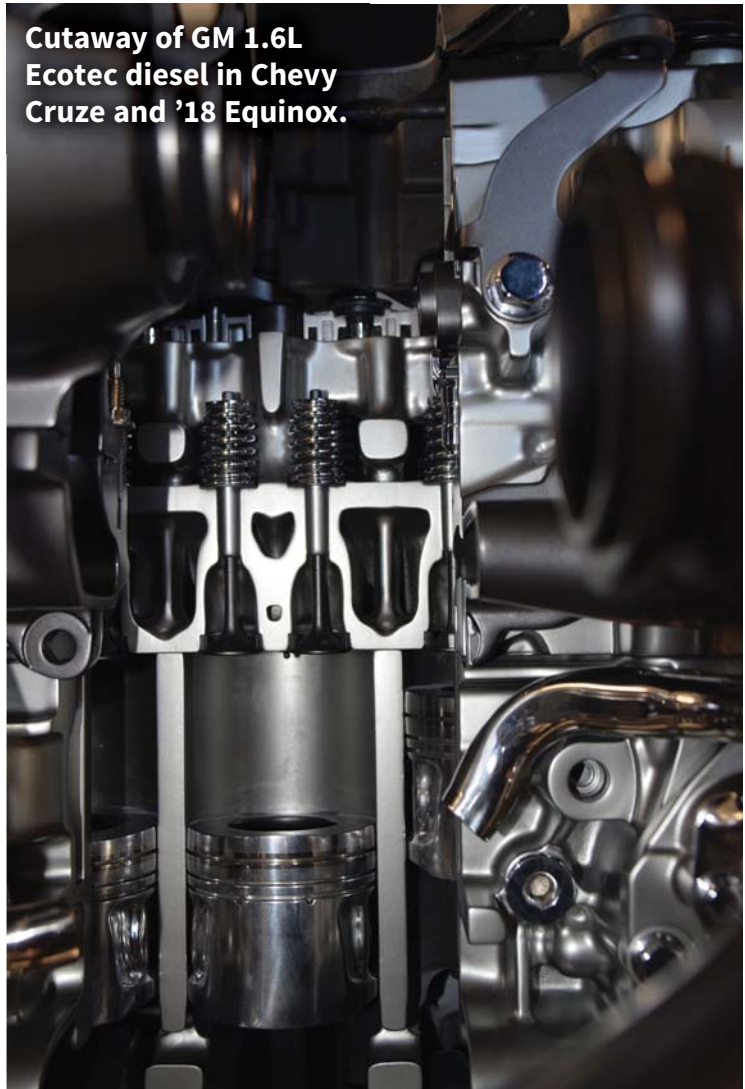
But Chevy's 2.0L diesel proved disappointing in showrooms: It never saw the light of model year '16.

Still, GM isn't giving up, having slotted a new 1.6L diesel 4-cyl. in the '17 Cruze and the forthcoming '18 Chevrolet Equinox CUV.

This time around, Nicholson says GM doesn't have to worry if the new 1.6L diesel only makes up 2% or 5% of the mix for Cruze sales, because the European plant manufacturing the engine is fully commercialized. "That plant is full whether we sell (diesel) Cruzes or not," Nicholson tells *WardsAuto*.

"We know the segment exists because customers who bought (diesels) before knew why they bought them and they didn't go away," he says. "We think there are still diesel intenders. So we want to go get them because they are

Cutaway of GM 1.6L Ecotec diesel in Chevy Cruze and '18 Equinox.

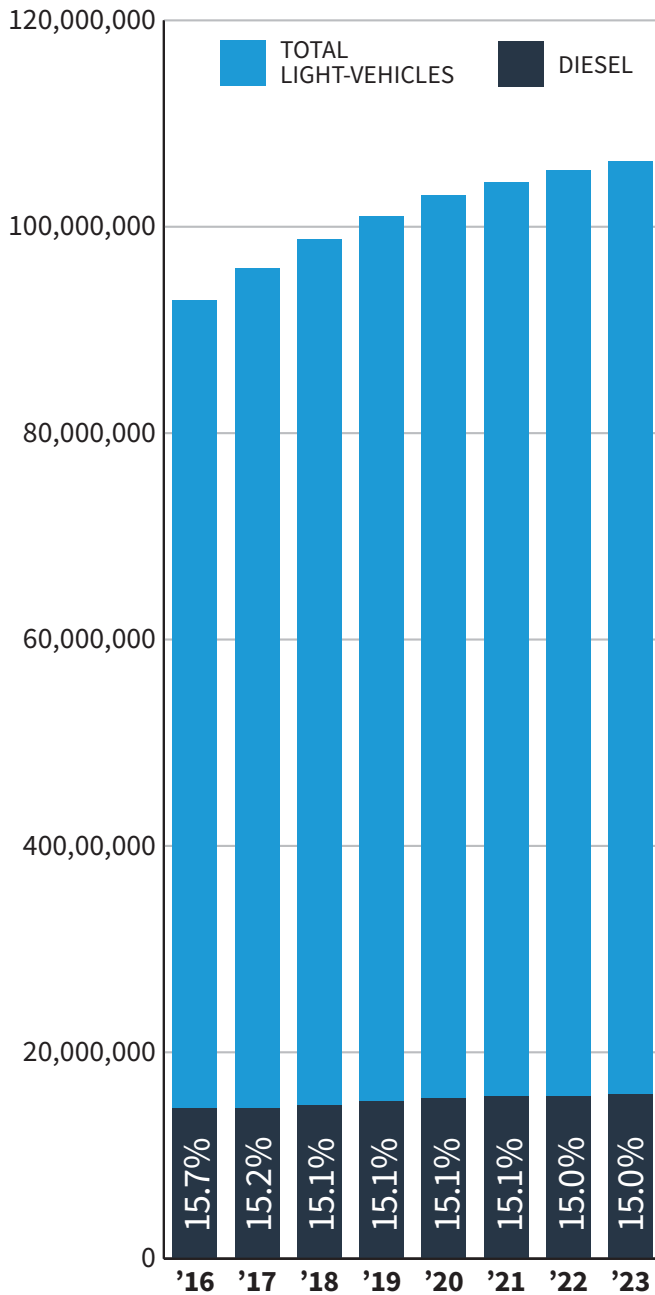


great customers to attract to the Chevrolet brand. They don't have anywhere to shop at the moment."

In the short term, Nicholson says European automakers "can't even come close to CO2 targets without diesels, and there's not that much flexibility in the supply chain and engine plants to do



Diesel Share of Global Powertrain Production (all light-vehicles)



Source: WardsAuto/AFS

much different.”

German supplier Continental, which makes high-pressure common-rail fuel injection systems that have delivered big gains for modern diesel engines, sees compression ignition becoming marginalized in the future, especially for car applications with engines below 1.6L in displacement.

“If you look at large, midsize and fullsize vehicles, SUVs, they are going to continue to have diesels,” says Continental’s Gregg Wiggins, senior vice president-powertrain. “They may be electrically assisted diesels. They may move into electrification because of these political city-center discussions that are ongoing. But certainly above light-commercial, when you get into the U.S. like our heavy-pickup market, those things will continue to be diesels.”

Fellow German supplier Rheinmetall Automotive, which manufactures engine blocks, pistons, pumps, thermal management and exhaust-gas recirculation modules for diesel engines, sees evidence automakers are continuing to invest in future die-



Rheinmetall's Horst Binnig notes brisk demand from customers for diesel components.

sel engine programs.

“We are not limiting investments for diesel,” Rheinmetall Automotive Chairman Horst Binnig tells *WardsAuto*, noting brisk demand from customers for diesel components incorporating new technologies.

Likewise, Japanese supplier Denso continues to see a robust market for its diesel fuel injectors, pumps and common-rail systems, which are produced at three plants in Hungary, Thailand and Japan for cars as well as agricultural and construction equipment.

“There’s a play for diesel no matter what happens in the auto-

motive side. We will continue playing in that arena,” Denso Senior Director Doug Patton tells *WardsAuto*.

In North America, Patton agrees pickups and SUVs hold great potential for diesel growth. “The work truck needs that diesel application,” Patton says. Denso scored a big win by displacing Bosch for the common-rail fuel system on GM’s redesigned 6.6L Duramax diesel V-8, which launched in December in ’17 fullsize heavy-duty pickups.

Patton is less upbeat about diesel’s prospects in small cars. “If you asked me this question



five years ago, I would have said I don't think there's a market for passenger-car diesel in North America," says Patton, whose outlook hasn't changed. "I think it's a matter of cost."

Jeffrey Breneman, executive director of the U.S. Coalition for Advanced Diesel Cars, says the industry has recovered well from the VW fiasco.

"We've worked hard to make sure the regulators and the policy makers could understand this was not a crisis of diesel technology," Breneman says. "It was decisions of one particular automaker, and OEMs in the market have gone through intense scrutiny on new models and even on older diesel models to make sure there weren't similar issues."

Breneman is confident in diesel's long-term ability to meet emissions regulations in every part of the world, and he isn't looking for government handouts or incentives to help diesel along.

"We want a level playing field and policies that don't favor one technology over another. Set the standard and get out of the way.

There are multiple pathways to get there, and the consumer has many choices," he says.

Breneman equates diesel's resilience to that of Detroit, a city with a rich automotive history that has faced enormous difficulties but is rising above them.

"Look at the headwinds that have been facing diesel for a decade and still prevail. It's a blue-collar fighter that is finding its space in the market," he says. "People keep counting diesel out, but it keeps coming back. There are penalties against diesel, and yet you see new product announcements." **WA**



This story was written by Senior Editor Tom Murphy with contributions from the WardsAuto staff. Murphy has

worked at WardsAuto for 20 years, covering technology and leading selection each year of the Wards 10 Best Engines, 10 Best Interiors and 10 Best User Experiences.