How & Why Diesel Technology Dominates Trucking Today and Will (Still) Be A Dominant player In The Future

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DIESEL TECHNOLOGY FORUM

The Diesel Technology Forum Represents Leaders in Clean Diesel Fuels and Technologies.

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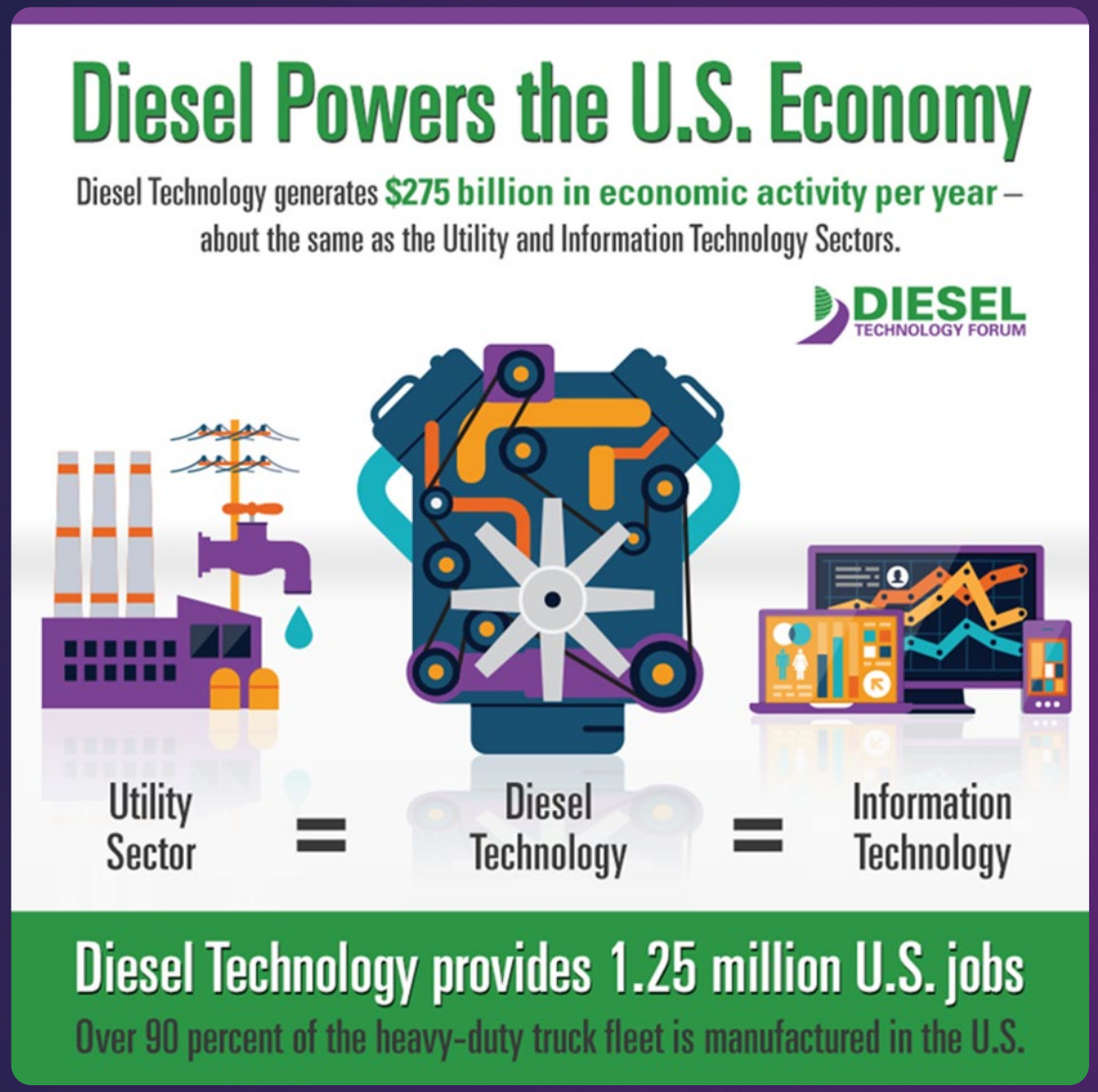

Diesel's economic impact about the same as utility or IT sectors

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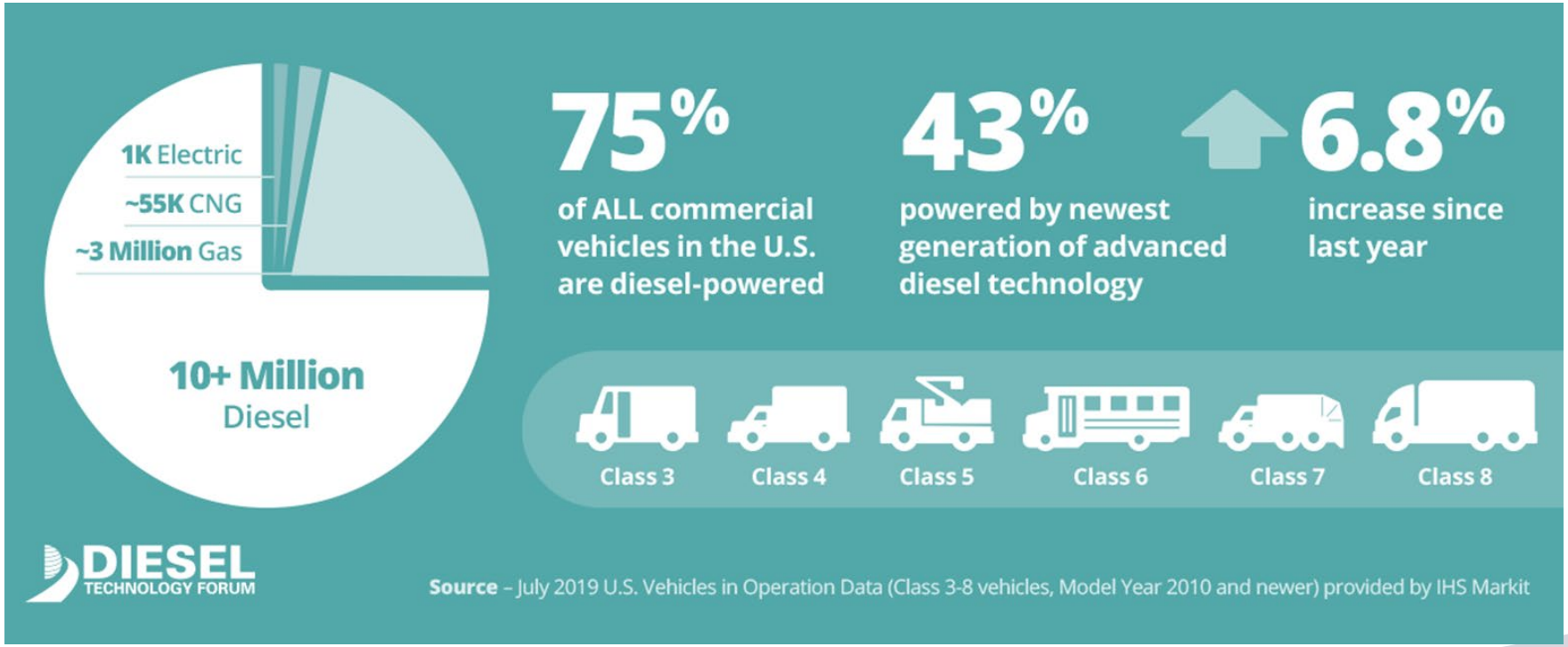
Why Diesel?

- Most energy-efficient internal combustion engine; with further efficiency gains coming.
- Proven - Continuous improvement over 100 years
- Available - more than 2/3 of all fuel retailers have diesel; extensive service and parts network nationwide.
- Durable –1,000,000 miles
- Reliable – key to uptime requirements in trucking, construction, emergency back up power
- Powerful - most energy density per unit volume
- Clean - now near-zero emissions, further reductions coming
- Renewable–fuel compatible existing and new engines; a low-carbon solution available now



Diesel is the Technology of Choice for America's Trucks

Today's generation of diesel is near zero emissions; tomorrow's will be even lower

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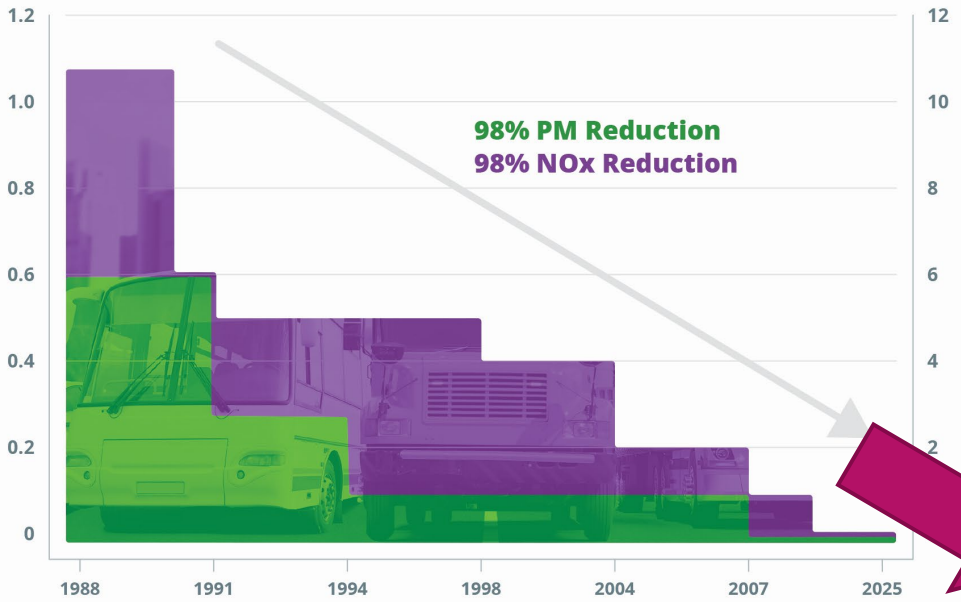
CLEAN DIESEL PROGRESS

Heavy-Duty On-Highway



Source: U.S. EPA Office of Transportation and Air Quality (OTAQ)

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EPA United States Environmental Protection Agency

Environmental Topics | Laws & Regulations | About EPA | Search EPA.gov

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News Releases from Headquarters > Air and Radiation (OAR)

EPA Jumpstarts Administrator Wheeler's Cleaner Trucks Initiative

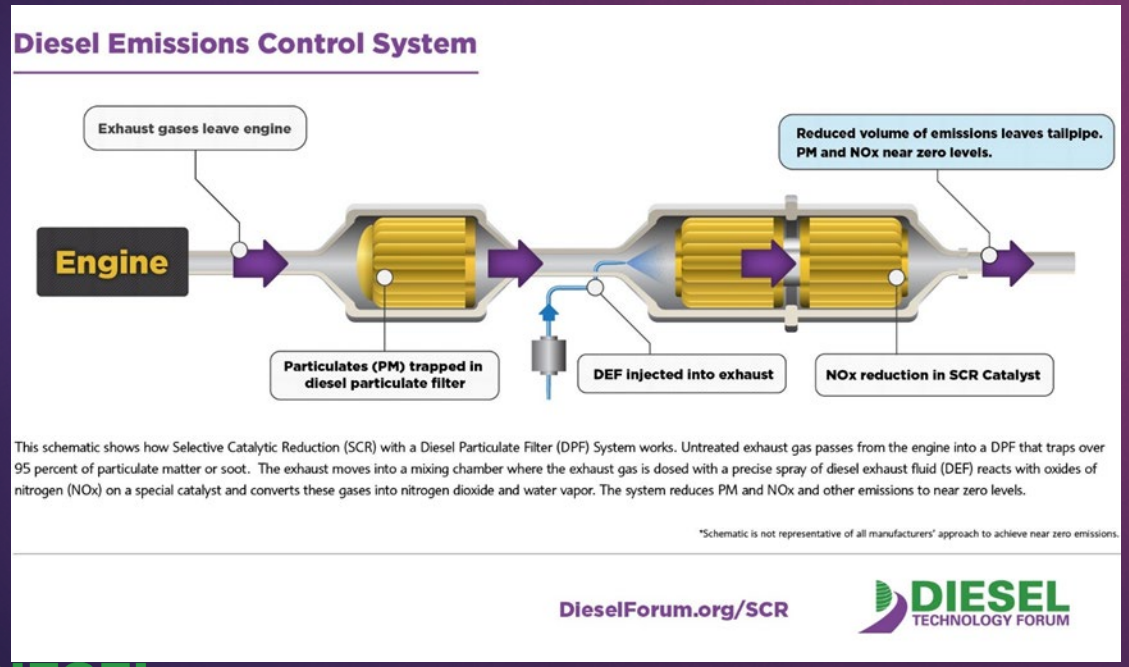
Agency seeks input on initiative for cleaner emission standards for heavy-duty trucks

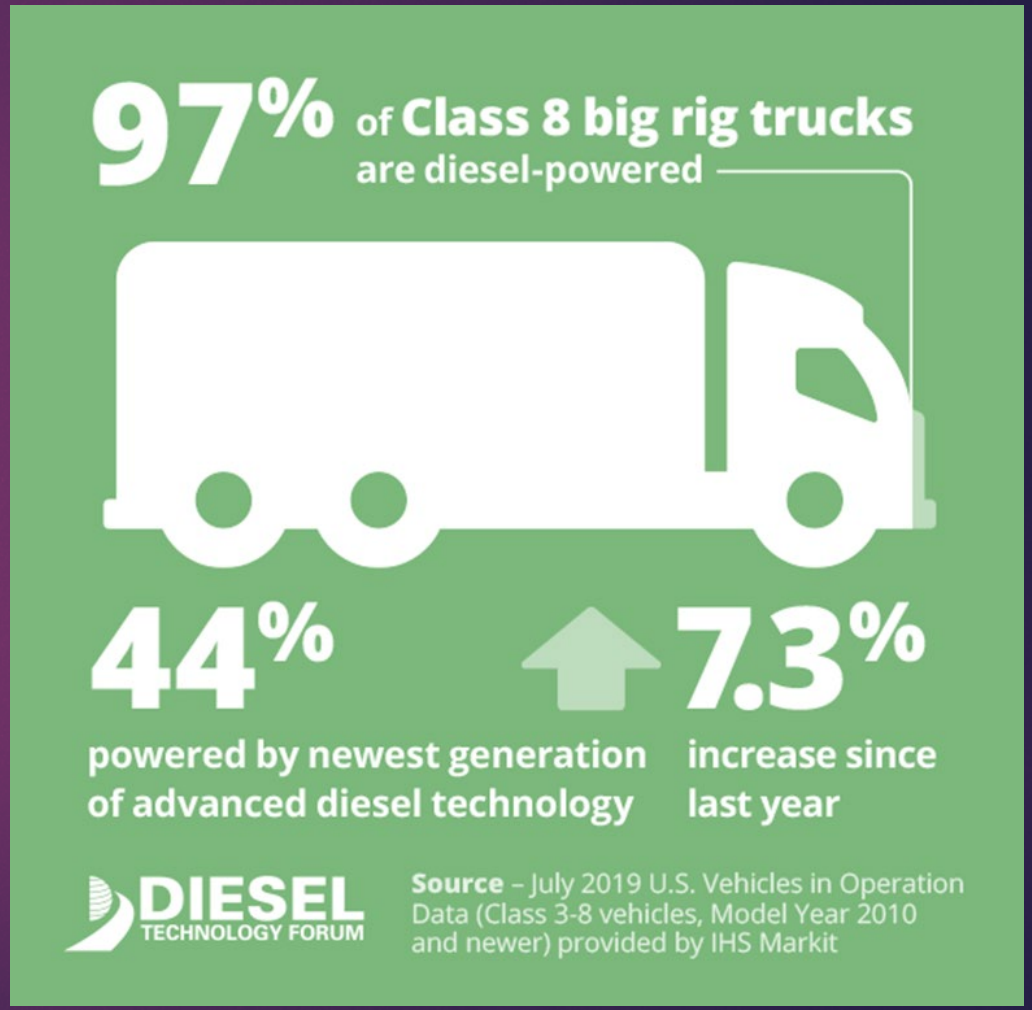
01/06/2020

Since 2011, number of New Technology Diesel Trucks on the Road has been growing ....

What is New Technology Diesel?

- Ultra low sulfur diesel fuel
- Advanced engines/combustion
- Integrated PM & NOX Emissions control systems





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… 43 % of all registered commercial diesel trucks in operation are New Technology generation

Percentage of Newest Generation Heavy-Duty Trucks

Ranking

1	Indiana	65%	6	Tennessee	47%
2	Oklahoma	56%	7	Maryland	47%
3	Utah	55%	8	Illinois	46%
4	Texas	50%	9	D.C.	46%
5	Pennsylvania	48%	10	Wyoming	45%

Indiana is #1 for 7 years in a row
at 65% for MY 2010+ heavy-duty trucks

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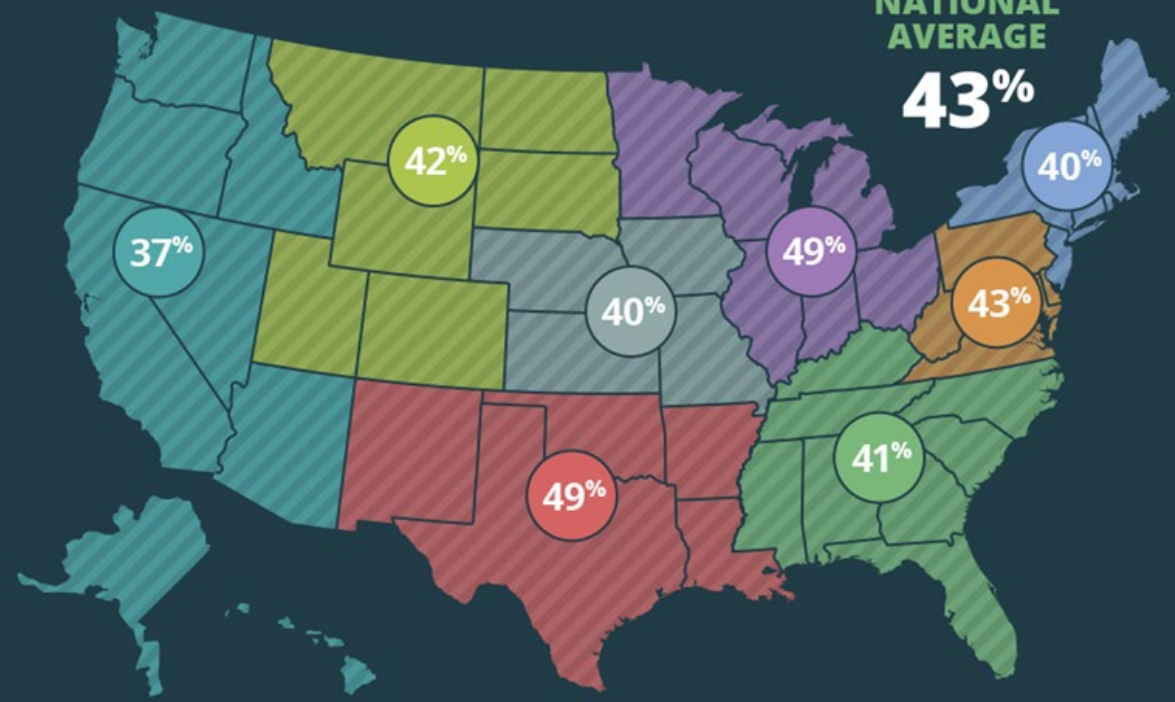
Source – July 2019 U.S. Vehicles in Operation Data (Class 3-8 vehicles, Model Year 2010 and newer) provided by IHS Markit

Percentage of Newest Generation Heavy-Duty Trucks by U.S. EPA Region

NATIONAL AVERAGE
43%



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Source – July 2019 U.S. Vehicles in Operation Data (Class 3-8 vehicles, Model Year 2010 and newer) provided by IHS Markit

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.... And these new diesel trucks are delivering significant Societal and Customer Benefits

New Technology Diesel Trucks Deliver Big Benefits for Climate and Clean Air

Fewer Emissions

126M Tonnes of CO_2

18M Tonnes of NOx

Saved Fuel

12.4B Gallons of Diesel Fuel

296M Barrels of Crude Oil

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Source – July 2019 U.S. Vehicles in Operation Data (Class 3-8 vehicles, Model Year 2010 and newer) provided by IHS Markit

New technology diesel trucks reduced **126 million tonnes of CO_2** emissions since 2007

Equal to removing CO^2 emissions from **26M** passenger vehicles from the road for one year or making them **zero emission** electric vehicles

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Source – July 2019 U.S. Vehicles in Operation Data (Class 3-8 vehicles, Model Year 2010 and newer) provided by IHS Markit

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Trucks in the Future will

- BE POWERED BY A RANGE OF FUELS BASED ON A RANGE OF FACTORS; BEST FUEL/TECHNOLOGY FOR THE JOB, AVAILABLE IN THE AREA; *ONE SIZE MAY NOT FIT ALL.*
- OPERATE IN A MORE EFFICIENT FREIGHT ECOSYSTEM - ALL POINTS IN THE GOODS MOVEMENT CHAIN;
- INCREASINGLY UTILIZE AUTONOMOUS FEATURES, CONNECTED TECHNOLOGIES AND….. HUMANS!

VOLVO LIGHTS

23 Heavy-duty battery electric trucks (HDBET)
29 Off-road battery electric tractors
58 Non-proprietary Level 2 and DC fast chargers
1.9 million kWh annual solar energy

https://www.lightsproject.com/

Daimler Trucks

https://freightliner.com/e-mobility/

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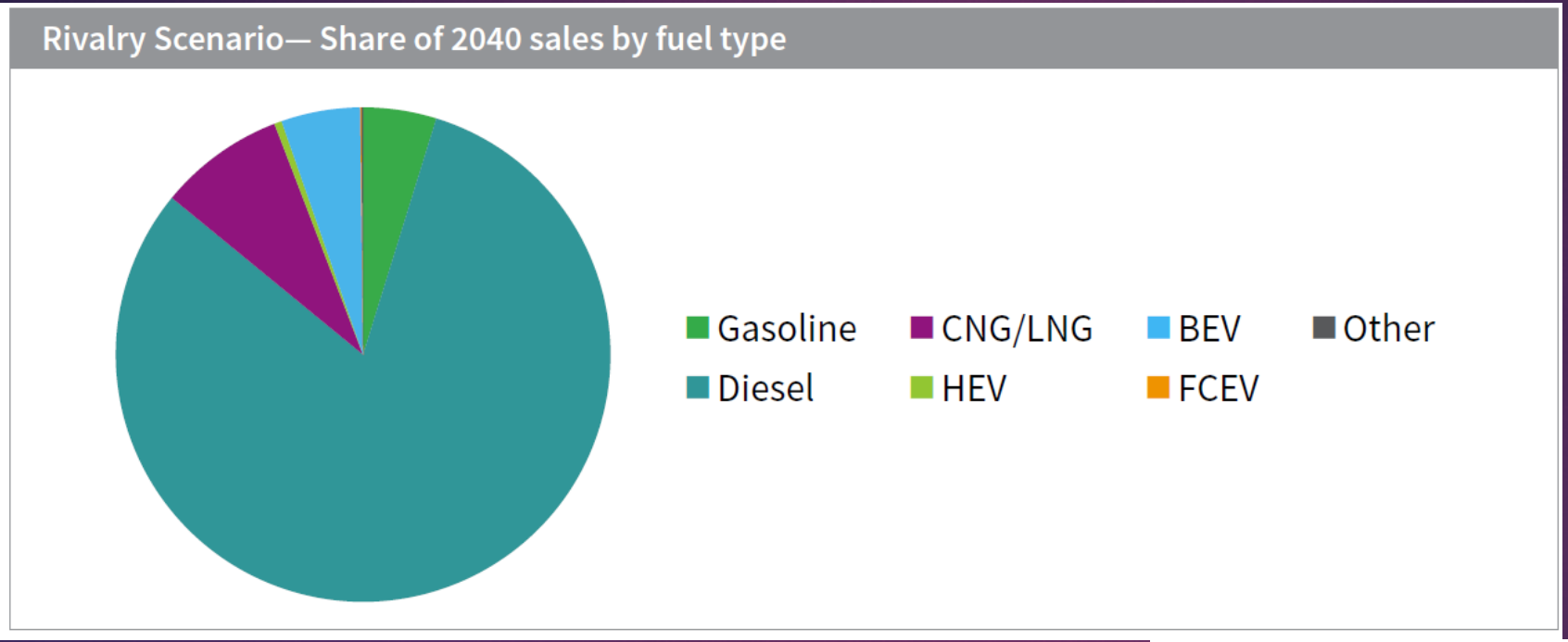
Service vehicle with Cummins PowerDrive hybrid system

Electrified power – hybrid drive

PowerDrive replaces the conventional transmission and switches in real time between two hybrid and two pure electric modes, optimizing the powertrain for the best fuel economics in any driving situation.

https://www.cummins.com/news/releases/2018/09/19/cummins-debuts-its-unique-and-versatile-hybrid-powerdrive-iaa-commercial

Diesel Technology will continue to dominate HD Truck Sector beyond 2040



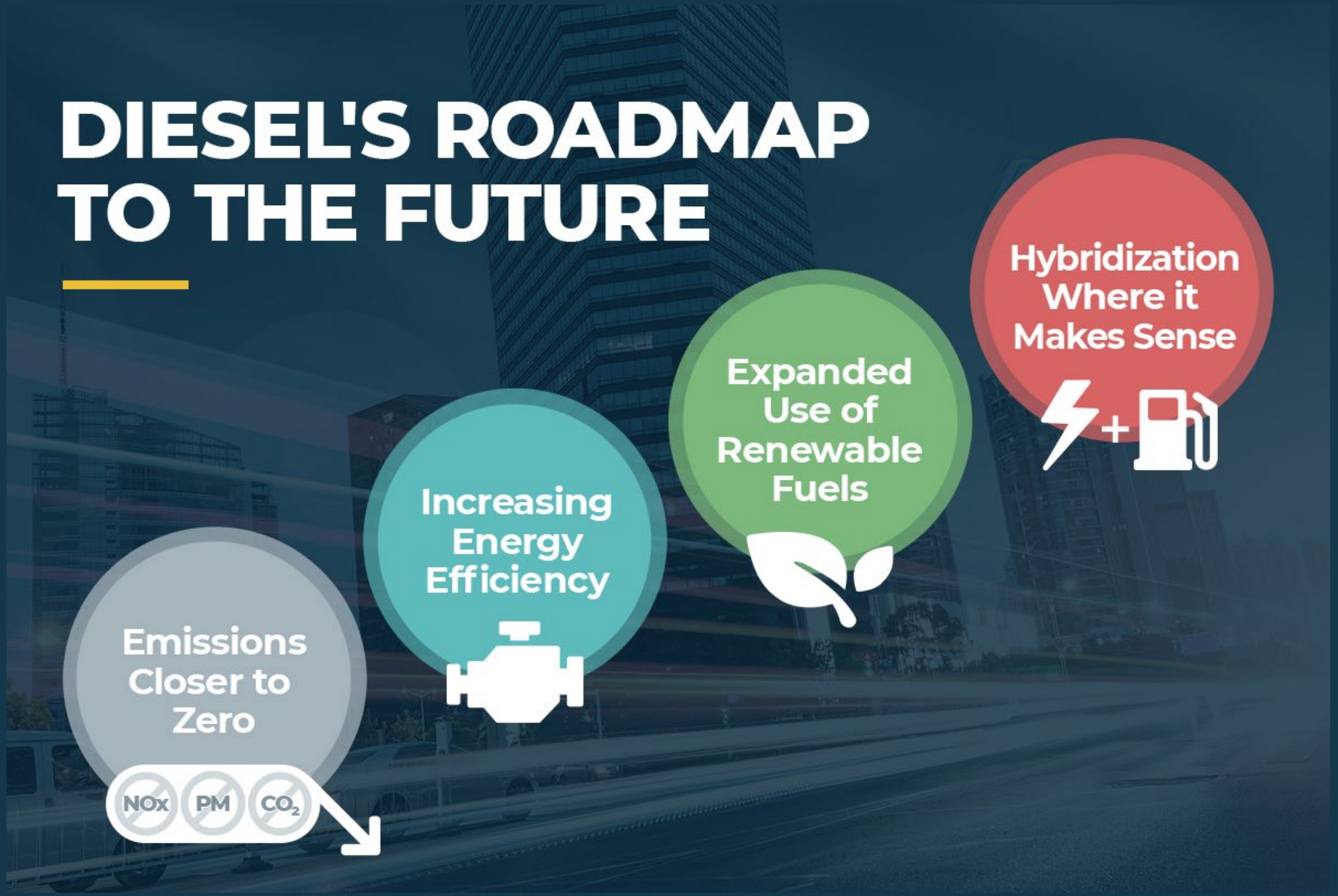
"Advancements in the diesel engine allow it to remain cost competitive to new technologies to 2040, but share will decrease over time."

IHS Markit™

Reinventing the Truck

Analyzing the impact of electrification, alternative fuels and autonomy advances on fleets, OEMs and suppliers.

DIESEL'S ROADMAP TO THE FUTURE



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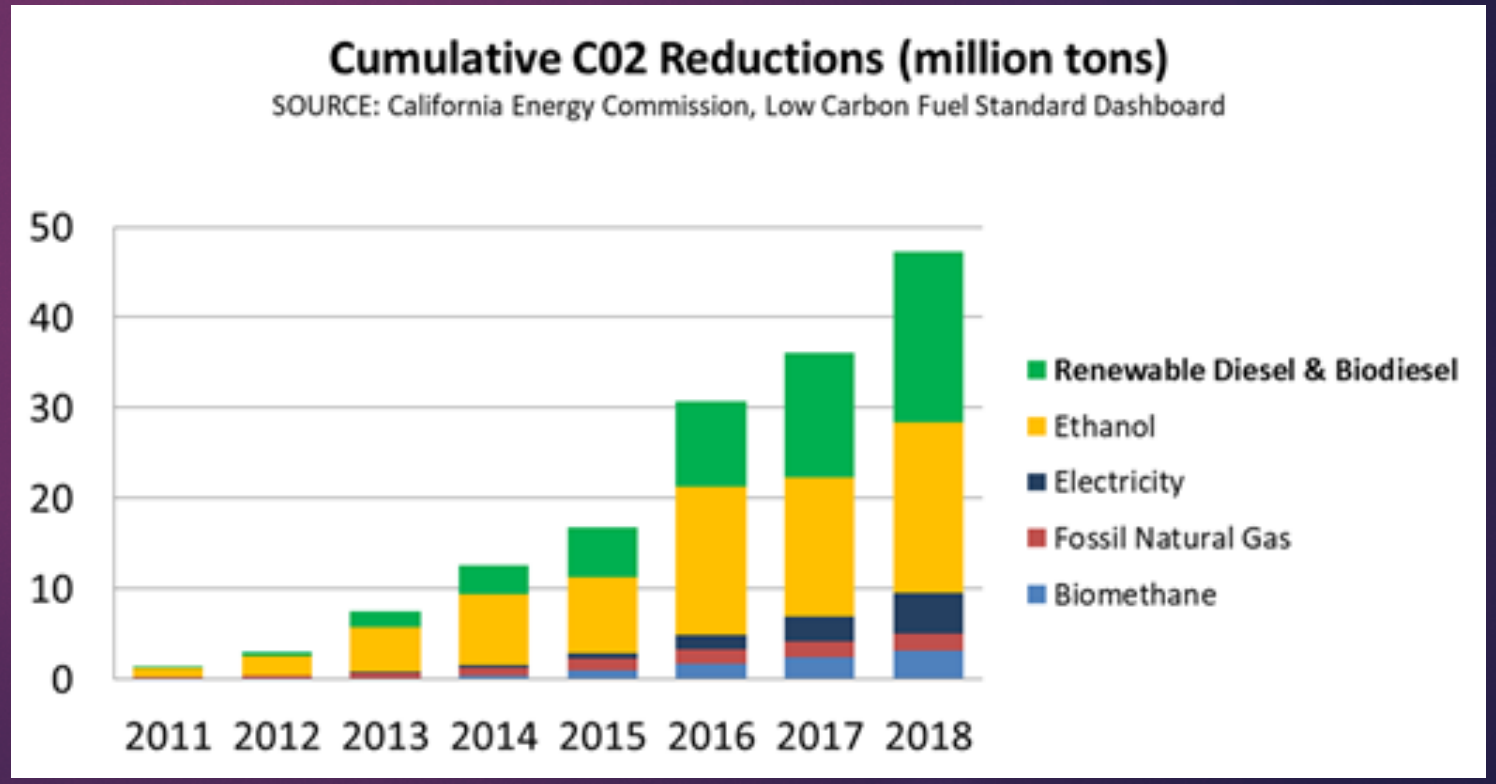
Increasing Use of Low-Carbon Renewable Biodiesel Fuels has **immediate climate benefits**, without changing infrastructure or engines

Increasingly use Low-Carbon Renewable Fuels

In CA, C02 Reduced (2011-2018)
Renewable Diesel and Biodiesel = 18.9 million tons

Ethanol = 18.8 million tons

Battery-Electric = 2.5 million tons



Final Thoughts

- Diesel is a technology of continuous improvement – lower emissions and increasing efficiency
  - New Diesel trucks are achieving near zero emissions today; new rulemaking ensures even **lower NOx emissions for the future (~2027)**
  - New Diesel trucks also have **lower GHG and are more fuel efficient**
- Use of **advanced renewable biofuels across existing fleets** brings fast carbon reduction and low emission benefits to large vehicle populations with minimal investments;
- Greatest **suitability for alternatives to diesel** likely to come in regular routes, short range, urban/sensitive areas operations, when fuel access, refueling/charging issues become solvable and affordable.
- **Attacking climate and clean air challenge will require many solutions; new generation of diesel technology is one of them.**

Thank You

More information at https://www.dieselforum.org

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