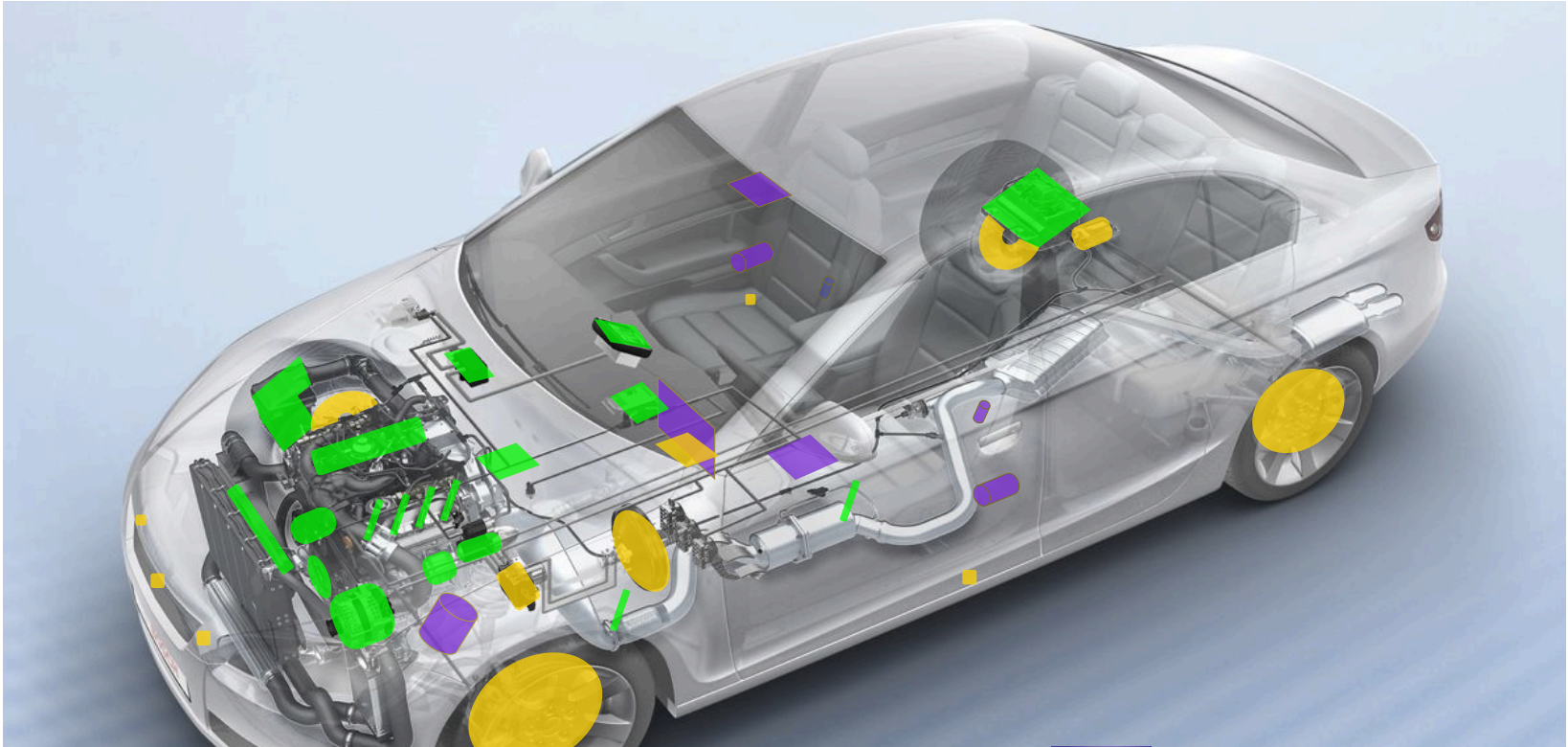


Automotive Technology business sector



BOSCH

Automotive Technology: an overview



clean &
economical

Powertrain systems



safe

Safety systems



comfortable

Comfort systems



BOSCH

Automotive Technology business sector

All Makes

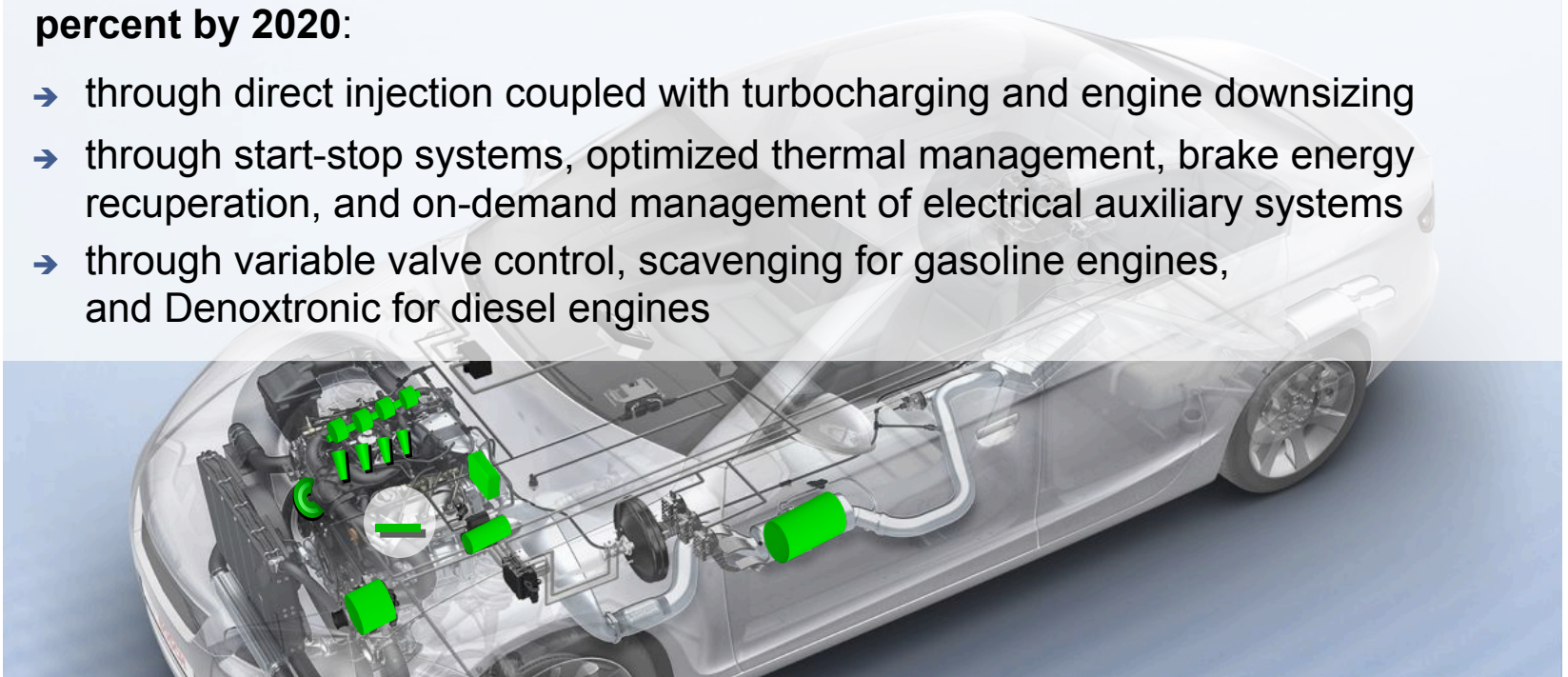


BOSCH

Sustainable mobility through innovation

The internal-combustion engine will dominate until electrical powertrains establish themselves in larger numbers. Bosch has the technology to **reduce** the fuel consumed and the CO₂ emitted by internal-combustion engines **by another 30 percent by 2020**:

- through direct injection coupled with turbocharging and engine downsizing
- through start-stop systems, optimized thermal management, brake energy recuperation, and on-demand management of electrical auxiliary systems
- through variable valve control, scavenging for gasoline engines, and Denoxtronic for diesel engines



BOSCH

→ Diesel cars are economical

- More than 30 % lower fuel consumption than port fuel injection gasoline engines on average
- Longer engine lifetime
- Higher resale value than gasoline cars

→ Diesel cars are clean

- About 80 % reduction in harmful emissions over the last 10 years
- About 25 % lower CO₂ emissions compared to port-fuel injection gasoline engines
- Quiet operation due to innovative pre-injection

→ Diesel cars are fun to drive

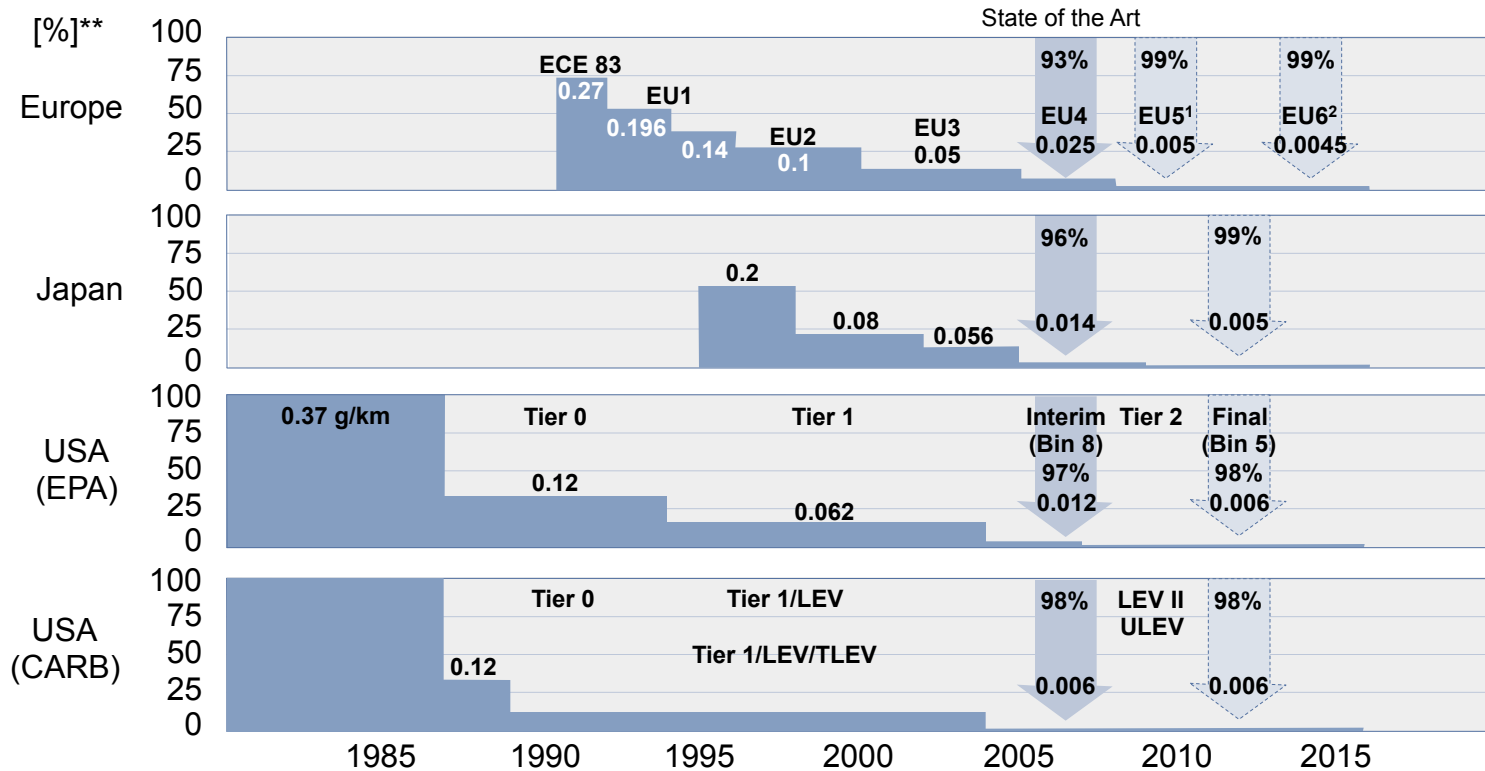
- High specific power output
- High torque → up to 50 % higher torque than gasoline cars
- Better acceleration at lower engine speeds
- Less fuel stops due to higher mileage



Source: Diesel Academy



World Wide Particulate Emission Regulations*



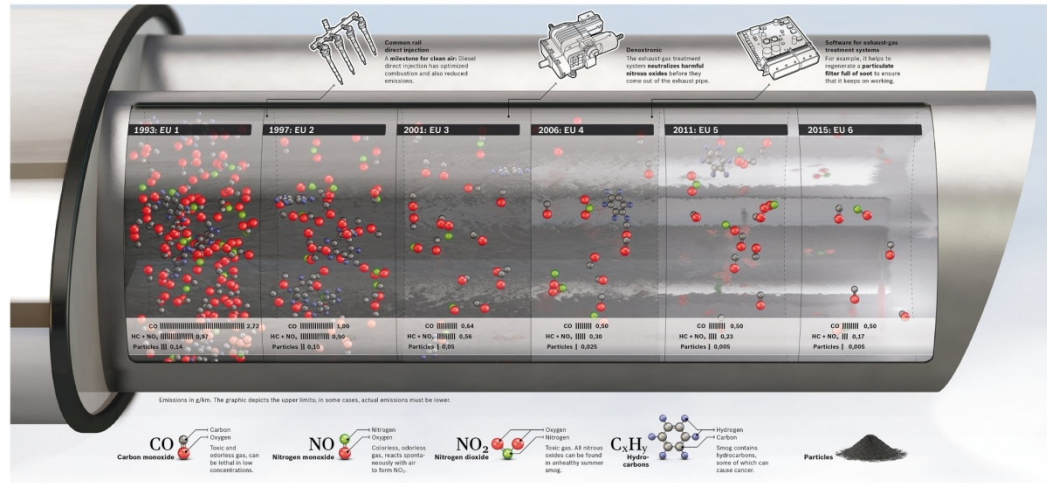
* All emissions standards (values) in g/km
 ** 100 % means the value of 0.37 g/km regimented in the USA in 1971
 PM = Particulate Matter Emissions

1) EU5 PM: from 09.2009: 5.0 mg/km (current PM measurement method)
 EU5 PM: from 09.2011: 4.5 mg/km (proposed limit with new PM method)
 2) EU6 PM: from 09.2014: 4.5 mg/km (proposed limit with new PM method)



Particulates Reduction by Clean Diesel

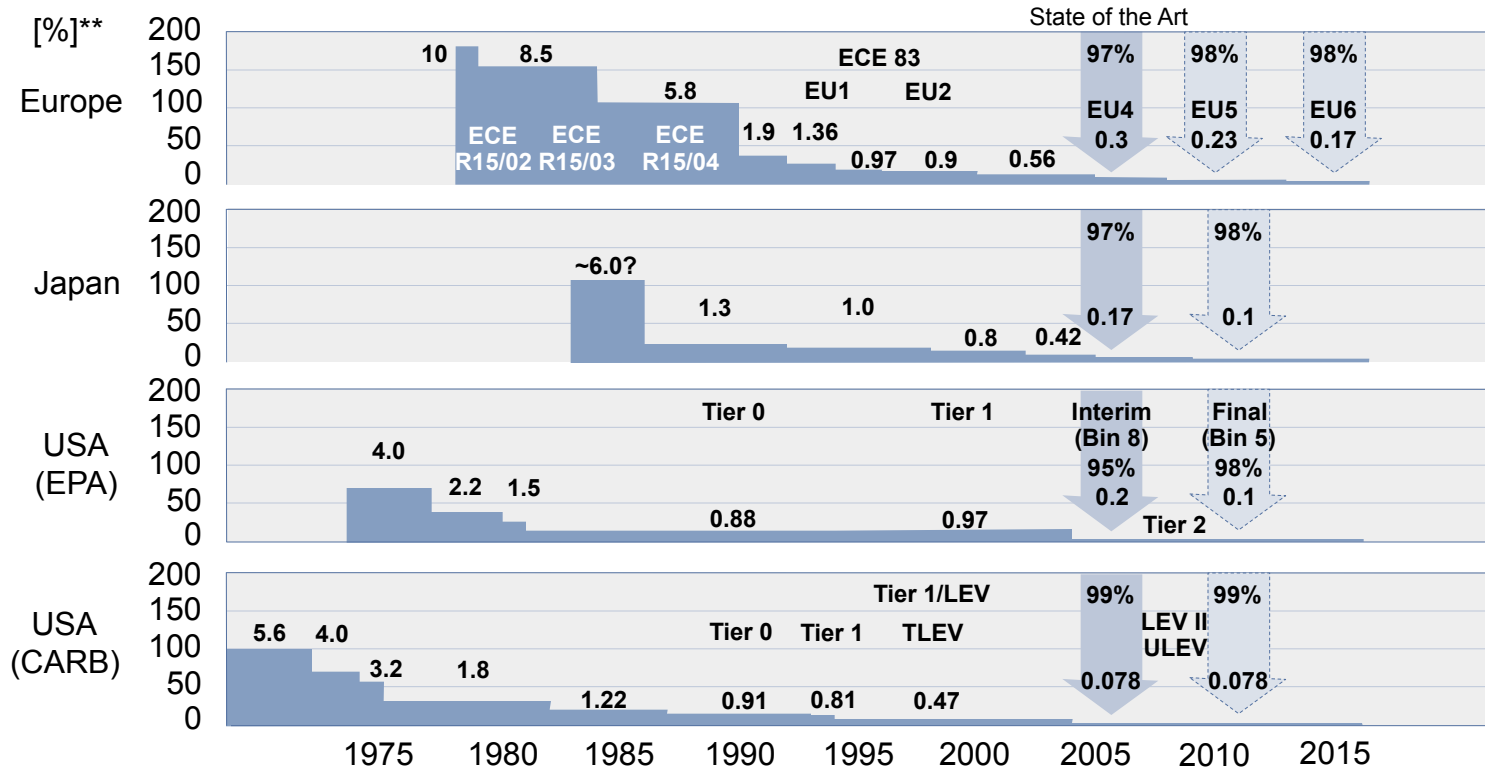
→ The Clean Diesel has 98%* less particulates than the diesel engines of 1990. The particulates generated in the engine are filtered out by the particulate filter.



The Clean Diesel has almost no further particulate emissions

* Comparison between ECE83 and Euro 5 emission legislation.

World Wide Nitrogen Oxide Emission Regulations*



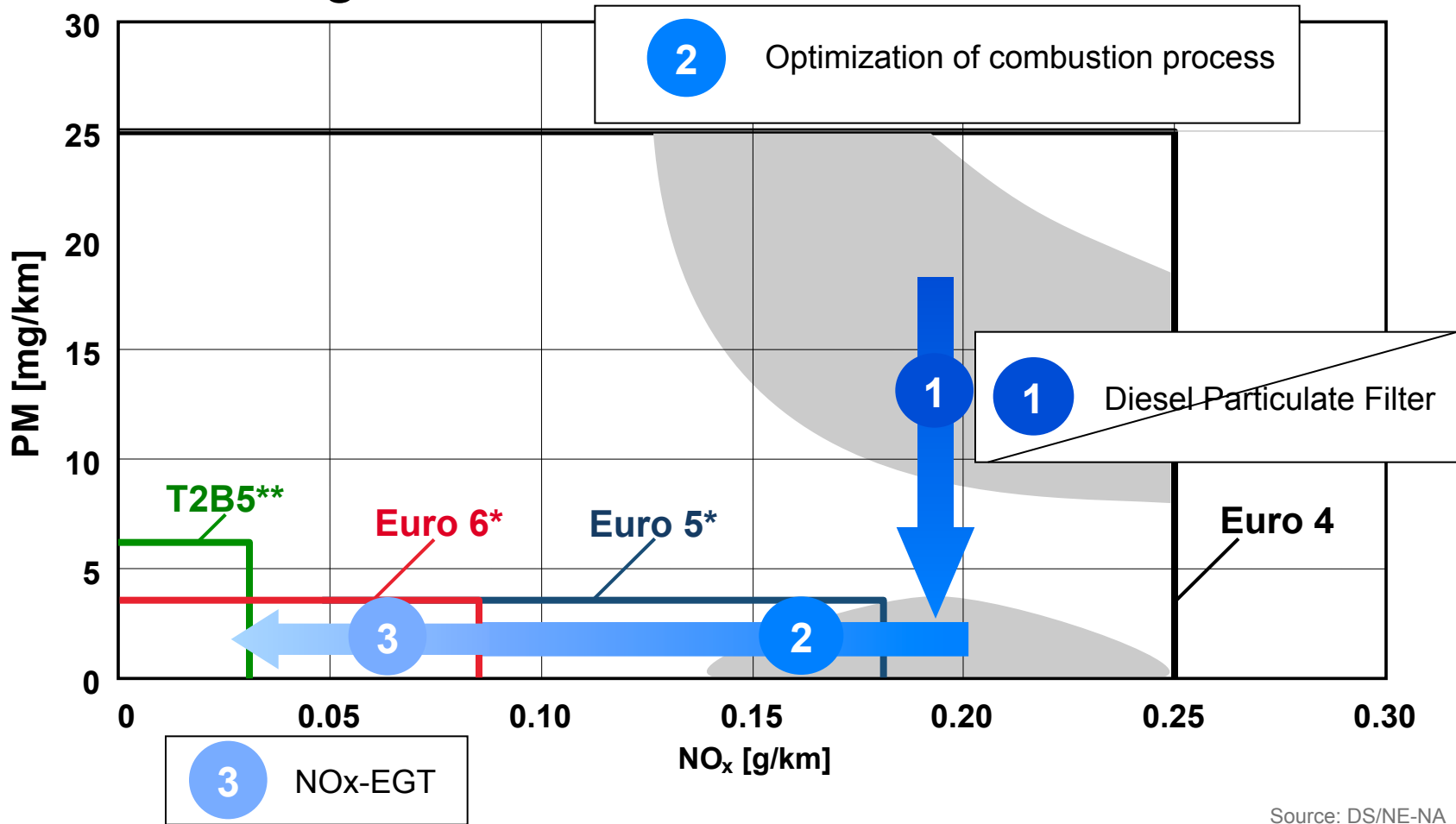
NO_x emission of a Clean Diesel is reduced by 98-99% in comparison to an older diesel engine version

* All emissions standards (values) in g/km

** 100 % means the value of 5.6 g/km registered in the USA in 1971



PC: Strategies to Reach Euro5 & 6 and Tier2 Bin5



Source: DS/NE-NA





Optimizing the Diesel System



Air Management

- Swirl-/Throttle Valve
- Turbo Charger/VGT*



Fuel Injection System

- New Generations
- Multiple Injections
- Reduced Tolerance
- Optimized Nozzle



Combustion Process

- Reduction of compression ratio
- Combustion strategies

DS/ENS-NA



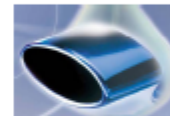
Tolerance Reduction

- Zero Fuel Calibration
- Fuel Balancing Control
- Individual Cylinder Control



Powertrain

- Hybrid Technology



Exhaust gas management

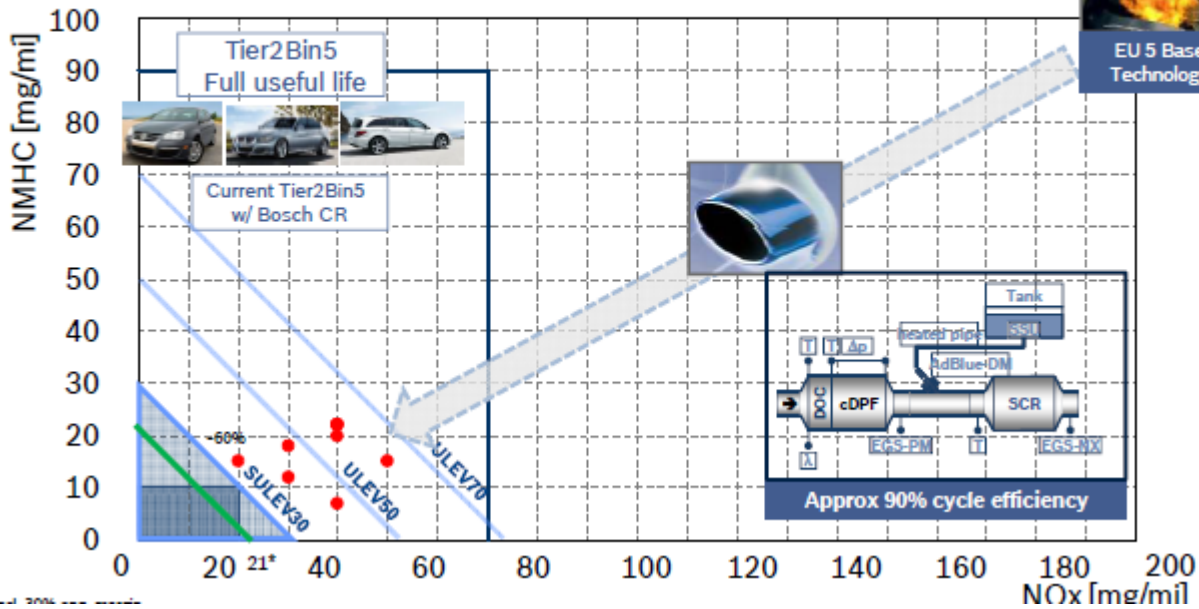
- Fast Catalyst Light-Off (reduce thermal losses)
- Diesel Particulate Filter
- NOx storage catalyst
- Catalystst temp control

Source: Diesel Academy





Current Emissions and Future Requirements



Source: Diesel Academy

Diesel Systems

