SEMINAR

"MEMBANGUN MODA TRANSPORTASI JALAN UNTUK SISTEM TRANSPORTASI MULTIMODA DAN LOGISTIK YANG EFEKTIF DAN EFISIEN DALAM MENGHADAPI MASYARAKAT EKONOMI ASEAN (MEA) 2015"

THE GOLF - PANTAI INDAH KAPUK - JAKARTA

RABU-KAMIS, 25-26 FEBRUARI 2015

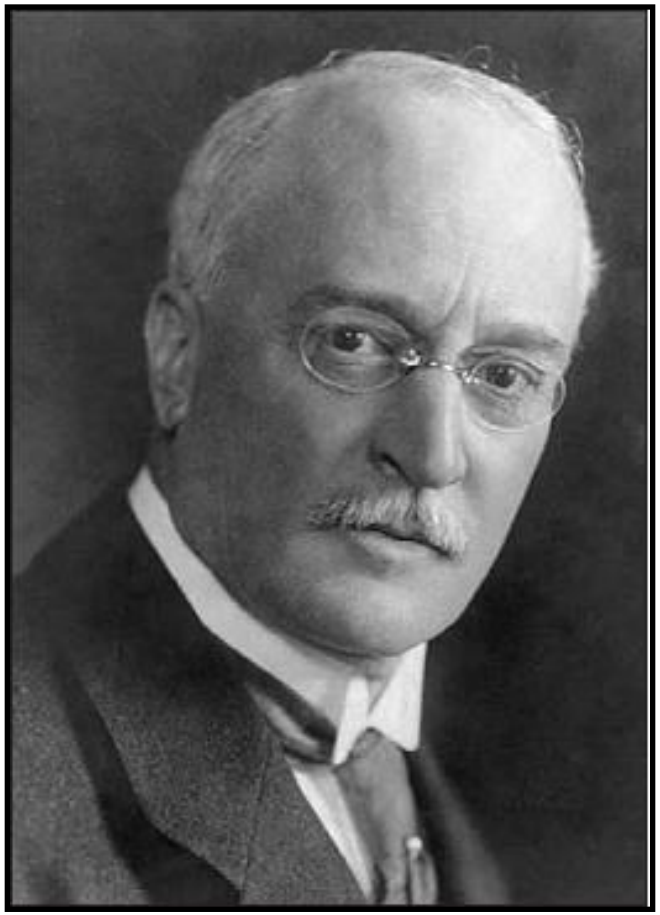
SPONSOR:

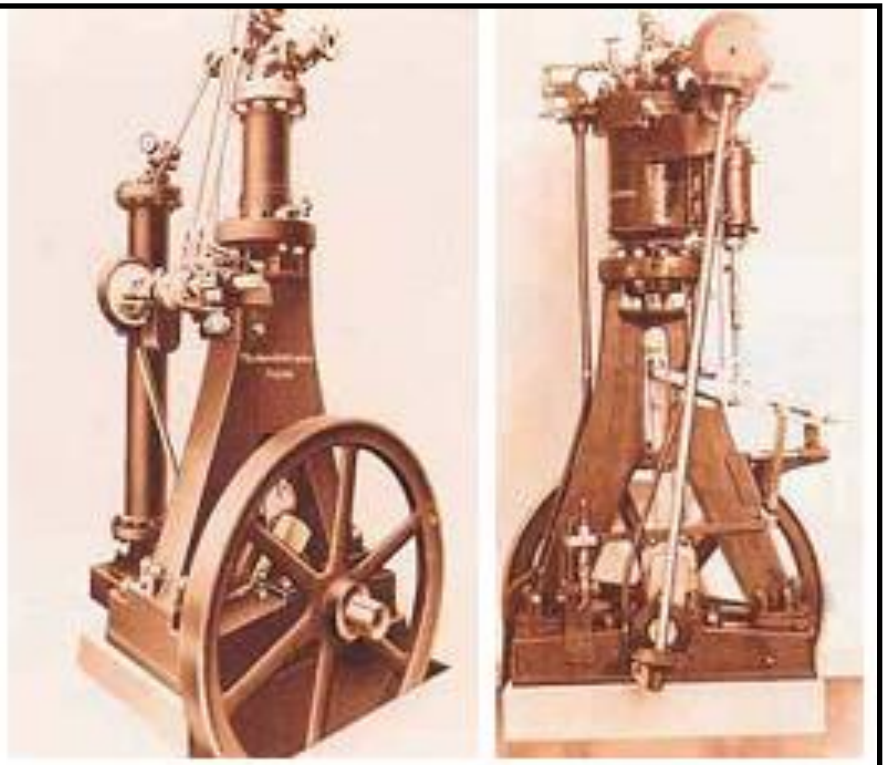
MITRA APTRINDO:

MEDIA PARTNER:

EVOLUTION OF DIESEL ENGINE TECHNOLOGY

MOHAMMED JAMEEL AHMED
PT TATA MOTORS DISTRIBUSI INDONESIA

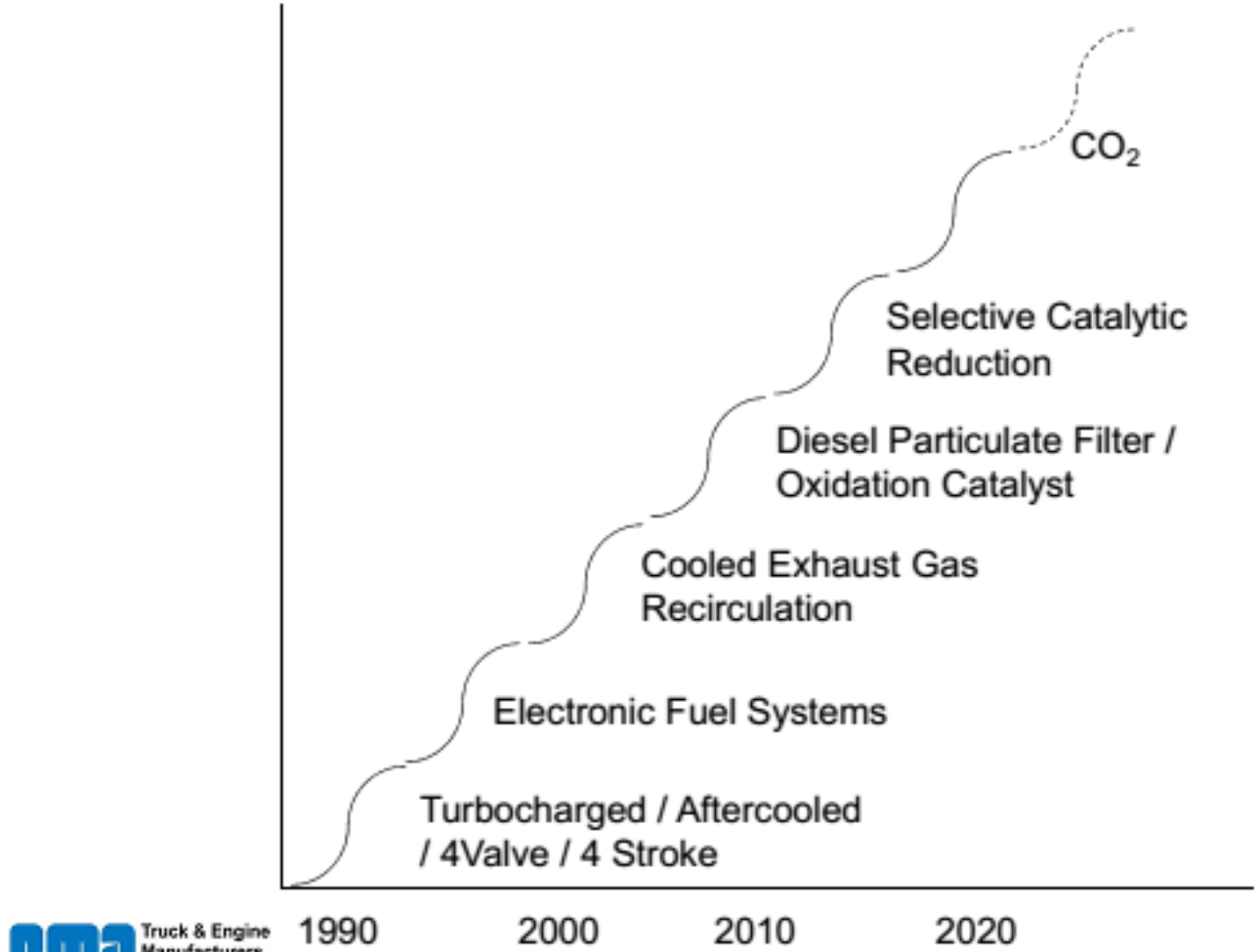




A B

Figure 1-8. A–Diesel's first experimental engine was built in 1893. B–Modified diesel engine. Following modification, including enlargement of the piston bore, the first power tests were performed on the diesel engine in 1895. The tests showed that the new engine had an efficiency of 26.2%.
(Diesel & Gas Turbine Publications)

Evolution of Diesel Technology



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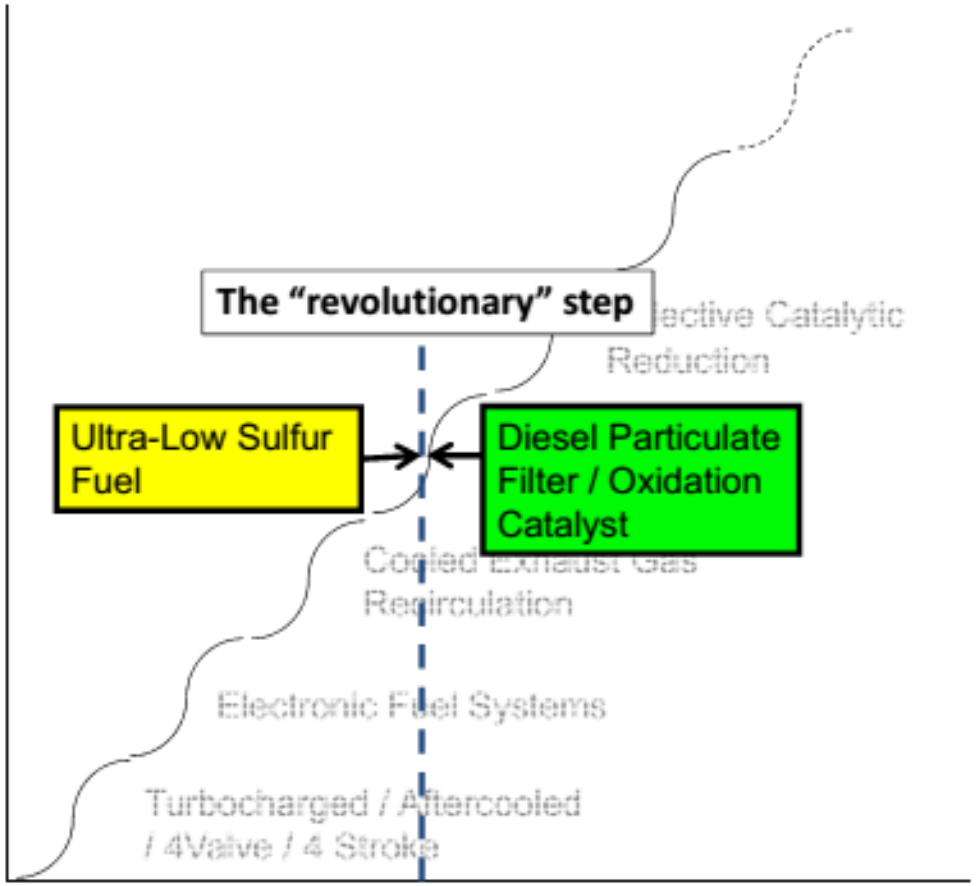
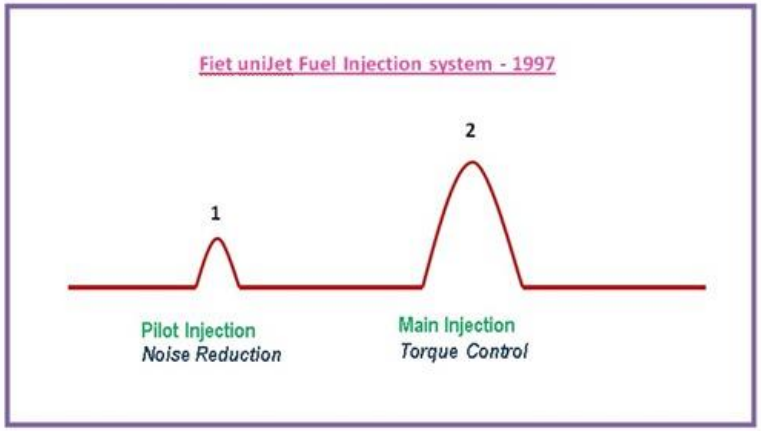
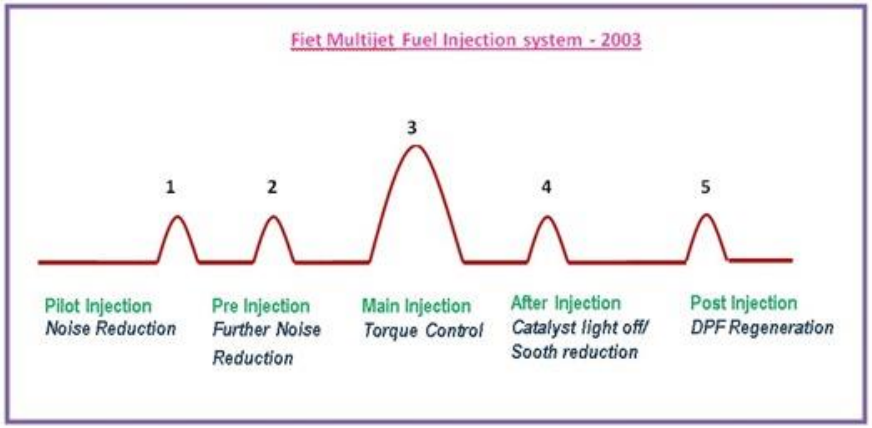
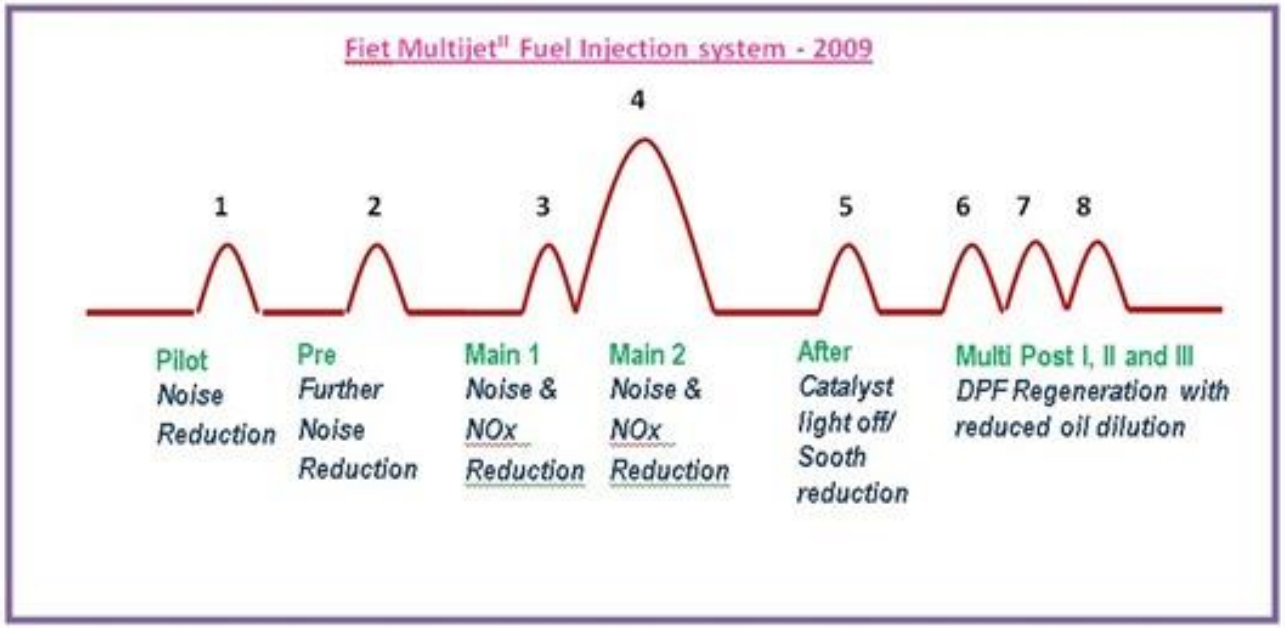
Evolution of Diesel Technology



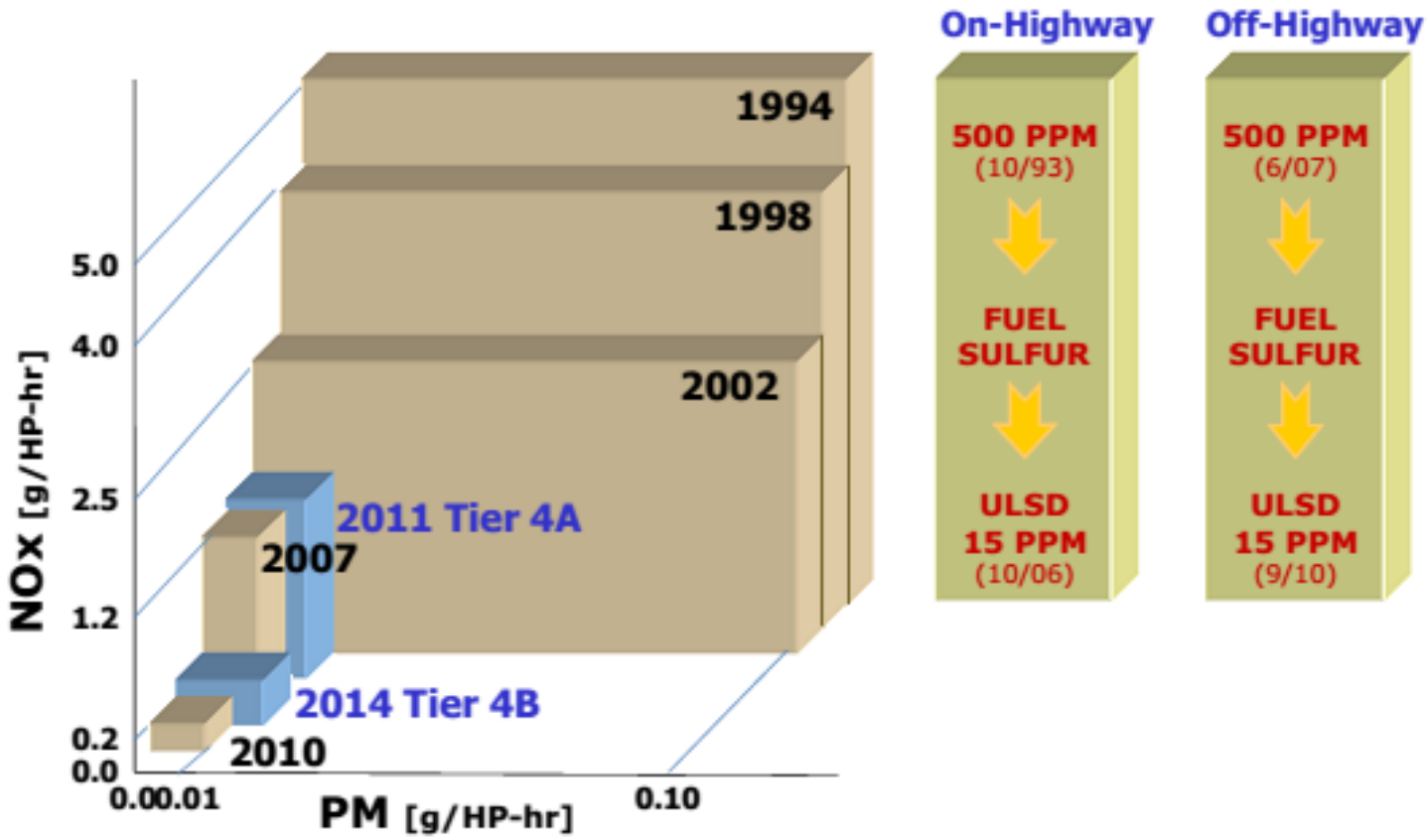
Truck & Engine Manufacturers Association™


Fiet uniJet Fuel Injection system - 1997
1
2
Pilot Injection
Noise Reduction
Main Injection
Torque Control


Fiet Multijet Fuel Injection system - 2003
1
2
3
4
5
Pilot Injection
Noise Reduction
Pre Injection
Further Noise Reduction
Main Injection
Torque Control
After Injection
Catalyst light off/ Sooth reduction
Post Injection
DPF Regeneration

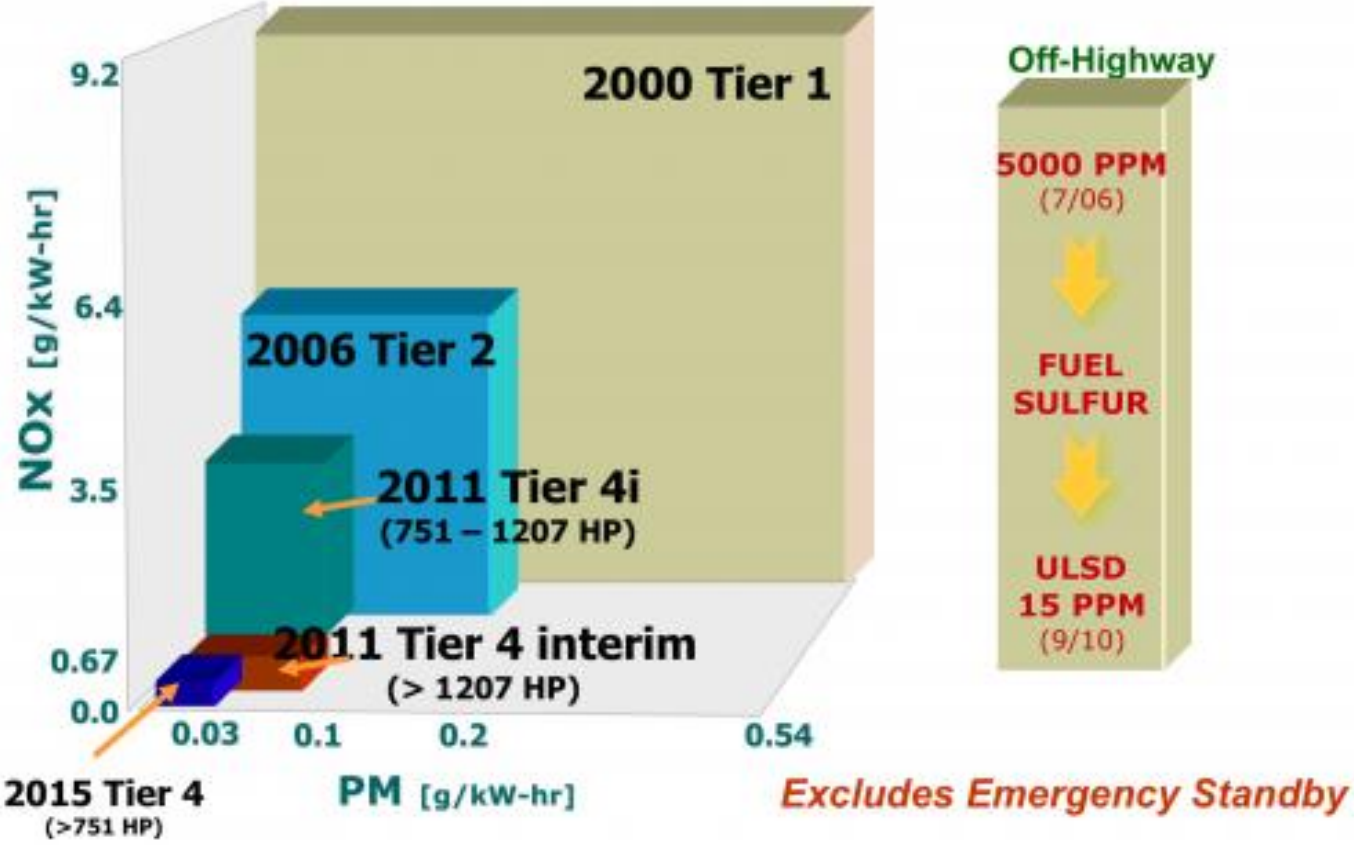

Fiet Multijet[II] Fuel Injection system - 2009
1
2
3
4
5
6
7
8
Pilot
Noise
Reduction
Pre
Further
Noise
Reduction
Main 1
Noise &
NOx
Reduction
Main 2
Noise &
NOx
Reduction
After
Catalyst
light off/
Sooth
reduction
Multi Post I, II and III
DPF Regeneration with
reduced oil dilution

Evolution of US Heavy Duty Diesel Emission Standards



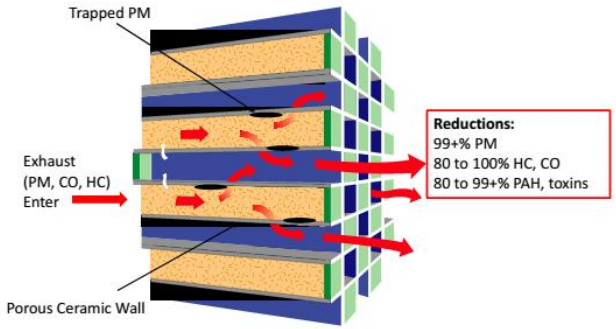
TRUCKMAGZ

Evolution of EPA Off-Highway Emission Standards



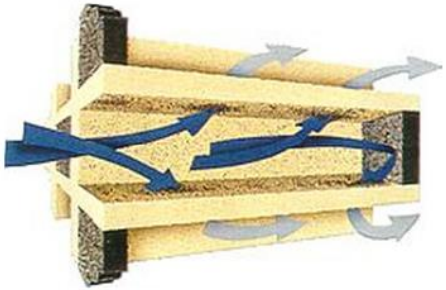
- TDE – “Traditional Diesel Exhaust”
- NTDE – “New Technology Diesel Exhaust”

Key to Emissions Reductions in NTDE
Wall-flow Diesel Particulate Filter



2007 And Beyond . . .
Integrating Engine and Aftertreatment

Active Particulate Filter



2007 And Beyond . . .
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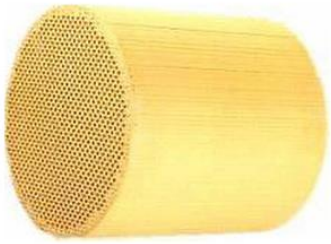
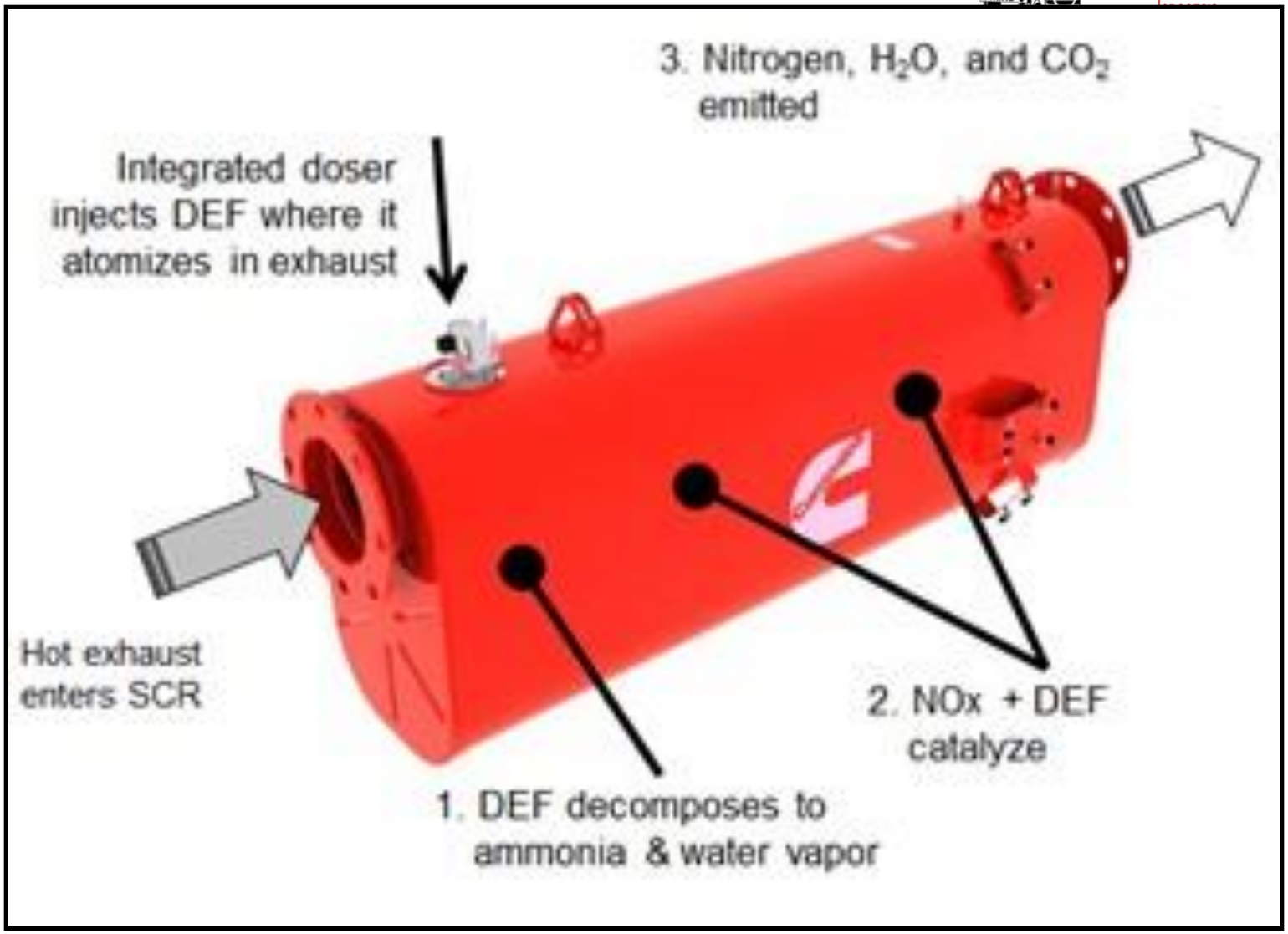
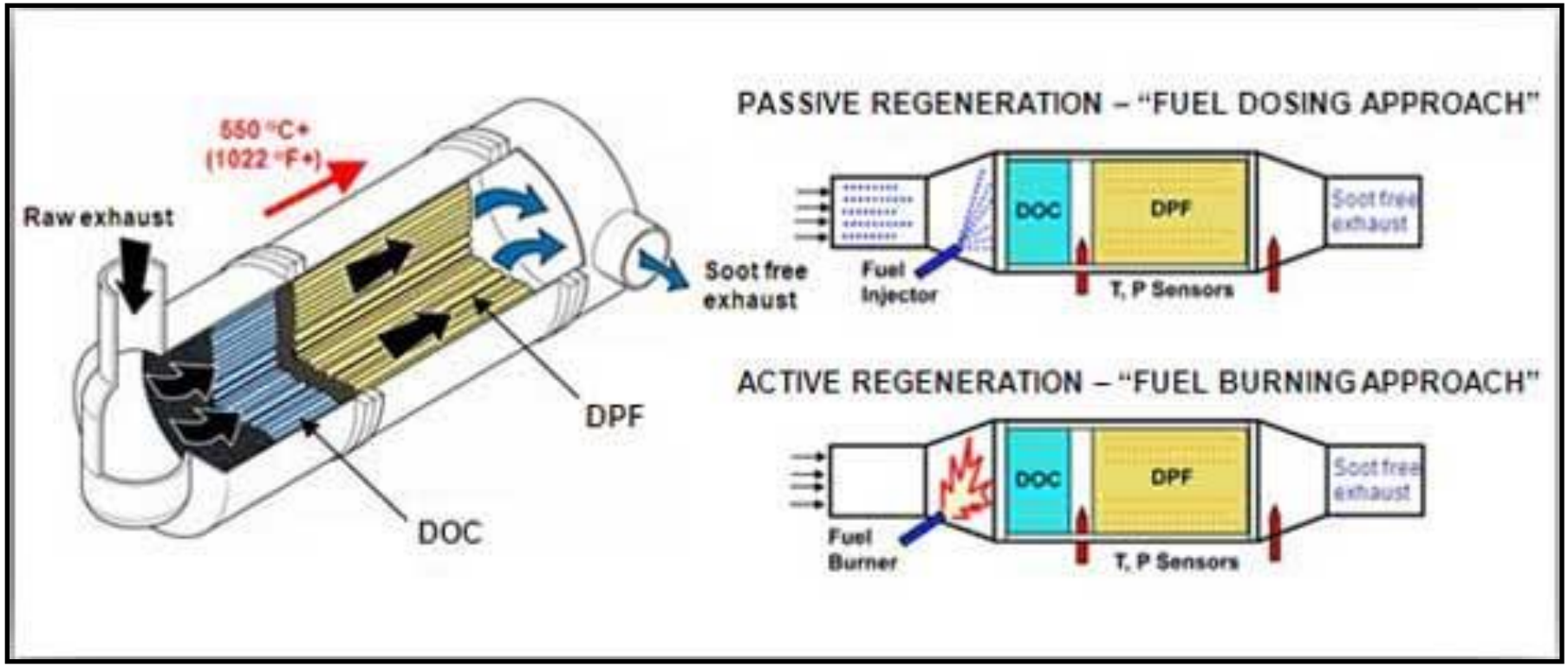



3. Nitrogen, H_2O, and CO_2 emitted
Integrated doser injects DEF where it atomizes in exhaust
Hot exhaust enters SCR
2. NOx + DEF catalyze
1. DEF decomposes to ammonia & water vapor


550 °C+
(1022 °F+)
Raw exhaust
Soot free
exhaust
DPF
DOC
PASSIVE REGENERATION – "FUEL DOSING APPROACH"
DOC
DPF
Soot free
exhaust
Fuel
Injector
T, P Sensors
ACTIVE REGENERATION – "FUEL BURNING APPROACH"
DOC
DPF
Soot free
exhaust
Fuel
Burner
T, P Sensors

FINAL TIER 4 ENGINE

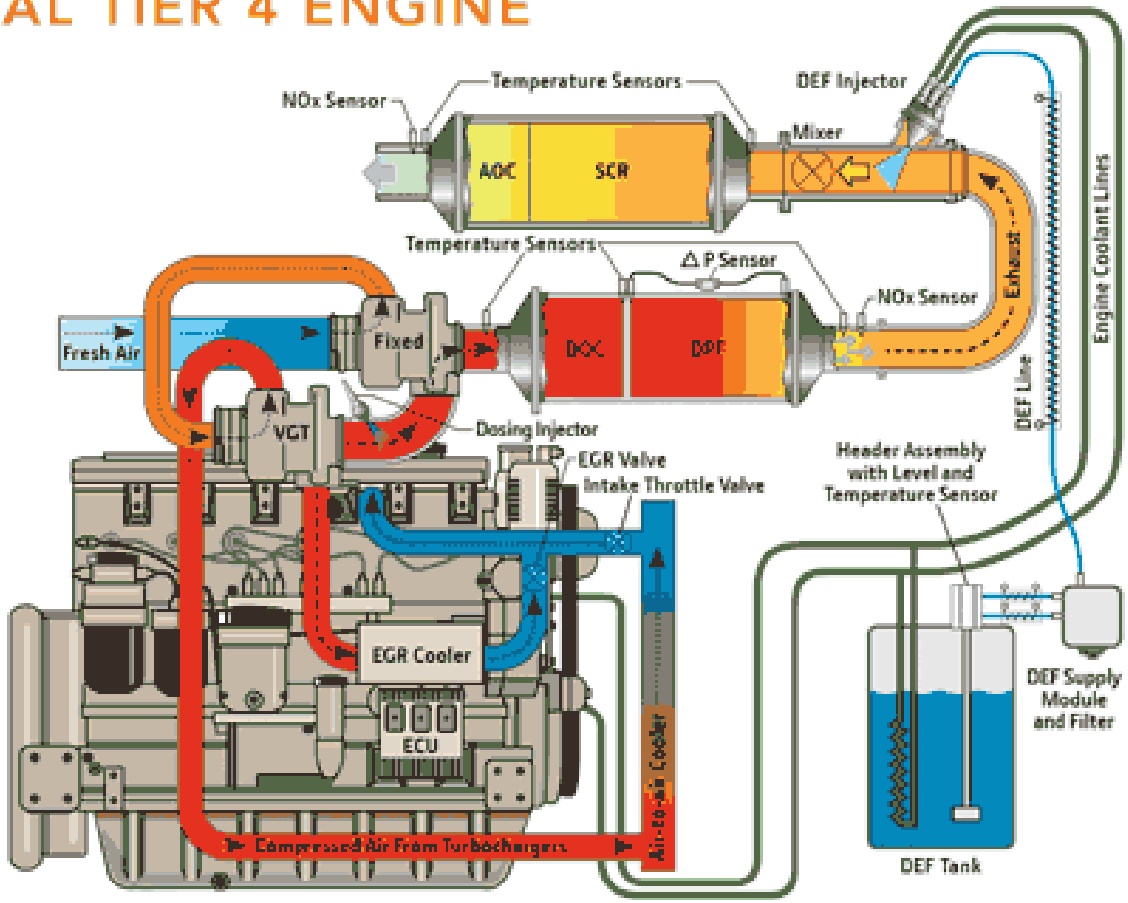
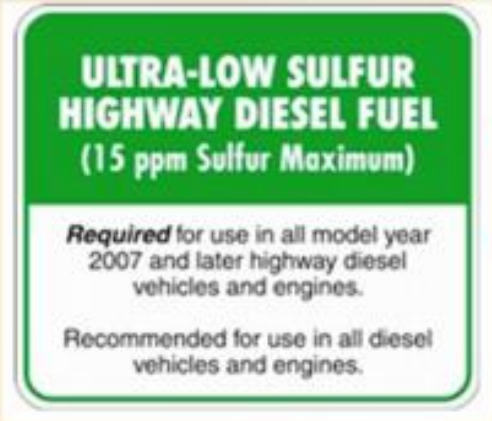


Photo courtesy of John Deere Power Systems

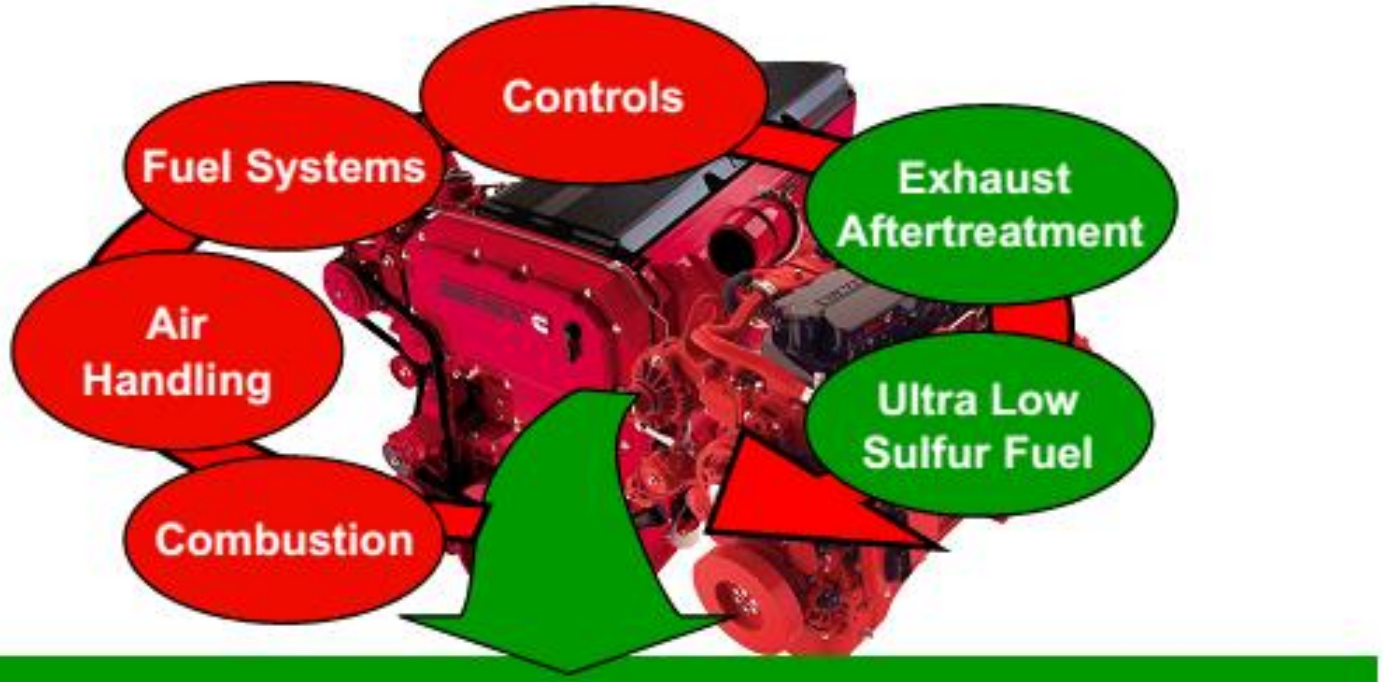
Low sulfur fuel enables diesel PM filters

Diesel particulate filter



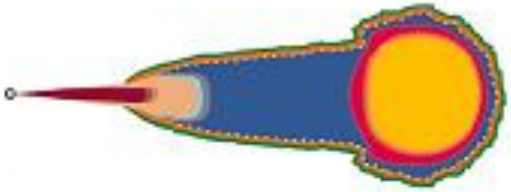
50 ppm Sulfur is necessary for diesel filters to function while 10-15 ppm sulfur is necessary for them to work well.

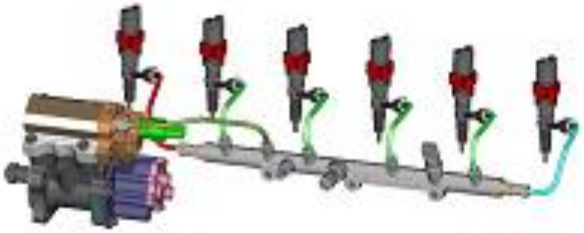
Transition to Clean "New Technology" Diesel: Advanced Component Technologies and System Integration



New Technology Diesel

Diesel Technology Development: Critical Subsystems

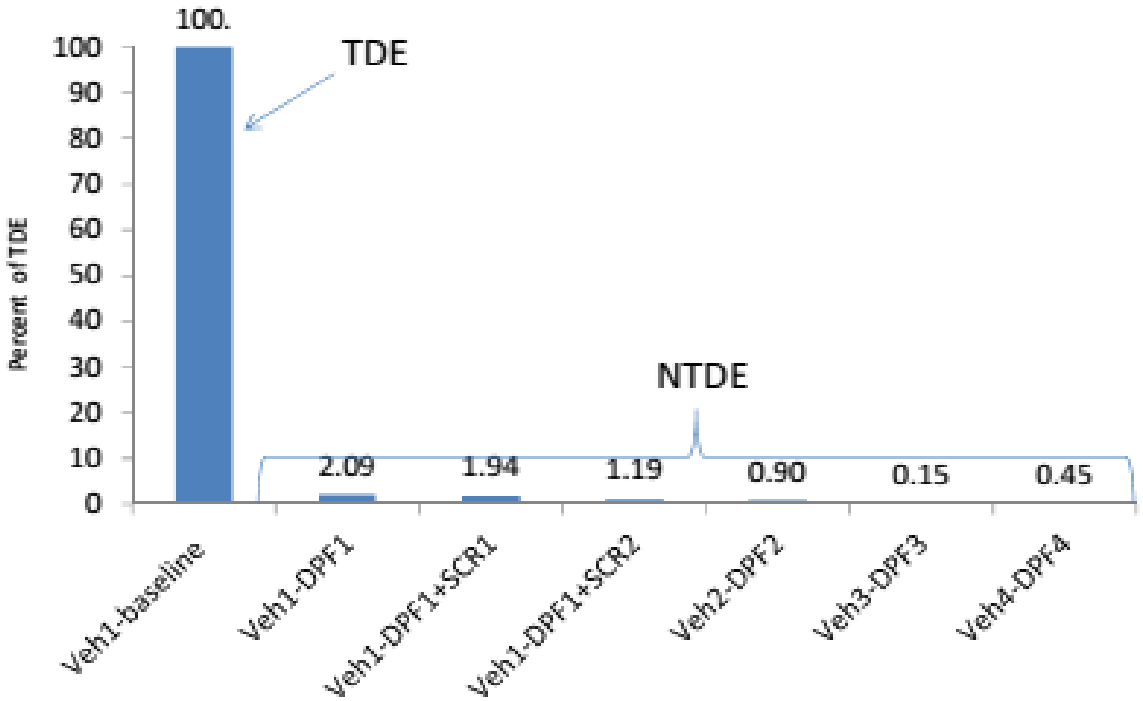




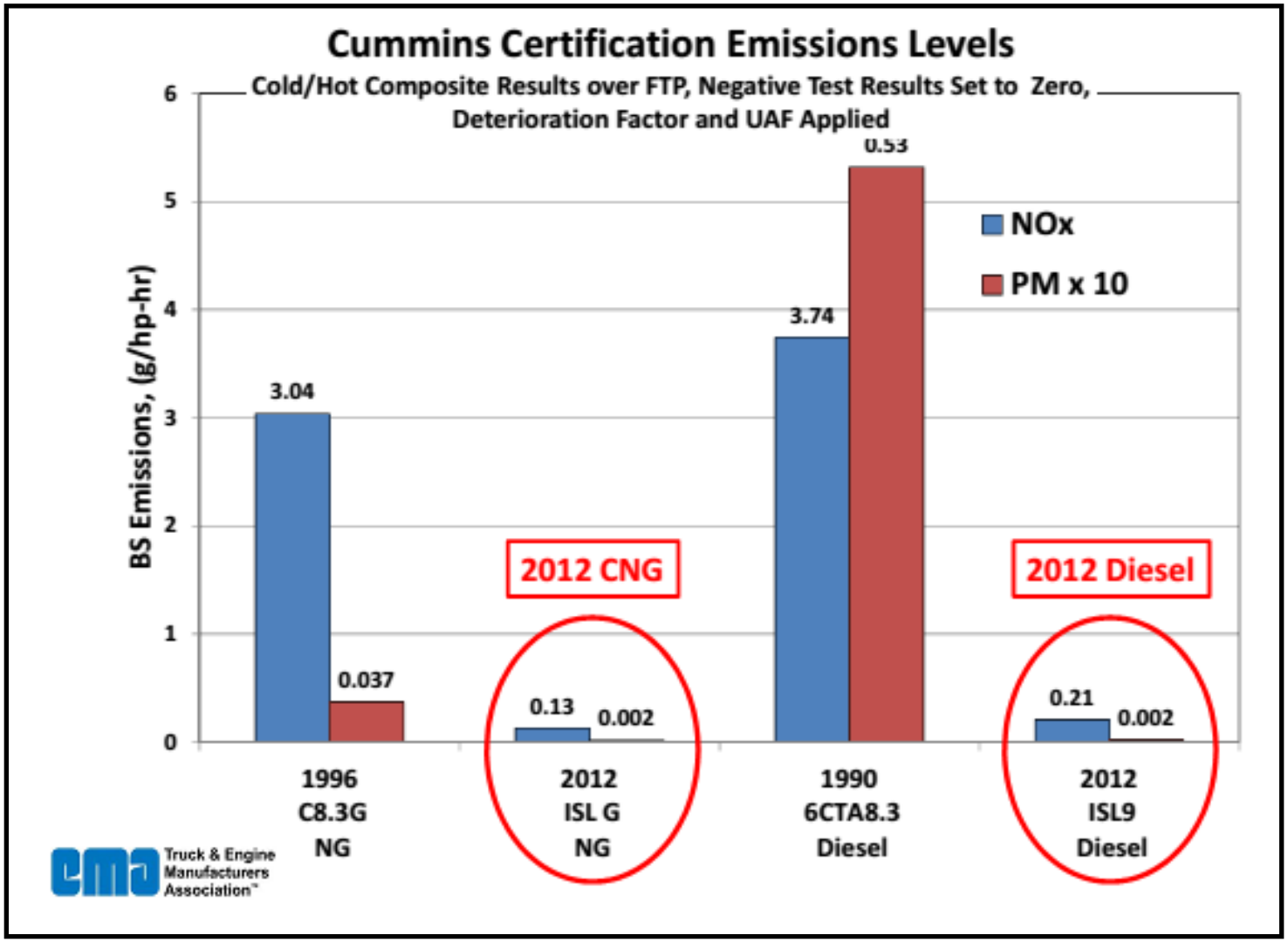
New Technology Diesel

- PM levels in New Diesel Technology Exhaust (NTDE) are more than 100-fold lower than in TDE
  - NTDE NOx and PM mass emissions are comparable to CNG and gasoline
- NTDE PM is chemically different from TDE PM

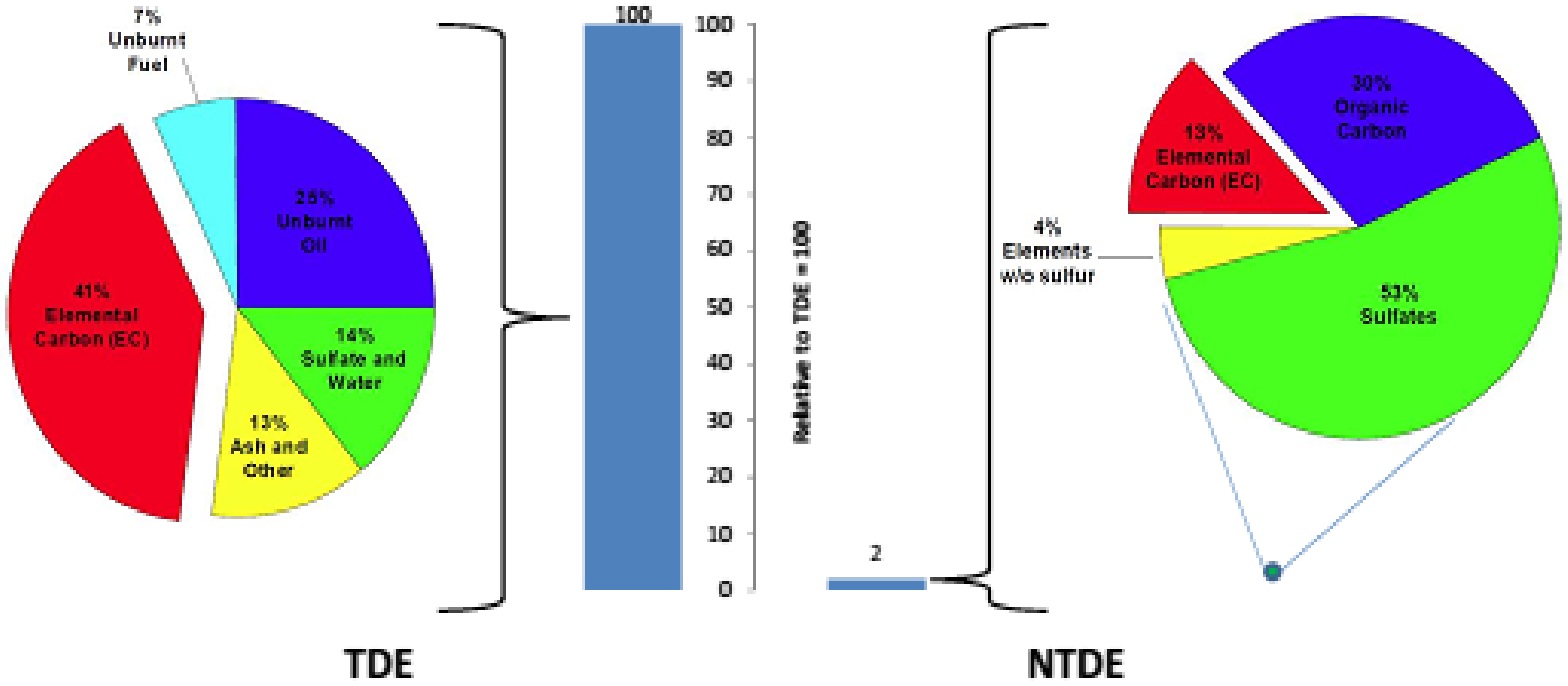
NTDE: Lower Particulate Emissions



CARB Study: Herner et al., EST 43:5928-5933, 2009, data from Table 2. Transit Buses: UDDS Test Cycle


Cummins Certification Emissions Levels
Cold/Hot Composite Results over FTP, Negative Test Results Set to Zero, Deterioration Factor and UAF Applied
BS Emissions, (g/hp-hr)
6
5
4
3
2
1
0
NOx
PM x 10
3.04
0.037
0.13
0.002
3.74
0.53
0.21
0.002
2012 CNG
2012 Diesel
1996 C8.3G NG
2012 ISL G NG
1990 6CTA8.3 Diesel
2012 ISL9 Diesel
Truck & Engine Manufacturers Association™

NTDE: Less PM and Composition Very Different



NTDE Reduces Emissions Across a Broad Spectrum of Compounds

Category	Reduction Relative to TDE
Single Ring Aromatics	82%
PAH	79%
Alkanes	85%
Hopanes/Steranes	99%
Alcohols & Organic Acids	81%
Nitro-PAHs	81%
Carbonyls	98%
Inorganic Ions	71%
Metals & Elements	98%
Organic Carbon	96%
Elemental Carbon	99%
Dioxins/Furans	99%

What about the Rest of the World?

EURO V+ and US 2007 standards require diesel filters and 10-50 ppm sulfur fuel

Heavy-duty Vehicle Emission Standards for Major Countries/Regions

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Euro pathway	Europe	Euro IV			Euro V						Euro VI
	China(1)	China II (Euro II)			China III				China IV		
	India(1)	Bharat II (Euro II)							Bharat III		
	S. Korea	Euro III				Euro V			TBD		
	Russia	Euro I	Euro II		Euro III			Euro IV			Euro V
	Thailand	Euro III							Euro IV		
	Brazil	Euro II	PROCONVE P-5 (Euro III)						PROCONVE P-7 (Euro V)		
Non-Euro pathway	Japan	New long-term standards					Post new long-term standards				
	US	US 2004		US 2007			US 2010				
	Canada(2)	US 2004		US 2007			US 2010				
	Mexico(3)	US 1998 / Euro III			US 2004 / Euro IV					TBD	

(1) Major cities have introduced accelerated adoption schedules - timelines in this table reflect nationwide adoption.

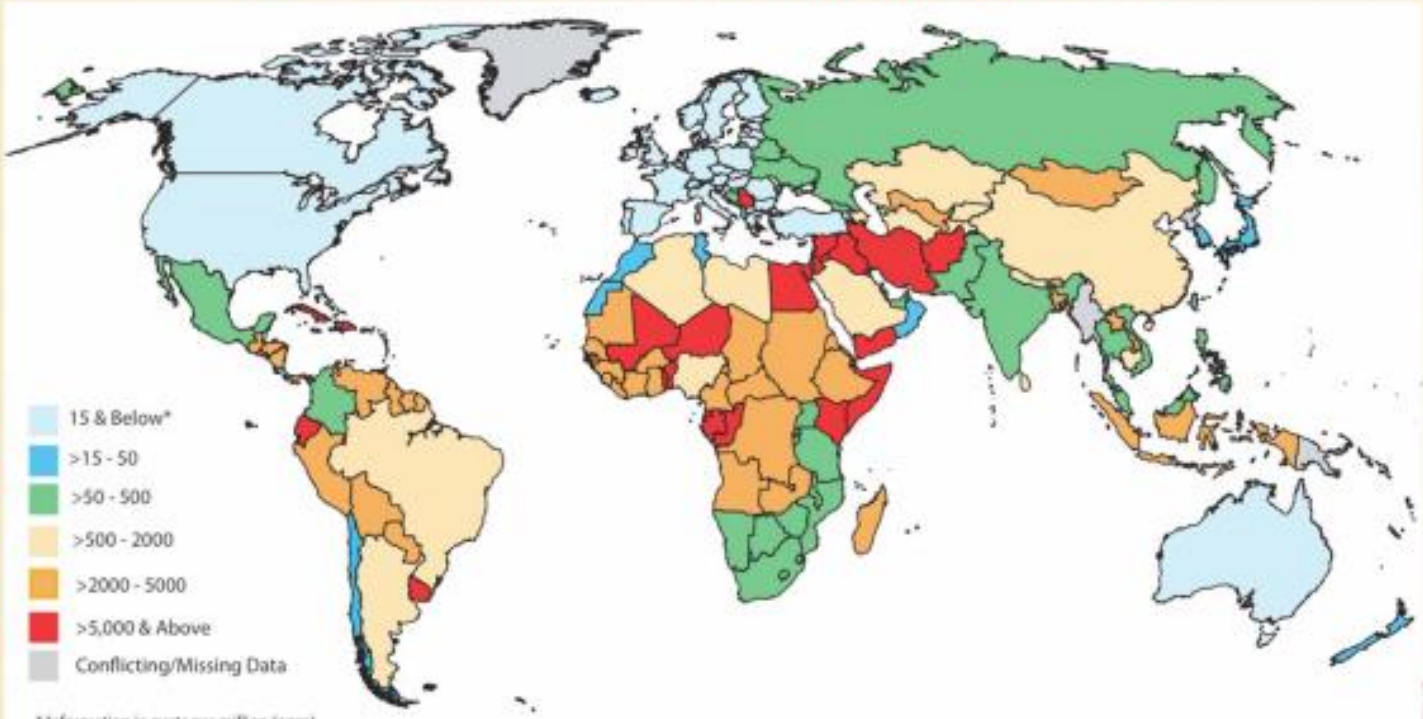
(2) Canadian standards are designed to be aligned with U.S. standards.

(3) Mexican standards are designed to be aligned with U.S. and Euro standards. Manufacturers may certify to either the US or Euro standard.

The New Technology Diesel Challenge:

No Low Sulfur Diesel Fuel in Most of the World

Status of diesel fuel sulfur, March 2012



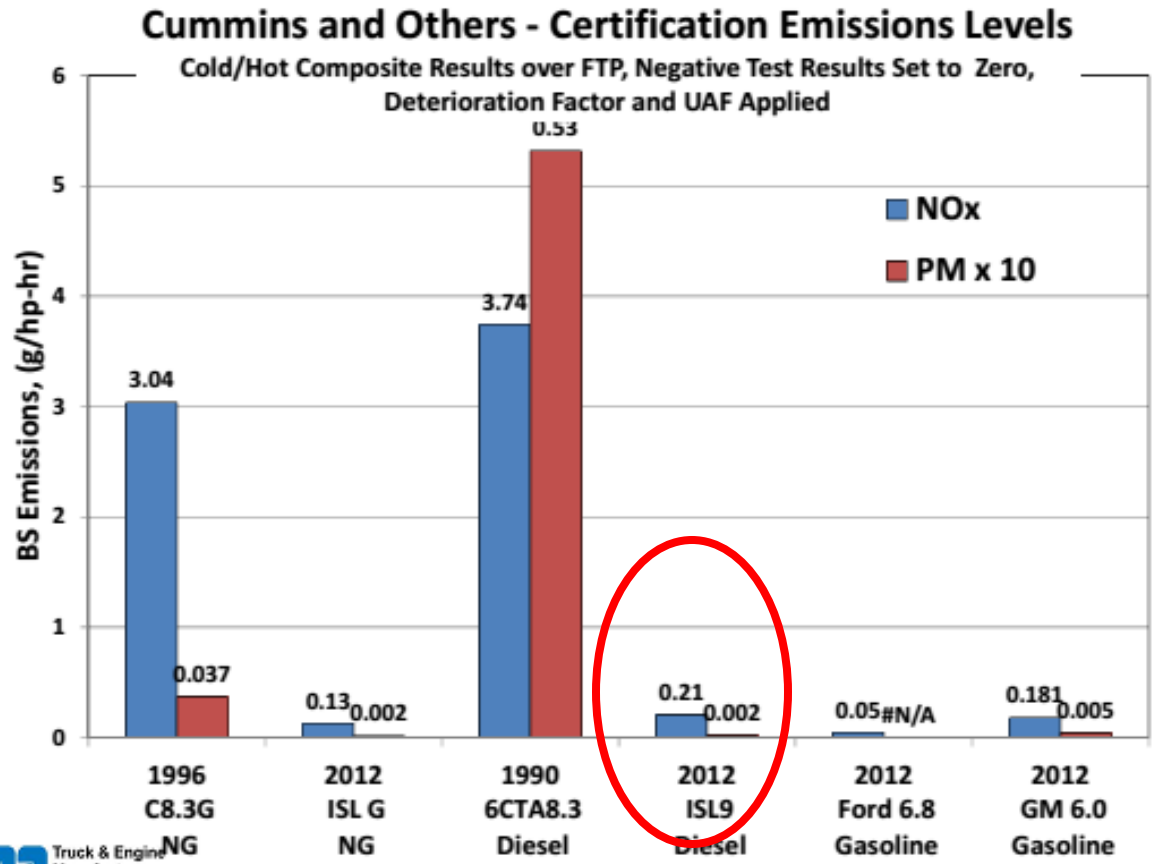
* Information in parts per million (ppm)

Sulphur levels are maximum allowable as of March 2012. For additional details and comments per country, visit www.unep.org/transport/pcfv.

Conclusions

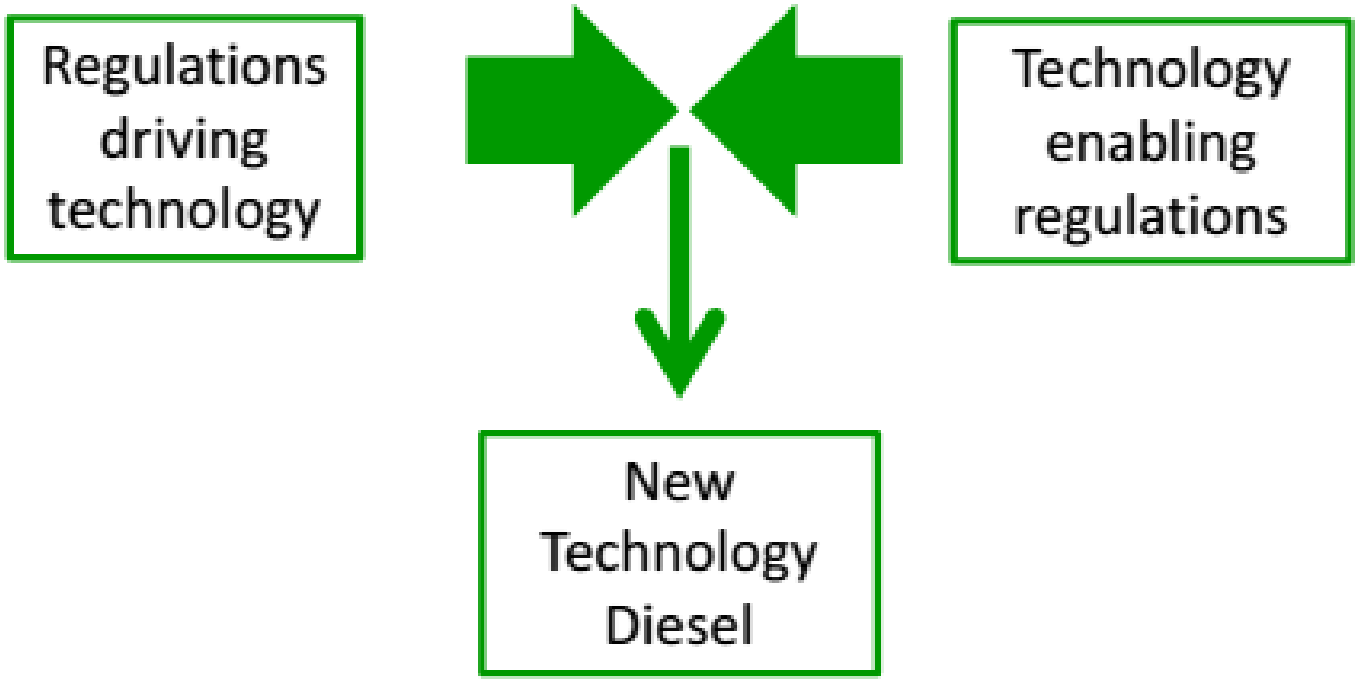
- New Technology Diesel Engines, specifically engines operating on Ultra Low Sulfur Diesel fuel and employing oxidation catalysts and wall-flow particulate filters, have fundamentally different (and significantly better!) exhaust characteristics than Traditional Diesel Engines
  - 99+% reduction in particulate mass
  - Chemically different particulate composition

CUMMINS ISB & ISL SERIES ENGINES ARE USED IN TATA WORLD TRUCKS 'PRIMA'



Truck & Engine Manufacturers Association™

Recognize the significant progress we have made together



Cummins ISLe/ISBe | Engine

Reduced emissions and particulate matter

Compliant for all markets

Available in Euro3and Euro 5

Lesser maintenance cost, lesser downtime

Capable up to 1800 bar injection pressure

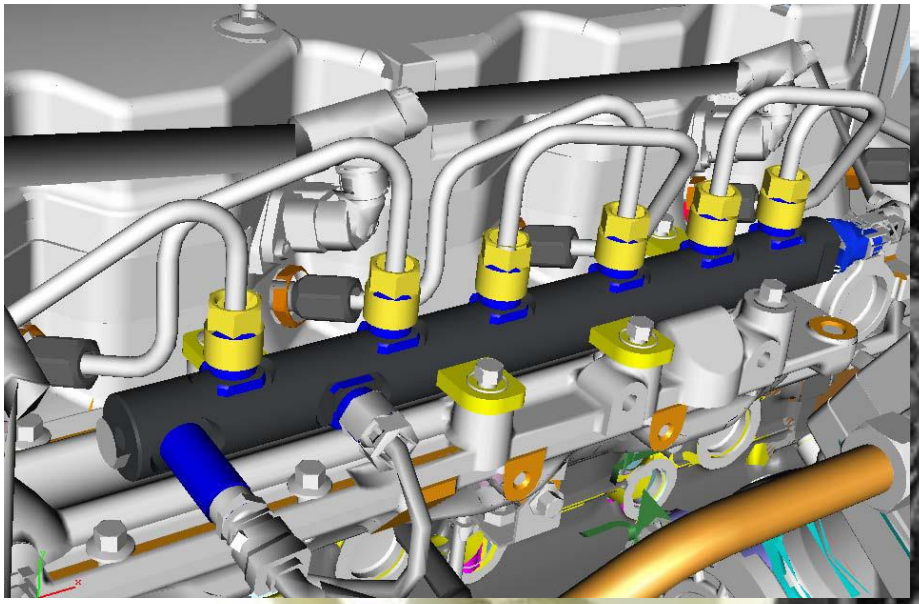
Oil drain interval higher (1000 hrs/60,000KM)

Fuel efficiency and engine life improves

Provides excellent performance across the rpm range

Turbocharger

Cummins ISBE Engine – 230 & 280 HP



[redacted]

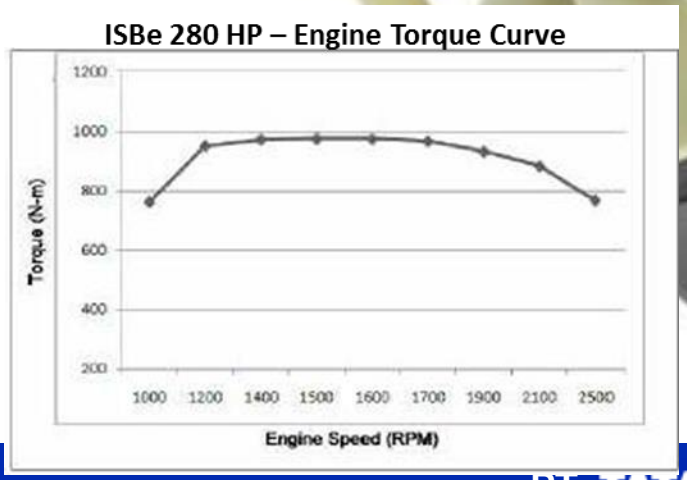
Electronically controlled high pressure fuel injection delivers higher fuel efficiency

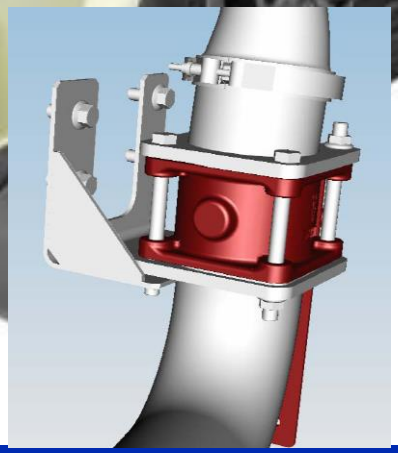
[redacted]

Flat torque Curve.

[redacted]

Eliminates engine failures and increases vehicle uptime





[redacted]

Auto idling shutdown and restart for better fuel efficiency

[redacted]

Lower maintenance cost

PRIMA LX 4023


PRIMA
2528.K

THANK YOU

CARE FOR OUR ENVIRONMENT AS THAT IS WHAT WE WILL LEAVE BEHIND FOR OUR CHILDREN