

DAIMLER

The New ICE Age
DEER Conference Oct. 17th 2012



Mercedes-Benz



BHARATBENZ

Dr. Igor Gruden, Powertrain Engineering, Daimler Trucks NAFTA

New ICE age ?

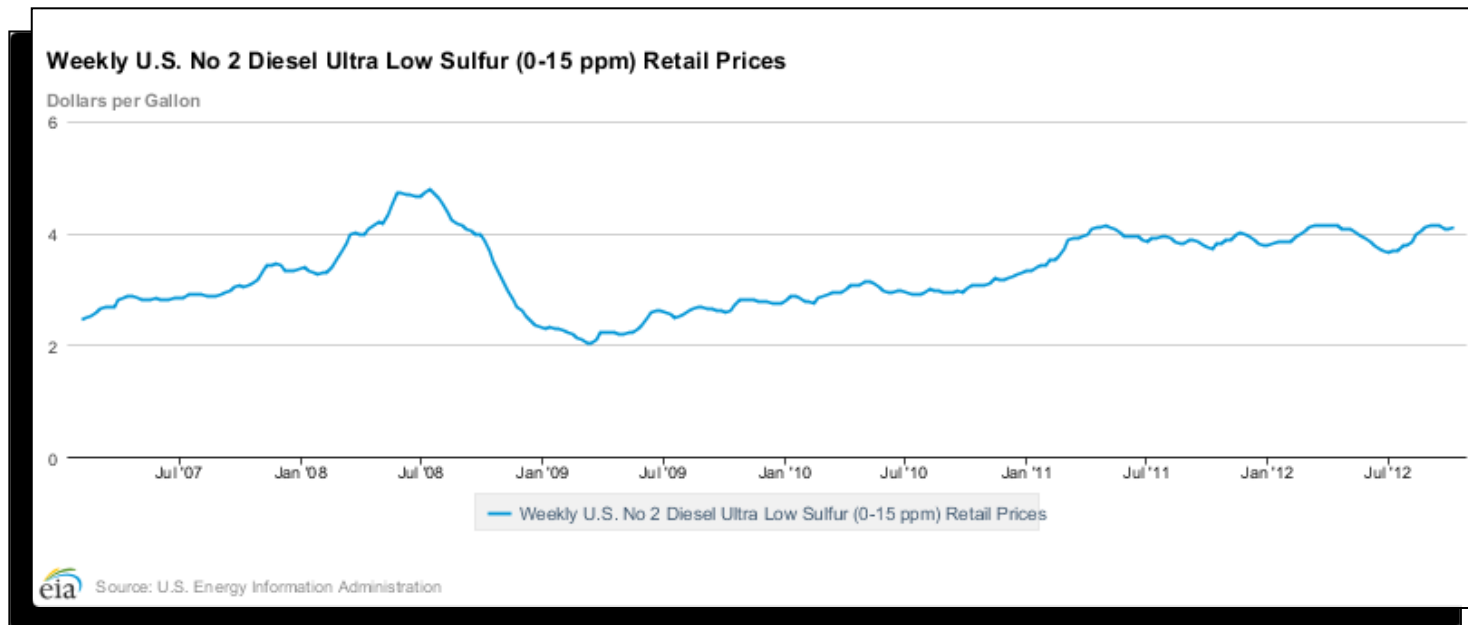


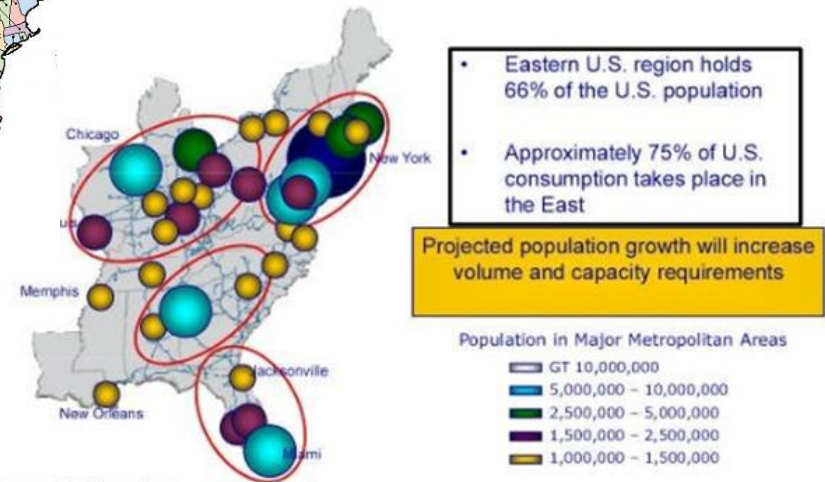
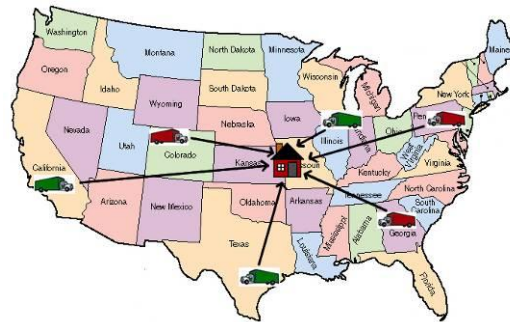
New I C E age !



Total Truck life Costs matters – fuel economy still dominating

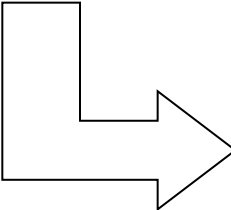
- ❑ The Customers Profitability, If Not Survival, Depends on Anticipating Total Truck Life Cycle Operating Costs, Including Reliability /Up-Time, Durability, and Payback Duration For Newer, More Complex Technology.
- ❑ Cyclical Fuel Market Trends To Be Considered and Optimized for A Best NO_x/BSFC Customer Value Ensuring Regulatory Compliance.
- ❑ Fuel Economy Continue To Be #1 Priority For Our Customers.





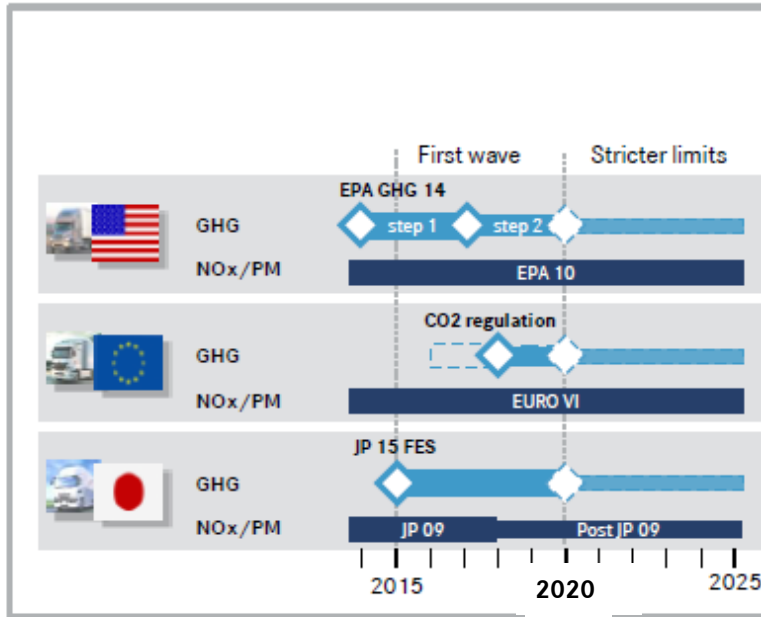
Market Factors

- Rising Fuel Prices
- Urbanization of Population
- 75% of Consumption Is In The East
- GHG Legislation – Efficiency Is Key

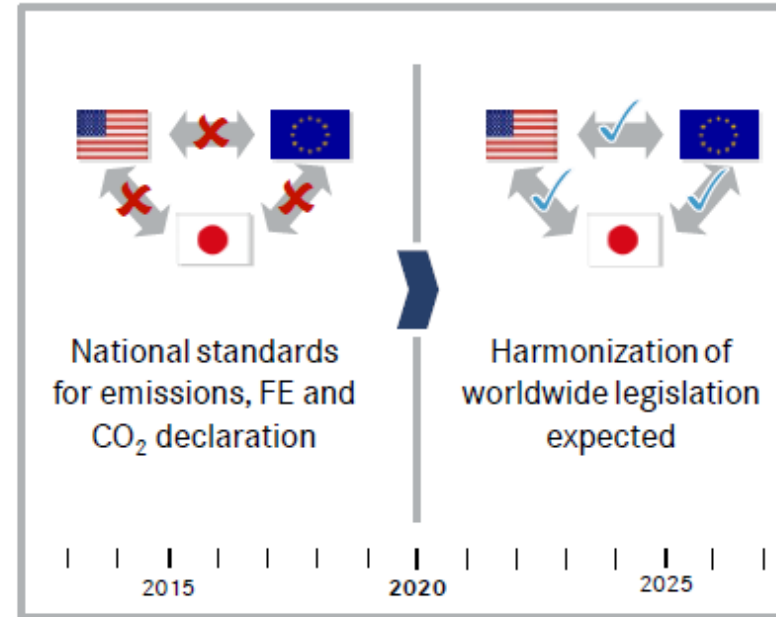
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- Freight Efficiency
 - Improved Aerodynamics
 - Lightweight
 - Flexibility in Logistics
 - Emphasis on Spoke & Hub Operations



Stricter emission legislation...



...but worldwide harmonization expected



US EPA GHG 2013 to 2020: Timeline

Step 1: Requirements for MY 2013-2014 finalized and being implemented.

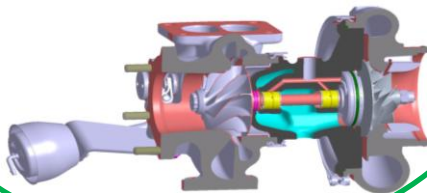
Step 2 Early stage of development with guiding principle “global harmonization”

- ❑ EPA's GHG 2014 standard must be met beginning model year 2014
- ❑ Daimler has decided to **certify its 2013 vehicle fleet with GHG2014 one year early!**

Fuel Economy

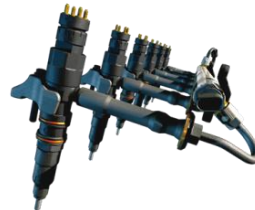
Asymmetric Turbo

Simplified design



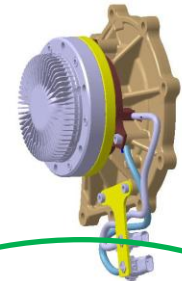
ACRS Gen. II

Optimized injection process



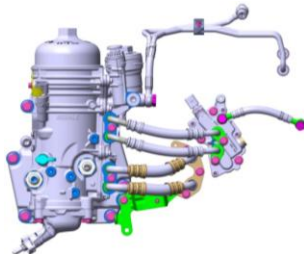
Advanced Cooling

Clutched, variable speed



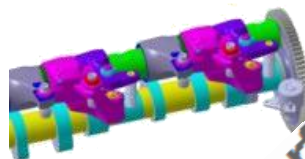
Fuel Filter Module

Simplified and extended maintenance



Integrated Engine Brake

Quiet 3 stage braking

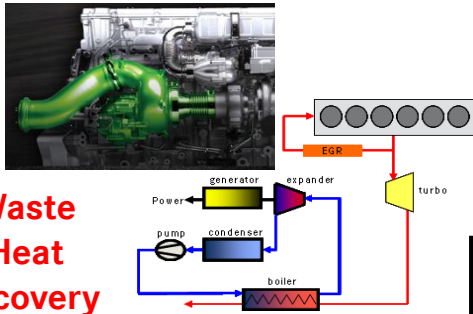


DDEC

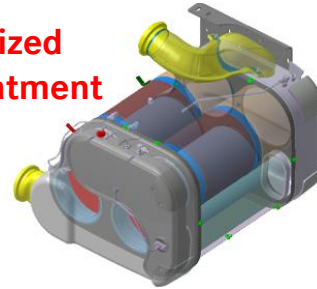
Optimized engine management



Waste Heat Recovery



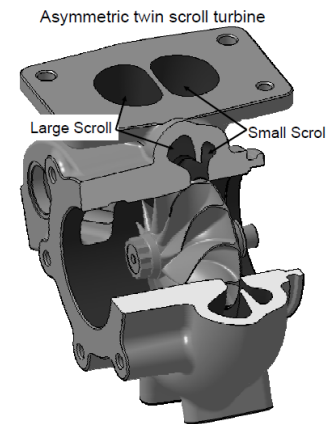
Optimized Aftertreatment



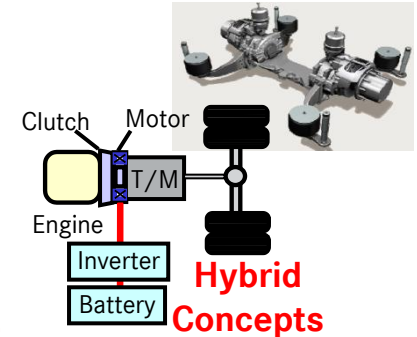
Advanced integrated Transmission Concepts



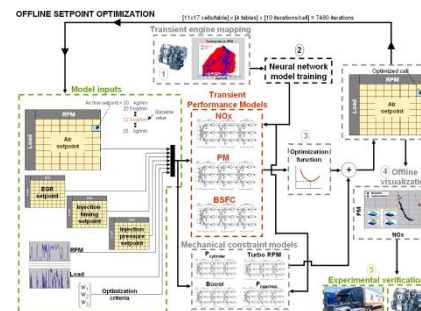
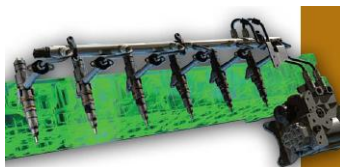
Optimized Combustion



Advanced turbocharger Technologies next generation



Enhanced High Pressure Fuel Injection System



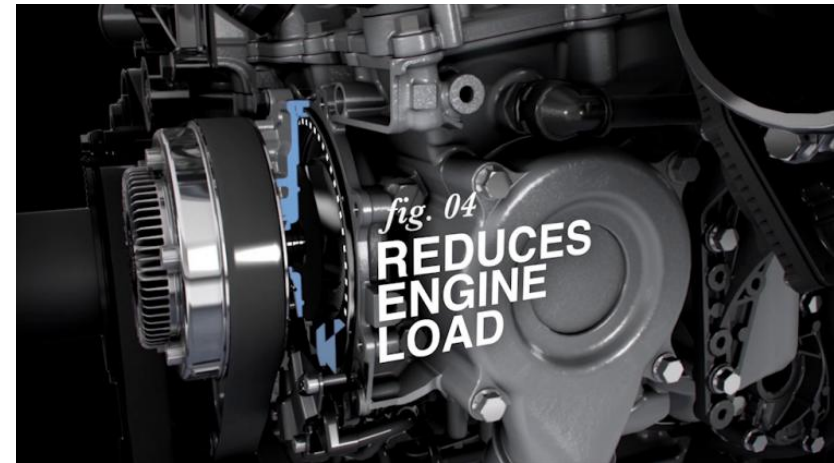
Next Generation Controller



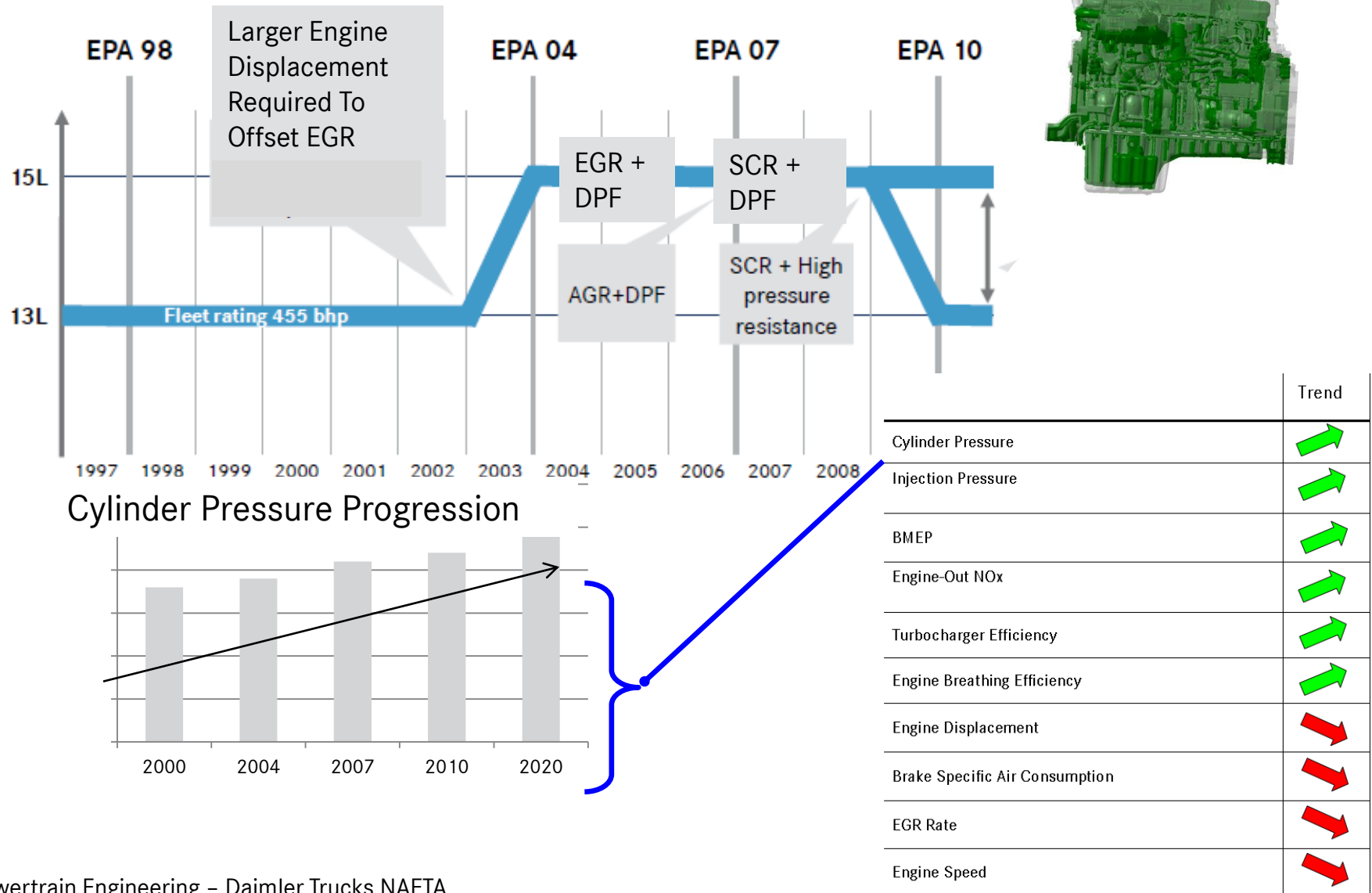
Predictive Torque & Auxiliary Management

Parasitic Management

- ❑ Smarter Use Of Optimized Accessories And Pumps
- ❑ Optimized piston / rings/ liner geometries designed to low friction
- ❑ Low viscosity oil
- ❑ Feedback Control System of accessories for optimal operation

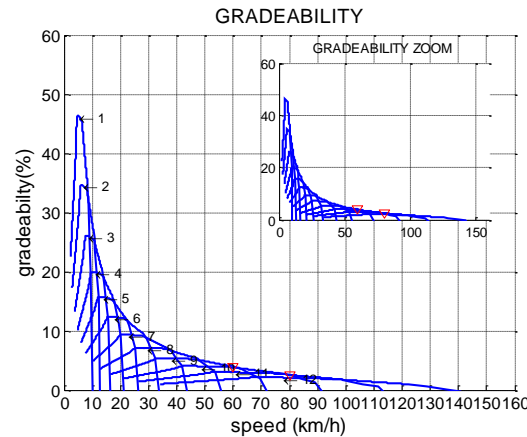


Historic overview displacement NAFTA

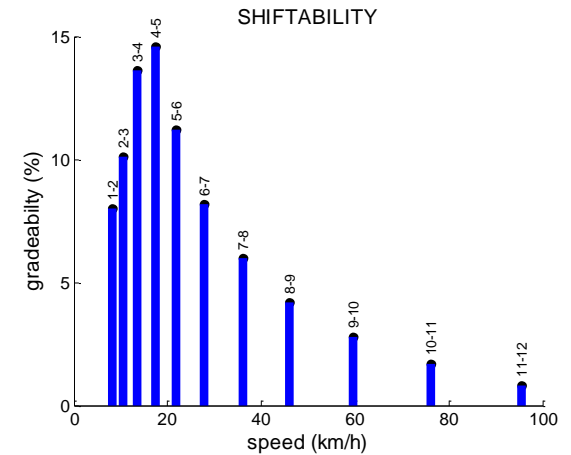


Powertrain = Engine + transmission + Axle

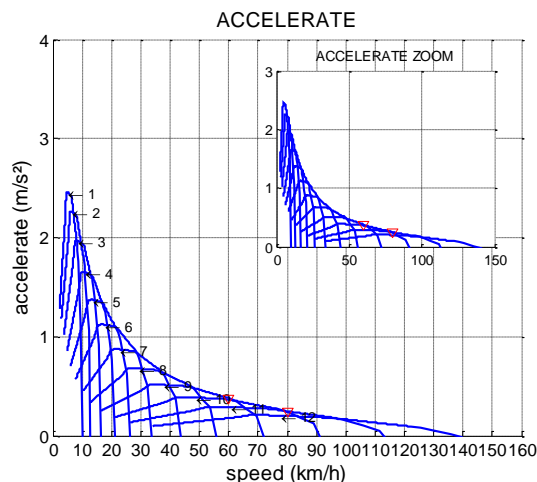
- ☐ Load Response
- ☐ Drive Time
- ☐ Drivability
- ☐ Low Speed Maneuvering
- ☐ NVH
- ☐ Thermal/Mechanical Stress
- ☐ Surge Margin
- ☐ Emission Compliance



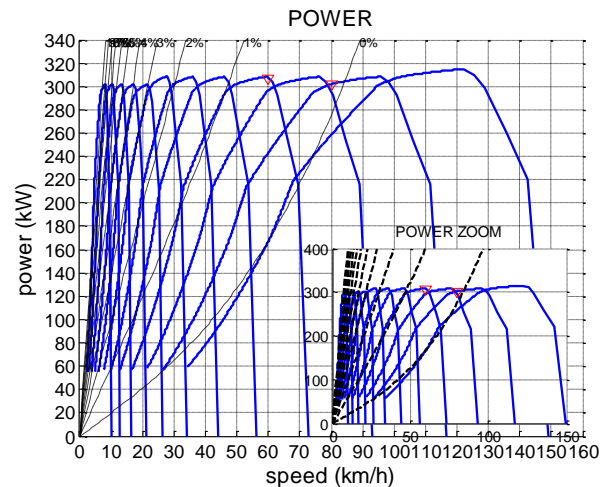
Gradeability



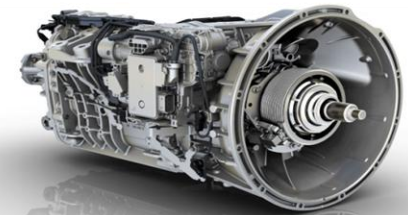
Shiftability



Max. Acceleration



Max. Power



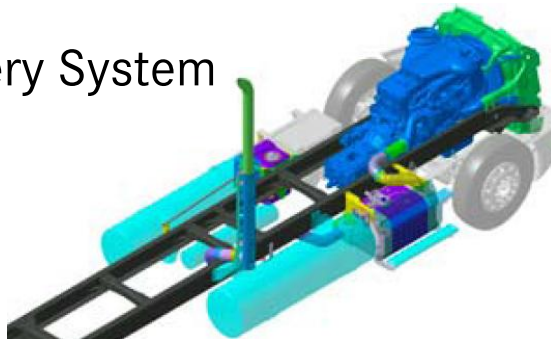
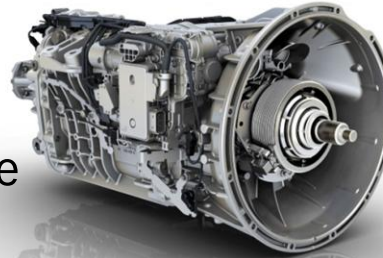
Light weight

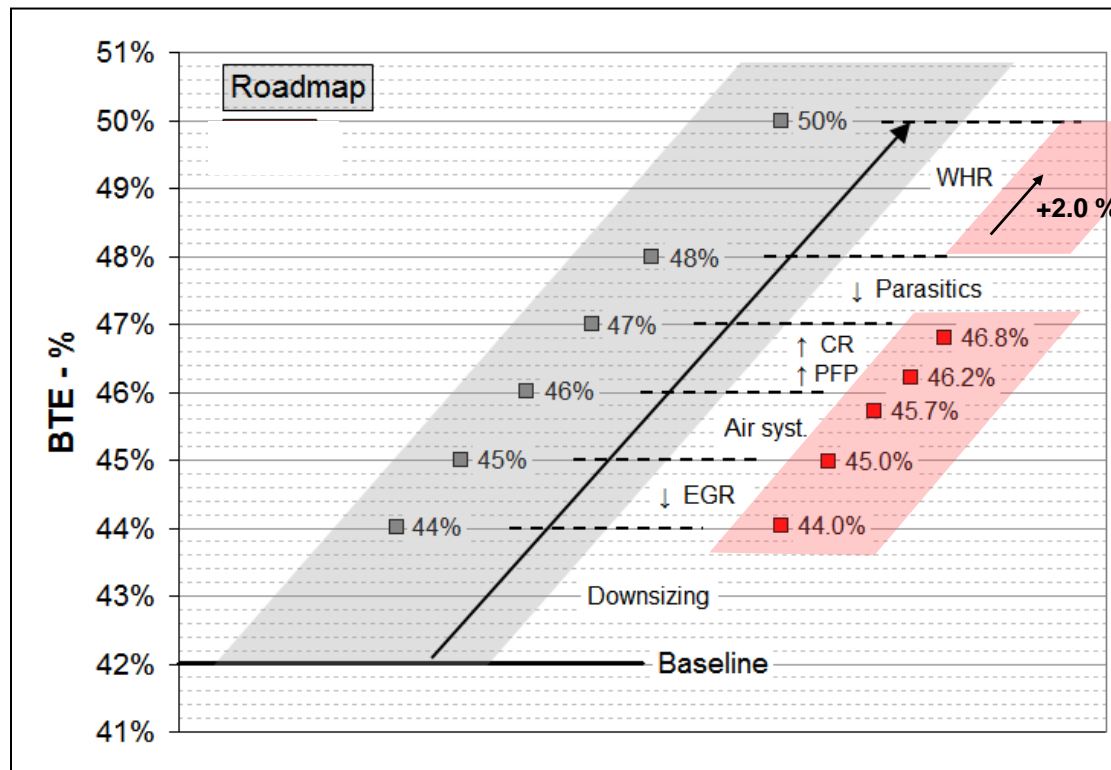


Complete Detroit Powertrain

The Detroit Transmission is the latest component in the completely integrated Detroit powertrain.

- ❑ Optimized Powertrain Interface in future
 - ❑ Torque
 - ❑ Cooling & Heating Flows
 - ❑ Data Exchange
 - ❑ Engine - Exhaust Aftertreatment Thermal Marriage
- ❑ Waste Heat Recovery System
- ❑ Hybrid concepts





Demonstrate 50% brake thermal efficiency via:

- ☐ Engine downsizing (higher BMEP)
- ☐ Higher compression ratio
- ☐ Improved combustion system
- ☐ Air system optimizations, reduced EGR
- ☐ Reduced parasitic
- ☐ Waste heat recovery

Complexity of Engine technologies over decades

Key engine technologies 1992

- ❑ Fuel injection System
- ❑ Turbocharging System

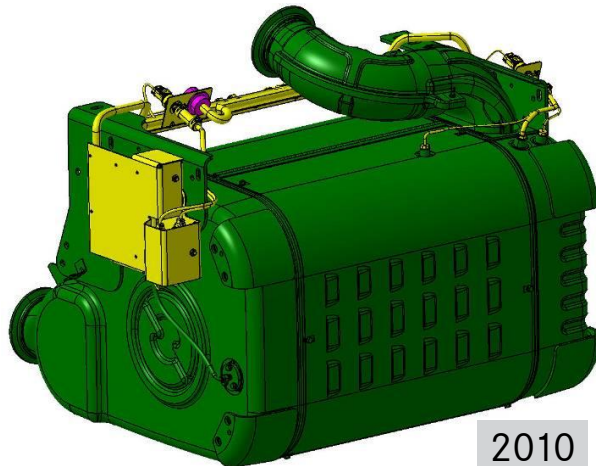
Key engine technologies > 2012

- ❑ Fuel injection System
- ❑ Turbocharging System
- ❑ EGR-Cooler
- ❑ Mechatronics (i.e. EGR-valve, var. coolant pump,...)
- ❑ Aftertreatment System
- ❑ ECU
- ❑ Sensors
- ❑ OBD specific sensors
- ❑ WHR Systems.....

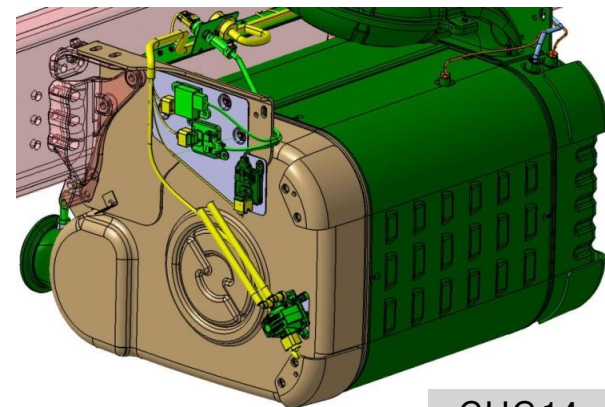
Collaboration with suppliers on key technologies will be even more important than in the past

Early involvement in new Technologies with i.e. aftertreatment suppliers

Technical Features	Benefits
Airless DEF delivery system	Better fuel Economy from elimination of air assist
Reduced number of parts in system	Contributes to lower weight, reduced complexity and improved serviceability



2010



GHG14

Early knowledge of ATS performance and aging is the key factor to develop a sophisticated, integrated System meeting future OBD requirements.
Again, important is an early collaboration with key suppliers

Combined Efficiencies with Engine and Truck



Developed with Future Emissions in Mind

GHG14



DETROITTM
DEMAND PERFORMANCETM

The Right Engine for Every Job



All Detroit Engines built with pride in our factory in Michigan



Summary

- ❑ Future Powertrain improvements will be more complex. Technologies which translate to over the road freight efficiency improvements will be crucial for future Heavy Duty Vehicle customer and regulatory demands
- ❑ Freight efficiency improvements require an optimized system integration
- ❑ Close Supplier collaboration is crucial in the Powertrain R&D phase to fulfill future market and legislation demands
- ❑ Future worldwide harmonization of GHG limits is beneficial to environment and customers
- ❑ Super Truck is a key demonstrator helping to continue The New ICE Age





Thank you for your attention !