

EURO 6



The road to Euro 6

Phil Moon
Product Marketing Manager, DAF Trucks



The road to Euro 6...



- The 'green' agenda – long-term sustainability...
 - Environmental: Air quality and CO₂ emissions
 - Energy security: Diesel and alternatives



Noxious matter (NO_x, PM):

- Acid rain, air toxicity, smog, global warming...
 - Technology known and available
 - Harmfulness determined by age vehicle parc



Greenhouse gases (CO₂):

- Global warming, sustainability...
 - Reduction of fuel consumption
 - Use of alternative fuels



Fuel consumption and CO₂...



- Burning of fossil fuels gives rise to most carbon emissions
- Road transport responsible for about 23% of all CO₂
- Trucks are responsible for 6-7% of CO₂

Greenhouse gases (CO₂):

- Global warming, sustainability...
 - Reduction of fuel consumption
 - Use of alternative fuels



Technical efficiency...

CO₂

- Fuel consumption and CO₂ emissions are directly proportional
- 1 litre burnt diesel = 2.63 kg CO₂



Technical efficiency...



Burn less diesel!

Operational efficiency...



- Efficiency – *i-fish'en-see*

'The ratio of useful work output compared to energy used in producing it':

$$\frac{\text{Payload} \times \text{Speed} \times \text{Miles}}{\text{Gallon}}$$

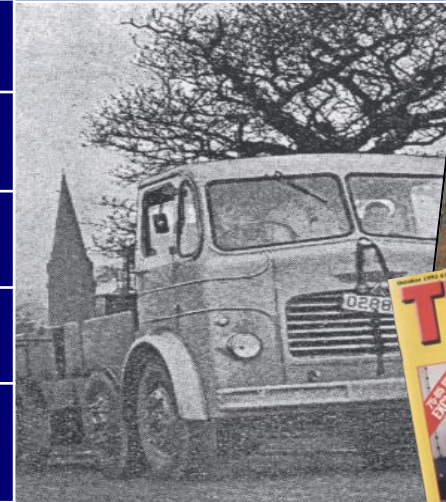


Operational efficiency...



Over all roads	Weight	MPG	Payload	MPH	Productivity factor
1960	24 t	8.1	15.0	24.8	3,013
1976	32 t	7.0	20.5	39	5,596
1992	38 t	8.0	25	42	8,400
2012	40 t	9.8	26.4	47	12,160

- 400% increase in productivity in 50 years
- 1 litre fuel for 1 tonne cargo for 100kms



4 typical influences on fuel...



- **Beyond control...**

- Seasonal effects 5 to 8%
- Body type 5 to 15%
- GCW 5 to 10%

- **Maintenance...**

- Axle alignment 5 to 10%
- Brake adjust 0 to 5%
- Tyre pressures 5 to 10%
- Tacho setting 3 to 5%
- Running in 2 to 5%

- **Specification...**

- Aerodynamics 5 to 10%
- Gearing 2 to 3%
- Engine power 1 to 3%
- Coupling dist. 2 to 4%
- Lights/cooling 1 to 3%

- **Driver...**

- Speed 3 to 5%
- Driving style 8 to 10%
- Idling time 0 to 5%



‘....a full range of solutions with the aim of increasing transport performance while reducing environmental impact and costs.’

Environmental: air quality and CO₂ emissions...



Noxious matter (NO_x, PM):

- Acid rain, air toxicity, smog, global warming..
 - Technology known and available
 - Harmfulness determined by age vehicle parc



The road to...

EURO 6



Environmental: air quality and CO₂ emissions...



- Four regulated exhaust emissions:
 - Carbon monoxide (CO)
 - Hydrocarbons (HC)
 - *Nitrogen oxides (NO_x)*
 - *Particulate matter (PM)*



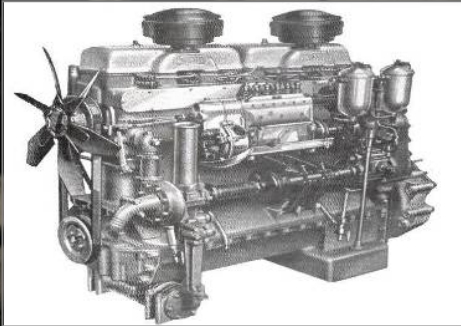
Euro 6...timing



- Euro 6 NEW registrations:
 - From 31st December 2013
- Euro 5 vehicles built up to 30th Sept 2013:
 - Derogation for registration up to 31st Dec 2014
- Euro 5 vehicles built after the 30th Sept 2013:
 - will have to be registered by 31st Dec 2013

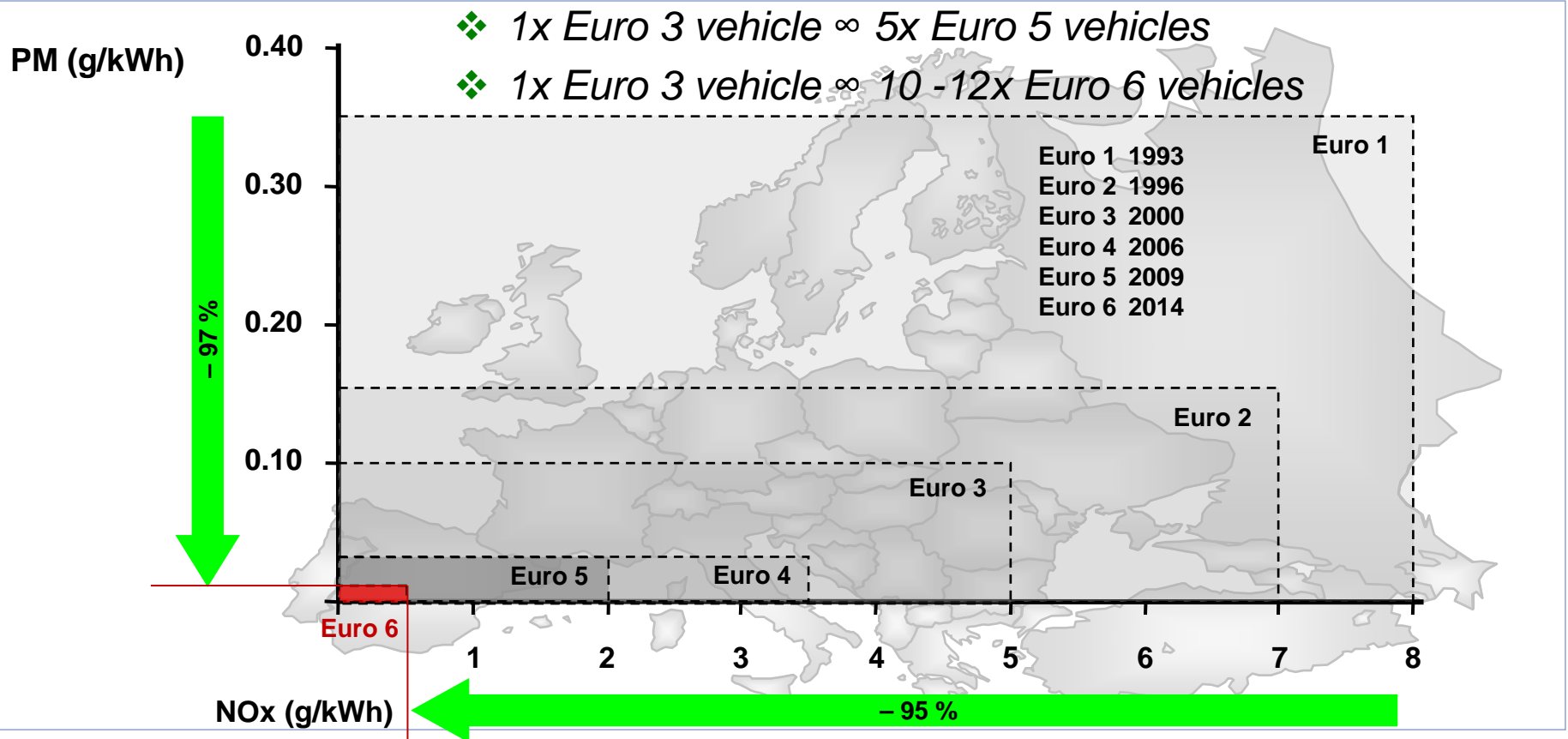


Internal combustion engine...

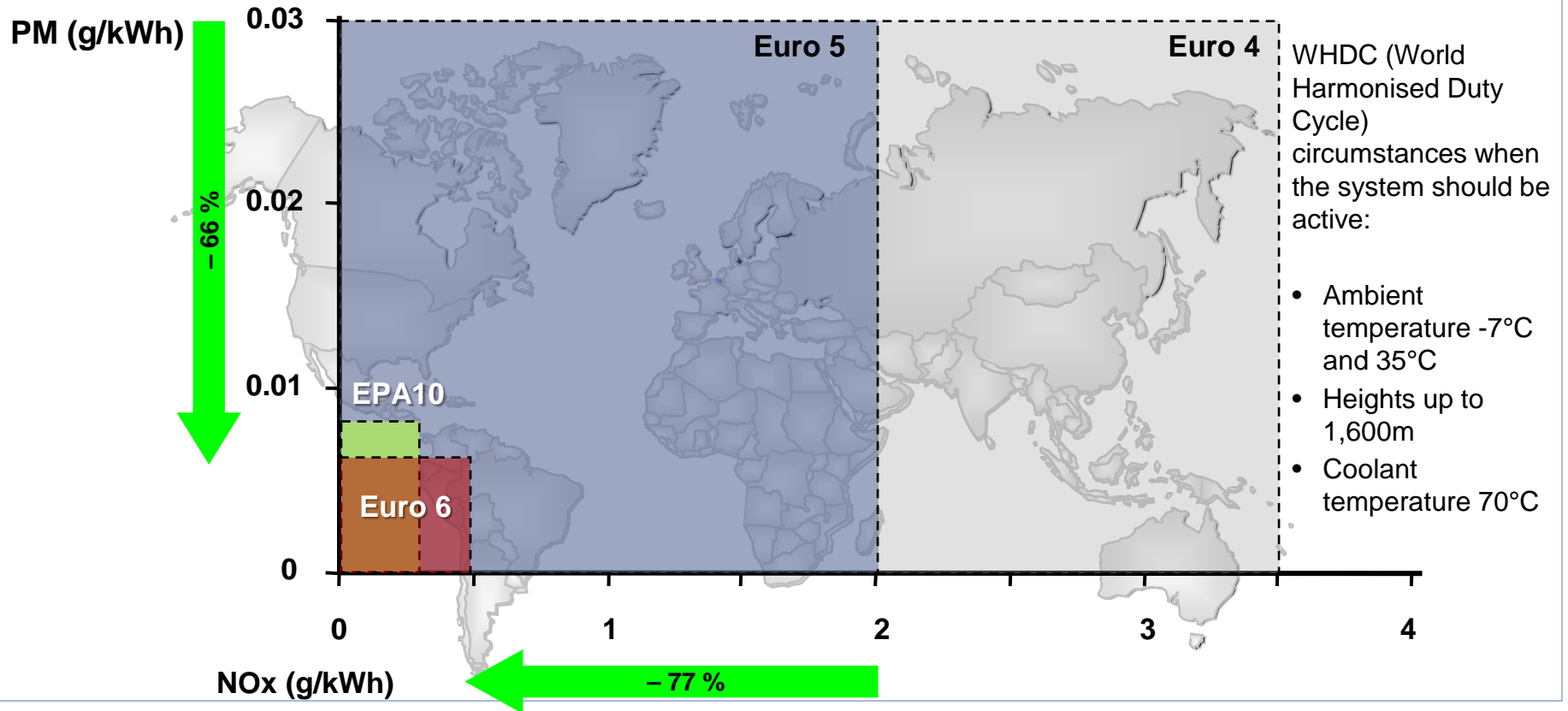


Reliability
More power
Lower noise
Economy
Emissions?

Emission regulation: Euro 6...



Emission regulation: Euro 6 and EPA10...



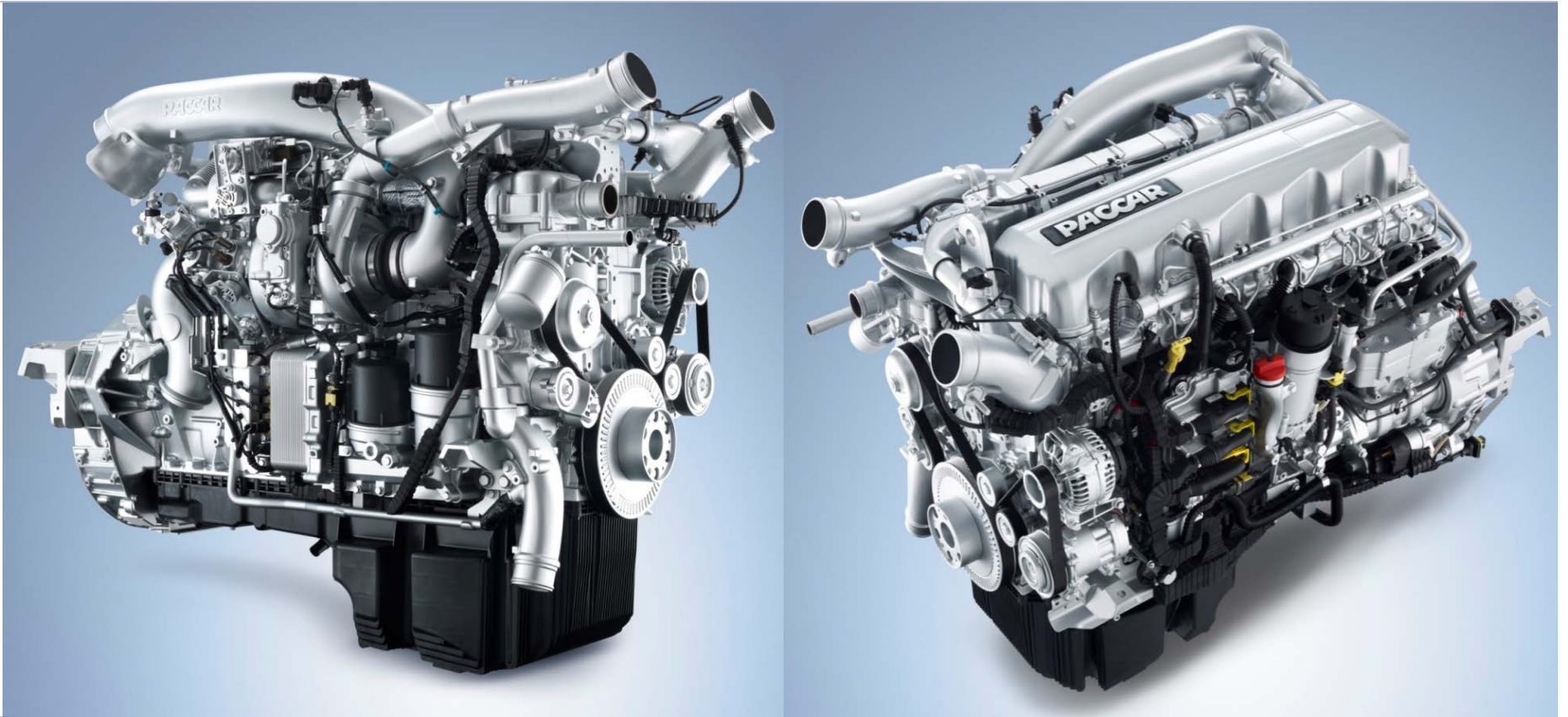
MX EPA10...



- Horsepower range of 380 to 485hp
- Torque outputs up to 2,370Nm
- Equipped with:
 - PLD fuel injection system
 - Exhaust Gas Recirculation (EGR)
 - Selective Catalytic Reduction (SCR)
 - Diesel Particulate Filter (DPF)



New PACCAR MX-13 engine... *EURO 6*



New PACCAR MX-13 engine... *EURO 6*



Concept:

- Swept volume 12.9 litre
- 6 cylinders in-line
- Robust, compact design
- Function integration
- Common rail fuel injection
- Variable turbo geometry
- Exhaust gas recirculation (EGR)
- Exhaust after treatment (SCR and DPF)

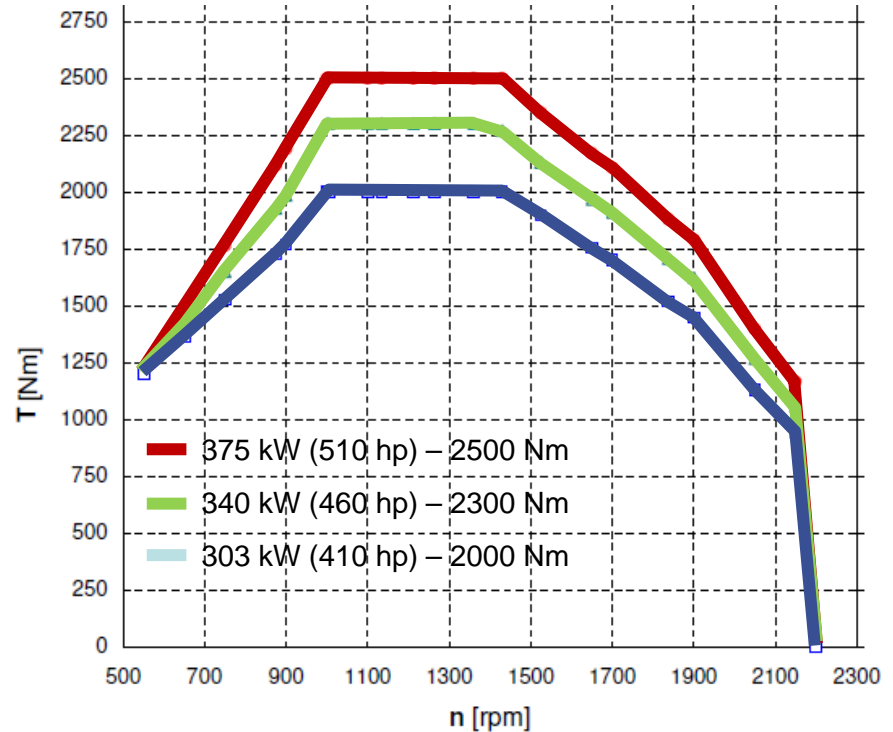


Driveline performance...

EURO 6



- Best-in-class performances
- Power range: 410 - 460 - 510hp
- Torque: 2000 - 2300 - 2500Nm
- High torque at low revs
- Available over large speed range (1000-1410 rpm)



Optimised combination of:

- Selective catalytic reduction
 - Improved efficiency
- Diesel particulate filter
 - Passive and active regeneration
- Common rail
- EGR / air management system
 - 3 smartly controlled cooled actuators: VTG, EGR valve, back pressure valve
- Engine management (modes)



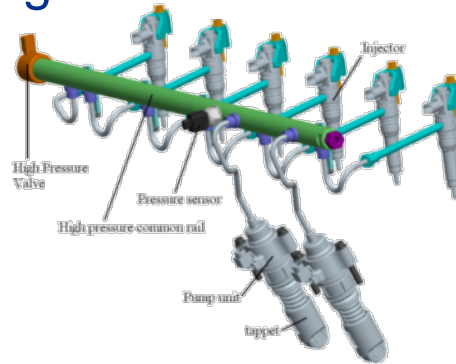
Low emissions, high efficiency...

EURO 6



Common rail:

- 2,500 bar injection pressure
- Injection flexibility...
 - Possibility for pre and post injection
- 2 pump units integrated in the block...
 - Stable pressure build-up and limited friction losses



Low emissions, high efficiency...

EURO 6



Variable turbo geometry:

- Sliding nozzle VTG
- Electronically controlled actuator
- Cooled actuator and bearings
- Optimised compressor mapping
- Good transient response
- Improved MX engine brake

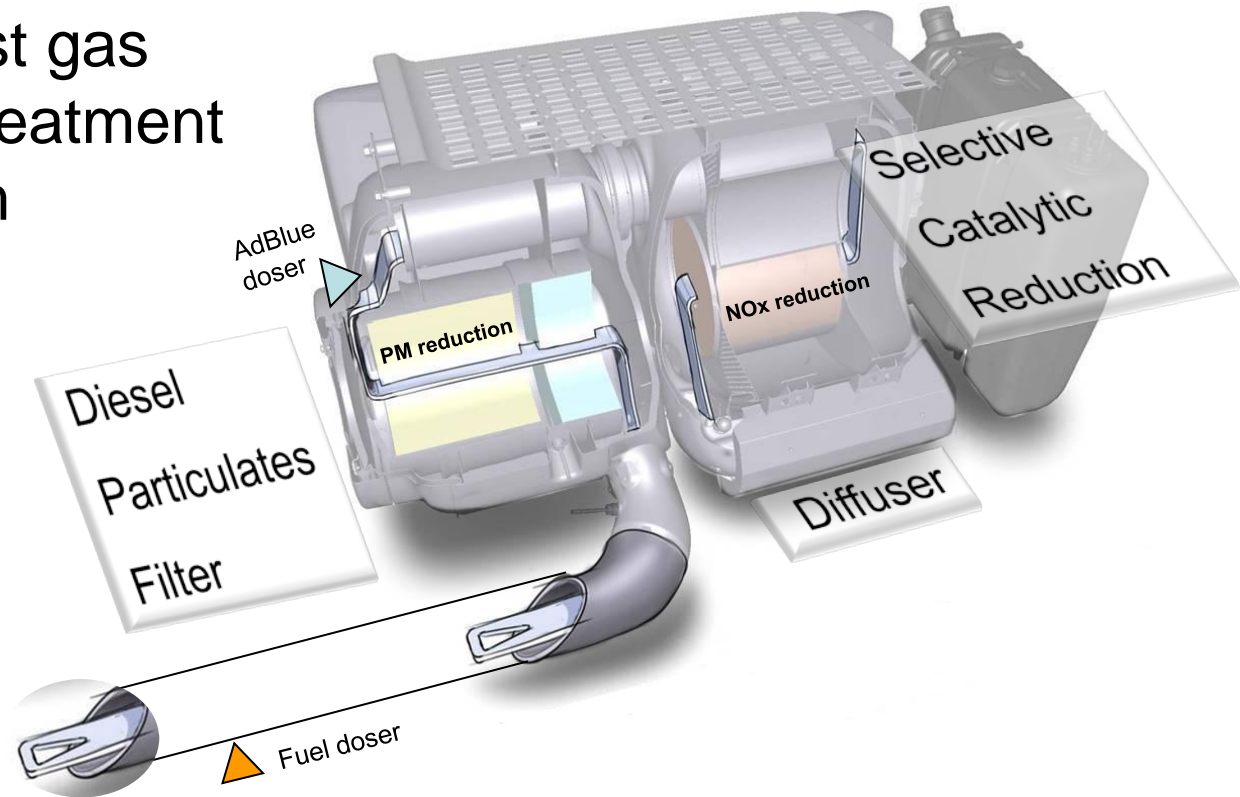


Low emissions, high efficiency...

EURO 6

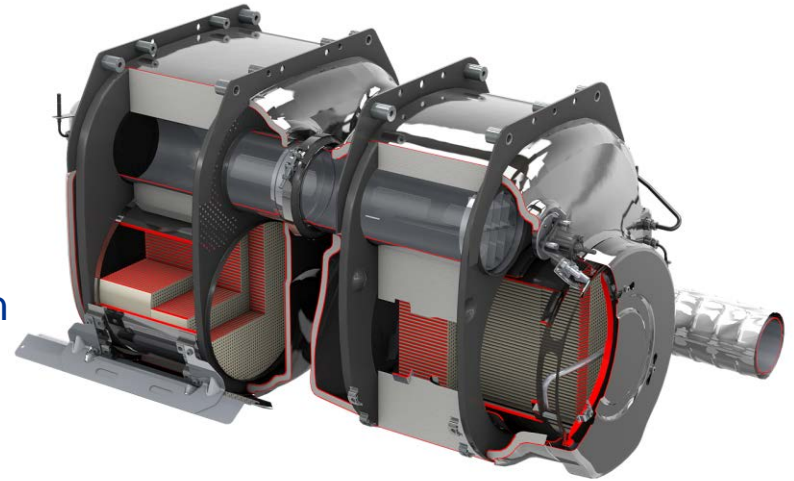


Exhaust gas
After treatment
System



Diesel particulate filter:

- Closed system - 99% filtration
- Focus on passive regeneration
 - Cordierite soot filter with smart coating
 - Exhaust gas temperature and composition
 - Insulated exhaust pipes
- Low back pressures
- Exchangeable, cleanable filter
 - Ash cleaning intervals 500,000 km



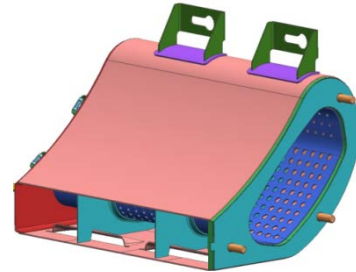
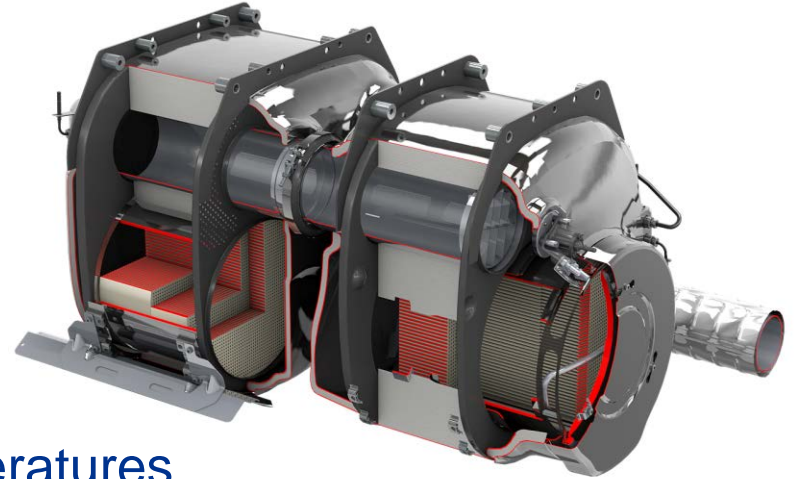
Low emissions, high efficiency...

EURO 6



Selective Catalytic Reduction:

- New Airless doser
- New catalyst
 - High efficiency at low temperatures
- Diffuser to control exhaust gas temperatures



Reduced pollution certificate... *EURO 6*



2011 Budget:

- Scheme announced to encourage early take up of Euro 6...
 - £5 to £40 for up to 15T; £370 for 18-26T; £500 for 32T+
- Unlike previously will only run for 5 years max
- Closing date for Euro 6 reduced pollution rate - is 2016...
 - Entry into the tax class will close in Jan 2014 (Euro 6 becomes mandatory).

- RPC scheme may be discontinued in 2014 if road user charge comes in...
 - Grant to compensate RPCs for E4, E5 & E6 vehicles until 2016



Potential impact of Euro 6...

EURO 6



- More cooling – 28% increase
- Chassis packaging - limited fuel tank capacity?
- Unladen weight - 200 to 250 kgs payload reduction?
- Fuel economy - 3 to 8% worse than Euro 5 or 10% AdBlue usage?
- Repair and maintenance costs - reduced service intervals/ash cleaning?
- Capital cost - £10,000 to £12,000?



....without any offsetting measures

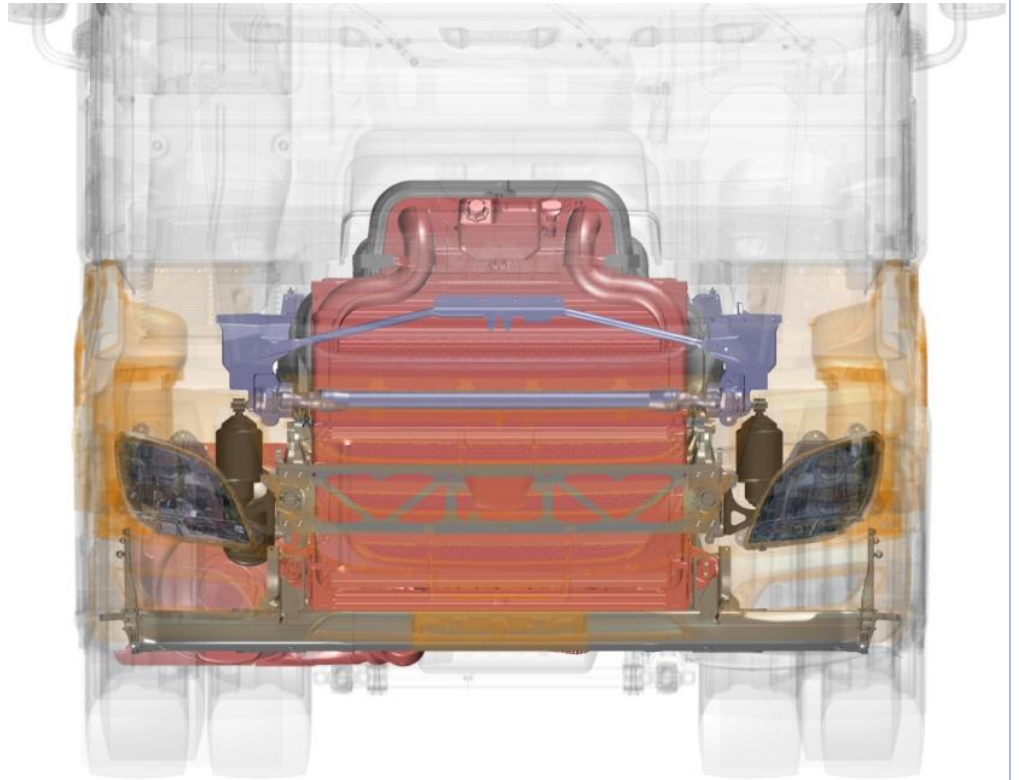


COOLING



Combined unit

- Radiator - increased surface (+30%) for efficient cooling:
 - Fan engagement reduced (- 50%)
 - No up-speed
- Intercooler - (+40%) for fuel efficiency



Driveline efficiency

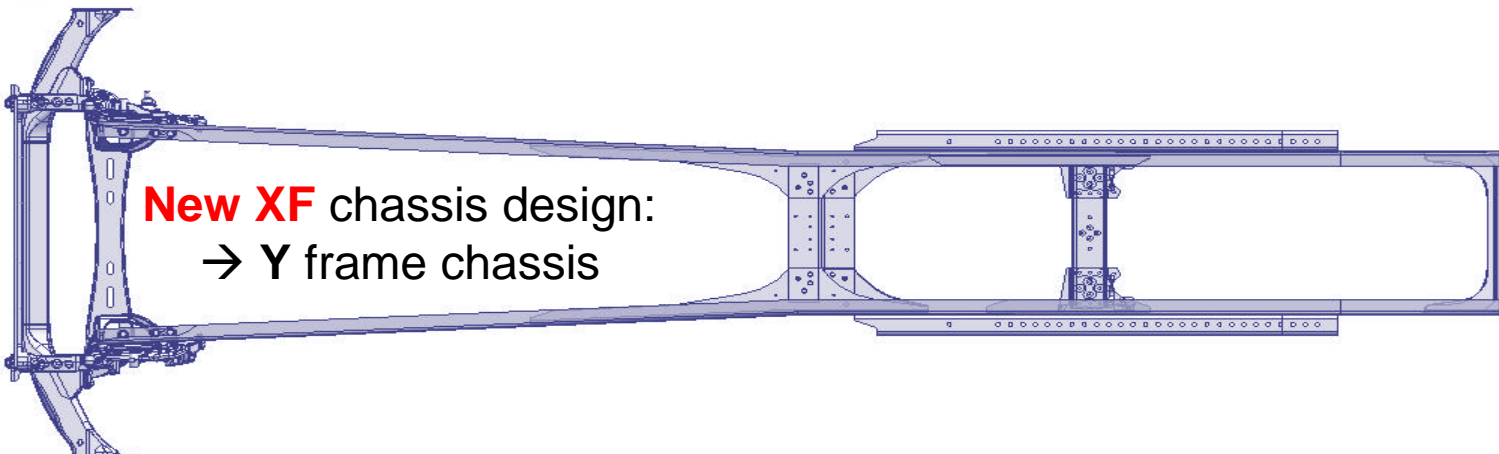
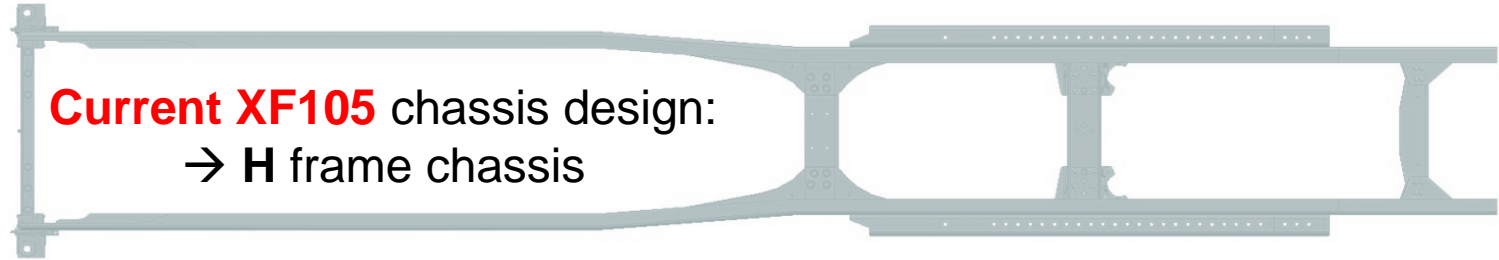


- Larger air intake
- Improved cooling
- Smart Air Control
- AS Tronic enhancements
 - Unique controls for excellent drive off and maneuvering
 - Fast Shift
 - Eco-Roll
- Soft cruise resume
- Improved MX Brake



New chassis design...

EURO 6

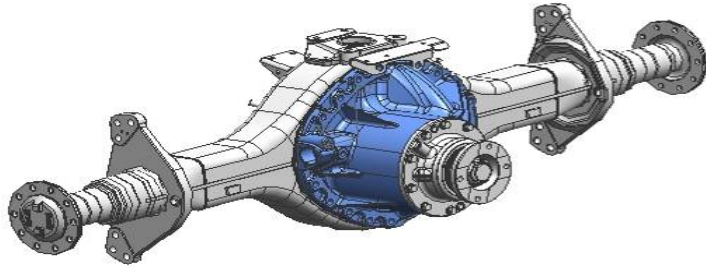


New front & rear axle and suspension



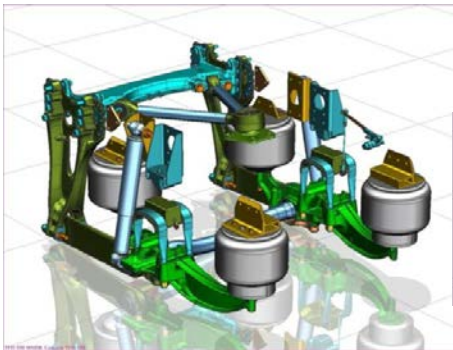
New Front axle

- Standard: 8.0t, optional: 9.0t
- Wider track: 2.55m overall width
- Enhanced steering performance



New Rear Axle

- 13 tonne carrying capacity
- 44 tonne GCW: 460bhp/2300Nm
- Approx. 40kg weight reduction
- Fast ratios to 2.38:1 for 1160 rpm cruising



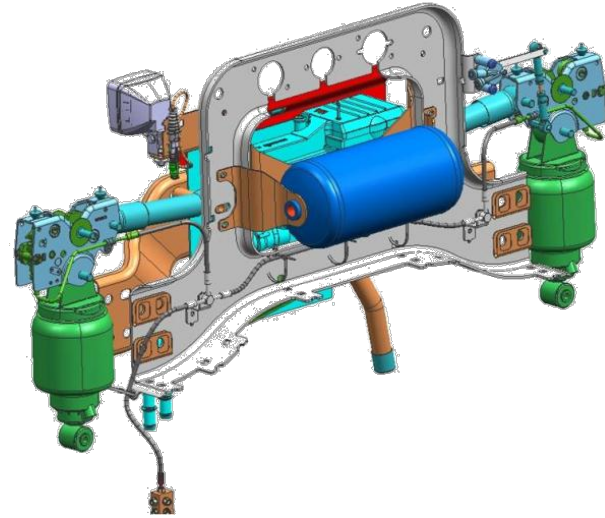
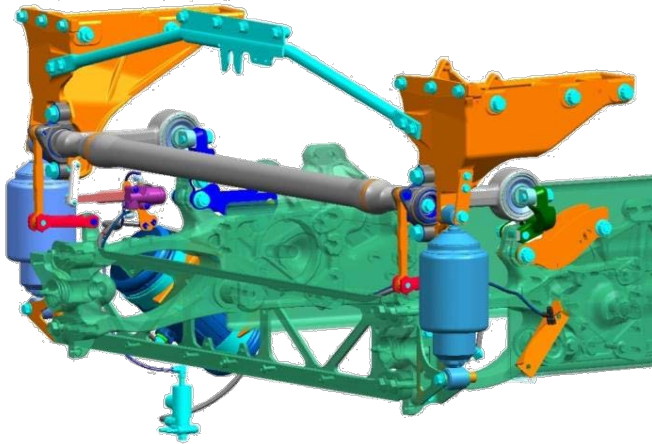
New Rear Stabilink suspension

- Anti-roll bar and reaction rods combined
- Improved ride and handling
- Approx. 60kg weight reduction

Cab suspension



- Higher comfort
- Lower interior noise
- Excellent ride & handling
- Crash-worthiness

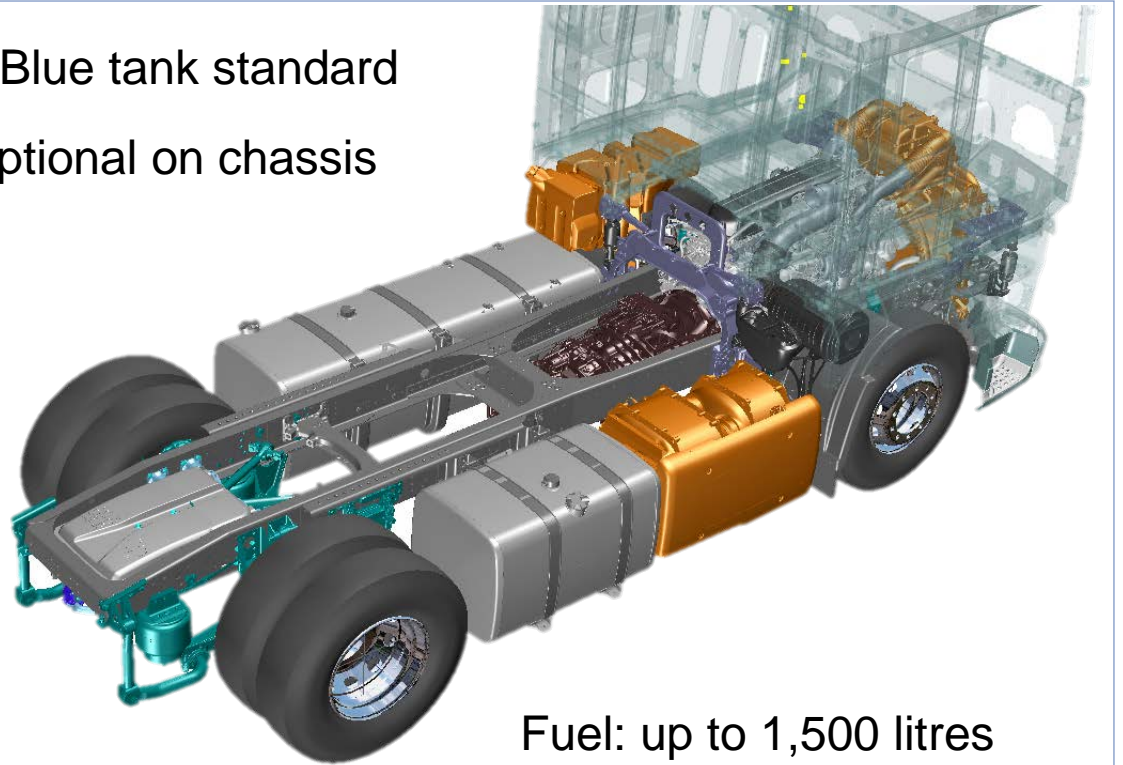
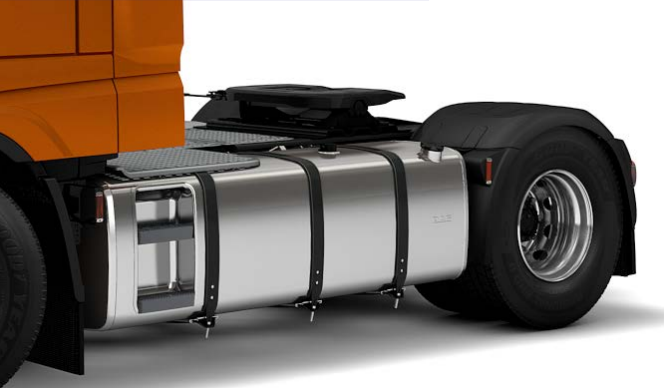


Chassis packaging...

EURO 6



90 litre AdBlue tank standard
140 litre optional on chassis

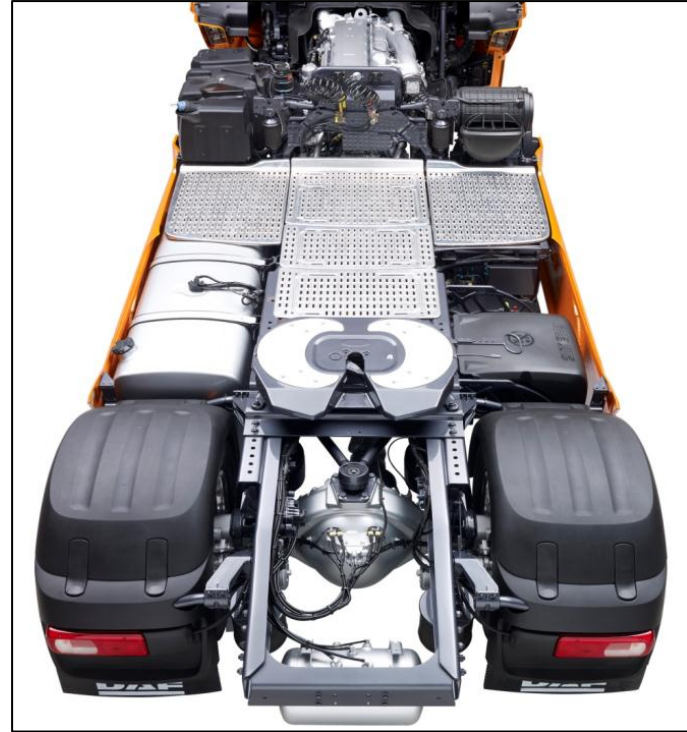


Fuel: up to 1,500 litres

Maximum flexibility...



- Batteries located in rear overhang or side mounted above spare wheel carrier
- Lightweight construction
- Main switch integrated in box



Interior Design....



Ergonomics...



- Attractive new design
- Optimal ergonomics
- High level fit & finish
- Soft touch dash top panels
- New brake, clutch & accelerator pedals

Driver performance assistance.....



Focus on fuel economy

- Anticipation
- Shifting
- Braking
- General fuel saving advice

Maintaining fuel efficiency...

EURO 6



- Design target – to match today's fuel economy
 - Common rail fuel injection
 - ATe features - piston rings, insulated manifold
 - Larger cooling system - direct mounted fan works 50% less
 - 40% larger intercooler
 - Larger air intake - for clean cool air (180,000km intervals)
 - Improved aerodynamics
 - AS-Tronic - Eco-roll, fast shift, soft cruise resume
 - Driver performance assistant
 - Faster axle ratios/less oil
 - Smart air compressor



New DAF XF...

EURO 6



- Performance:
 - Similar power/ torque, but more responsive
 - Powerful engine brake : +30%
- Low emissions:
 - Euro 6 emissions
 - Fuel consumption similar to Euro 5/ATe level
 - Low oil consumption (ash load DPF)
 - Weight increase: +90 kgs
 - 4x2 Fuel capacity up to 1,500 litres
 - Same R&M costs as Euro 5
- Business case??



Environmental: air quality and CO₂ emissions...



Noxious matter (NO_x, PM):



- Acid rain, air toxicity, smog, global warming...
 - Technology known and available
 - Harmfulness determined by age vehicle parc

Greenhouse gases (CO₂):



- Global warming, sustainability...
 - Reduction of fuel consumption
 - Use of alternative fuels

Euro 6 – cleanest ever, better than gas engines?



Continuous development – less fuel, less CO₂

DAF

