

HVO und e-Diesel Blends als Drop-in Kraftstoffe mit sofortiger Wirkung in der CO₂-Bilanz

Ergebnisse zum Emissionsverhalten bei On- und Offroadeinsatz

**Way2Zero
Emissions:
ReFuels**

12. Oktober 2023
in Stuttgart



**WÜRTTEMBERGISCHER
AUTOMOBIL CLUB e.V.
AUTOMOBILE
INSPIRATION**

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Why do we need the whole variety of different powertrains?

Use-case focused view

Goal

Fast, resilient and sustainable contribution to a holistic CO₂ reduction

Use Case - Technologies

Battery

Fuel-Cell

+ liquid renewable fuels

Hydrogen-Engine



Commercial vehicle applications are highly heterogeneous (load, power, range, terrain, ...)
We need all technologies, to meet customer and societal needs of all applications

Why do we need the whole variety of different powertrains?

CO₂ - focused view | Extract of FVV-Study

https://www.fvv-net.de/fileadmin/Transfer/Downloads/Publikationen/FVV_R605_System_efficiency_information_paper_2023_EN.pdf

Input

- Vehicle fleet, lifetime view
- Infrastructure, lifetime view
- GHG emissions from needed materials, runtime and disposal
- CAPEX and OPEX from invest and operation
- Technical bottlenecks from infrastructure and raw material availability...

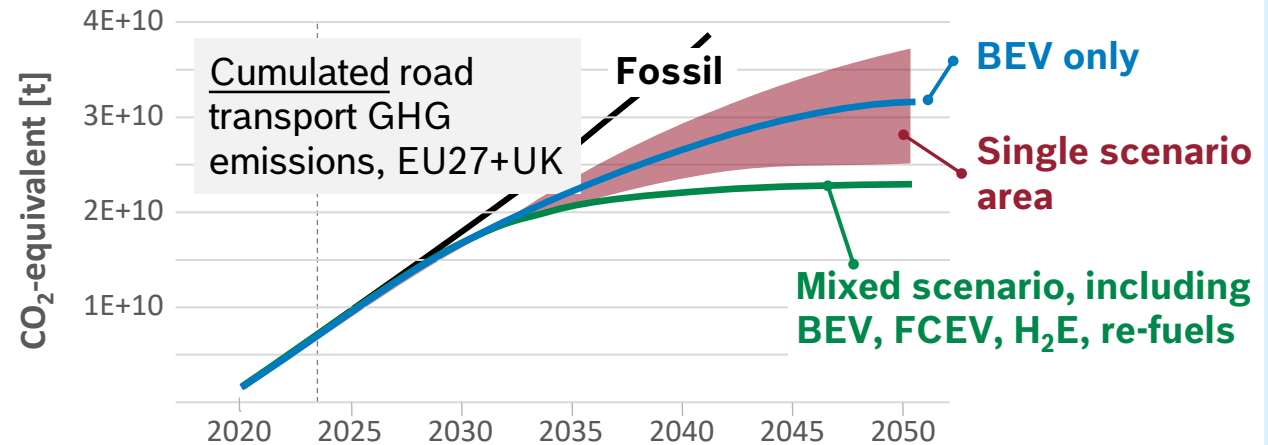
Linear optimization model

Optimization objective: Minimization of cumulated GHG emissions from road transport (EU27+UK)

Output

Different PT-scenarios (per vehicle segment and year)

- Ramp up speed, cumulated GHG emissions, specific invest ...



To sustainably reduce cumulative CO₂ in earliest timeframe, a holistic approach is mandatory



A proactive approach to “drop in” Diesel fuel development based on a paraffinic diesel blend

Aramco Overseas Company

Dr. Sandro Gail, Low Climate Impact Fuel program manager

Robert Bosch GmbH / Bosch Italy

Dr. Andreas Kufferath, Head of Engineering System Diesel Powertrain

David Nuccio, Powertrain Solutions, Engineering PT System Testing



Used non road mobility engine for fuel comparison

Engine Hardware and Installation

Used Engine: Deutz TCD 3.6 HP
 Main Application: Non road mobility
 Injection system: Common rail
 Exhaust gas treatment: DOC, DPF and SCR
 Technology / specs: State-of-the art



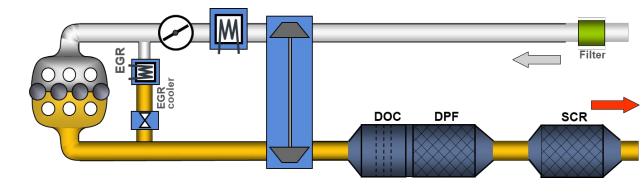
TECHNICAL DATA

Engine type		TCD 3.6 L4 HP*
No. of cylinders		4
Bore/stroke	mm in	98/120 3,9/4,7
Displacement	l cu in	3,6 221
Max. nominal speed	min ⁻¹ rpm	2300

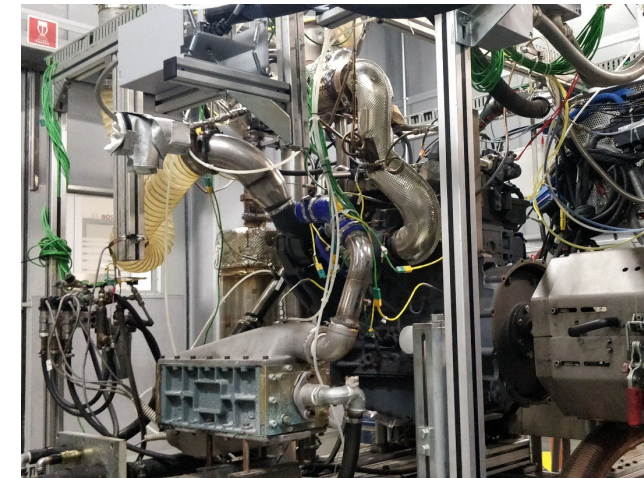
Engine type		TCD 3.6 L4 HP*
Power output as per ISO 14396 ¹⁾	kW hp	105 141
at speed	min ⁻¹ rpm	2300
Max. torque	Nm lb/ft	550 406
at speed	min ⁻¹ rpm	1600
Minimum idling speed	min ⁻¹ rpm	800
Specific fuel consumption ²⁾	g/kWh lb/hph	210 0,35
Weight as per DIN 70020 Part 7A ³⁾	kg lb	350 772

* HP= High Power variant

Engine exhaust gas treatment layout



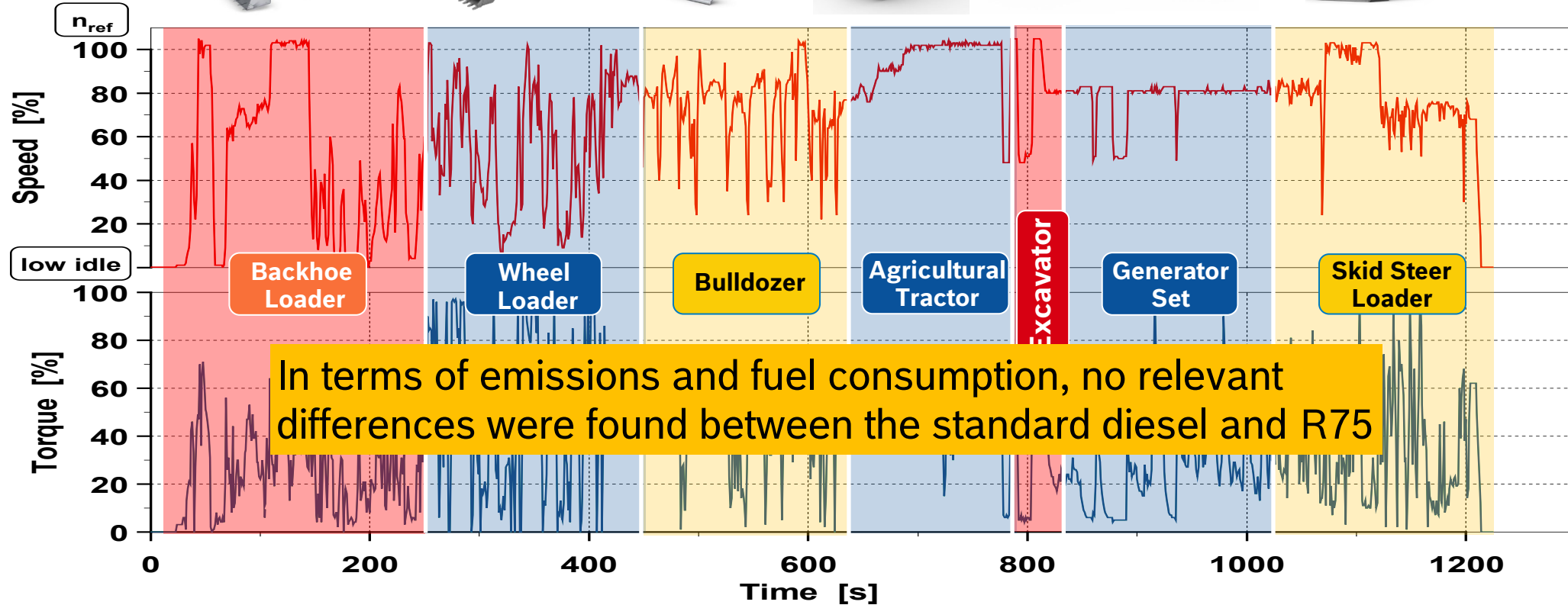
Engine test rig



Used off-road test conditions

NRTC (non road transient cycle)

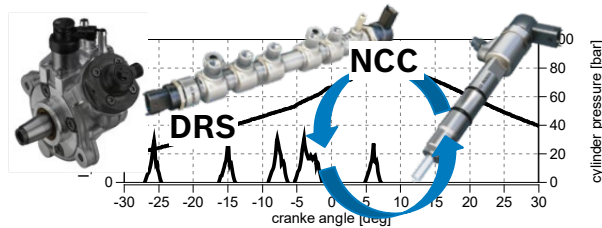
Representative categories



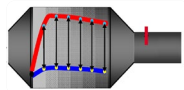
Emission comparison: Standard Diesel / R75

Technical overview 4th Gen Diesel Demonstrator

- = Fuel injection equipment
- = Improved turbocharging
- ≈ New software functions
- + Optimized NO_x raw emission



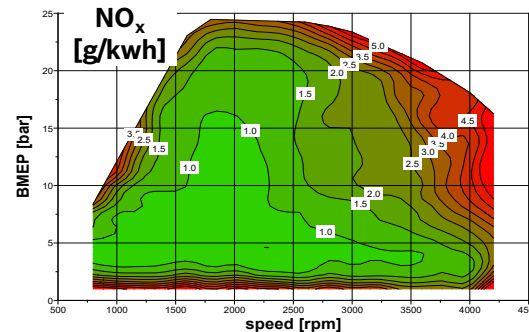
2500 bar FIE + NCC (PF25)



Advanced temperature management / software functions



Optimization in a system approach

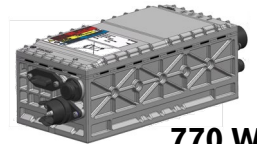


Improved calibration

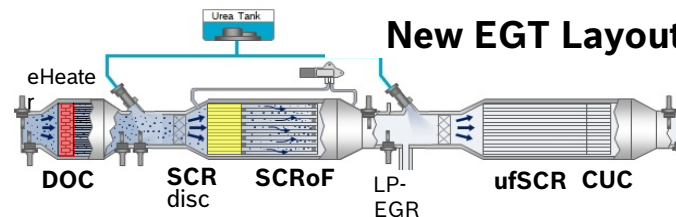
- + Enhanced EGT
- ≈ EGT Temperature management
- + Electrical Heater
- + improved mHEV (48V)



10/12 kW*



770 Wh

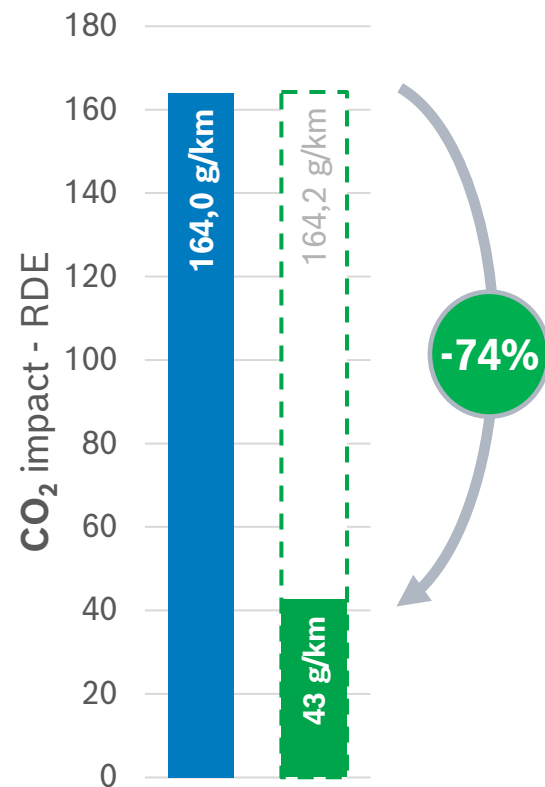
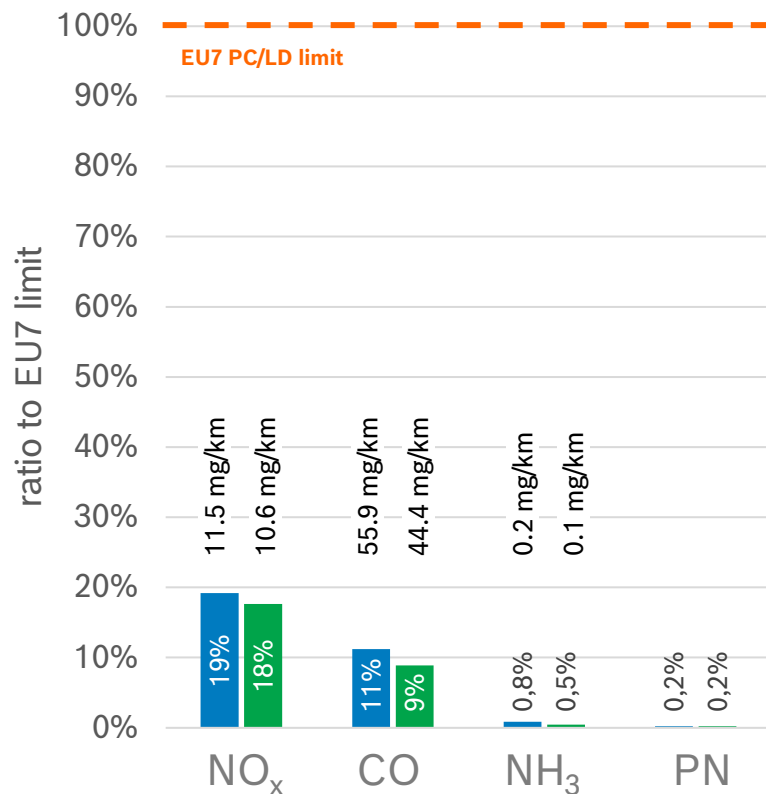


Technology / results can be transferred to LCV segment !

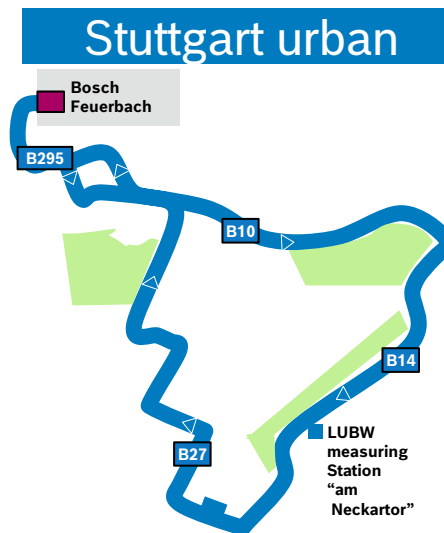


Emission comparison: Standard Diesel / R75

Tailpipe emission overview @ Stgt Urban



Test-Variant	No. of tests
Stuttgart-Urban, EN590 standard Diesel	11
Stuttgart-Urban EN590 R75 (75% e-blend)	12



Tailpipe emissions: Comparable low emission level / Big step in CO₂ impact of R75

Use of HVO / e-Diesel blends - immediate effect in carbon footprint

Summary

- “Drop-in” renewable fuels can immediately contribute to well-to-wheel CO₂ neutral mobility
- They are compatible w/ existing distribution infrastructure and are the only option to address the existing vehicle fleet (on and off-road)
- Commercial vehicle applications are highly heterogeneous. We need all PT-technologies, to meet customer and societal needs of all applications.
- To sustainably reduce cumulative CO₂ in earliest timeframe, a holistic approach is mandatory. Re-fuels are a part of the solution
- With re-fuels for nitrogen oxides and particulates an emission level with the already existing and robust technology can be achieved, that no longer has a relevant influence on air quality