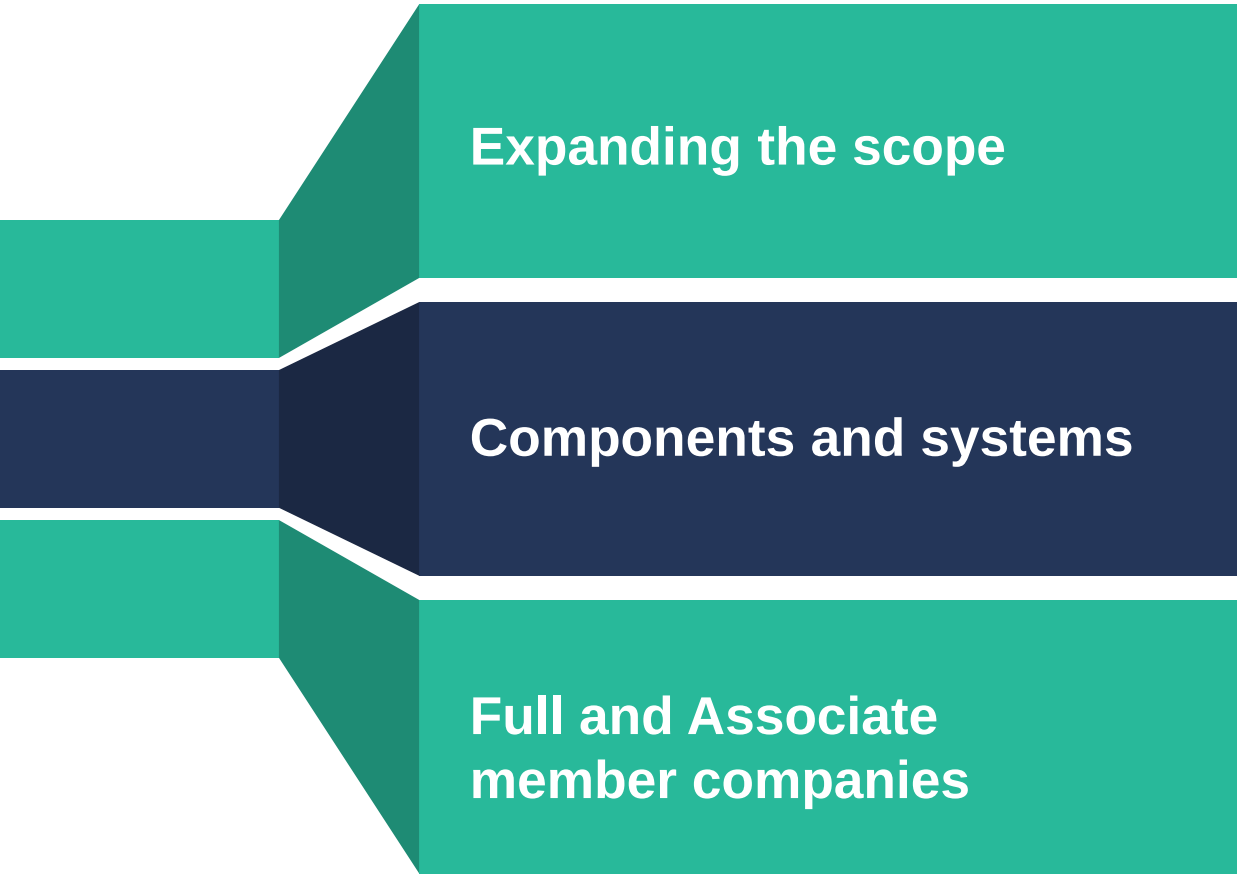
BS7 to Unlock the Full Potential of Emissions Control Technologies

Dirk Bosteels • 16th Int. ECT Conference • 7-8 October 2025

AECC is now the Association for Emissions Control and Climate



- Air quality and **Climate** requirements
- Mobile and **Stationary** emissions sources
- Sustainable **components and systems**

- Catalysts
- Filters
- Adsorbers

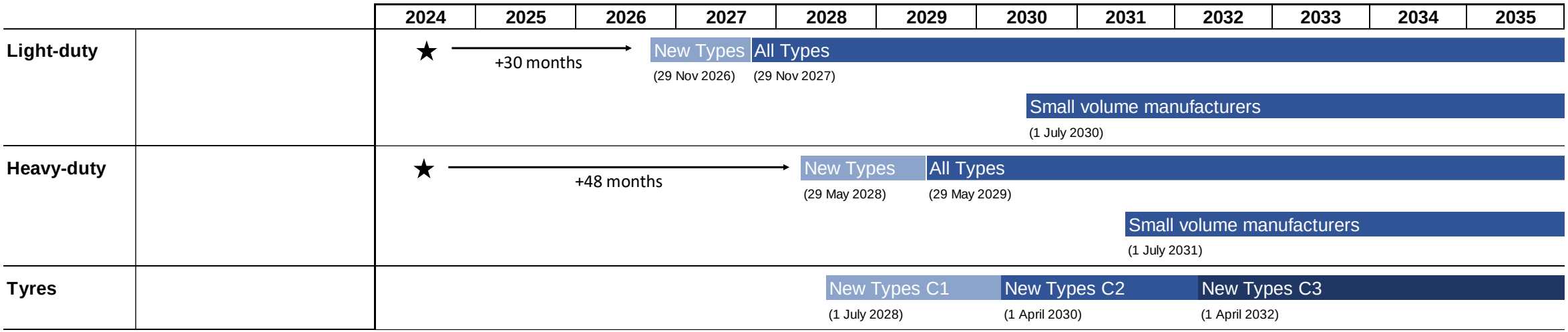
- System integration
- Fuel cells
- Electrolysers

EU Transparency Register #78711786419-61, consultative status with the UN Economic and Social Council (ECOSOC)

Overview of ongoing Euro 7 process

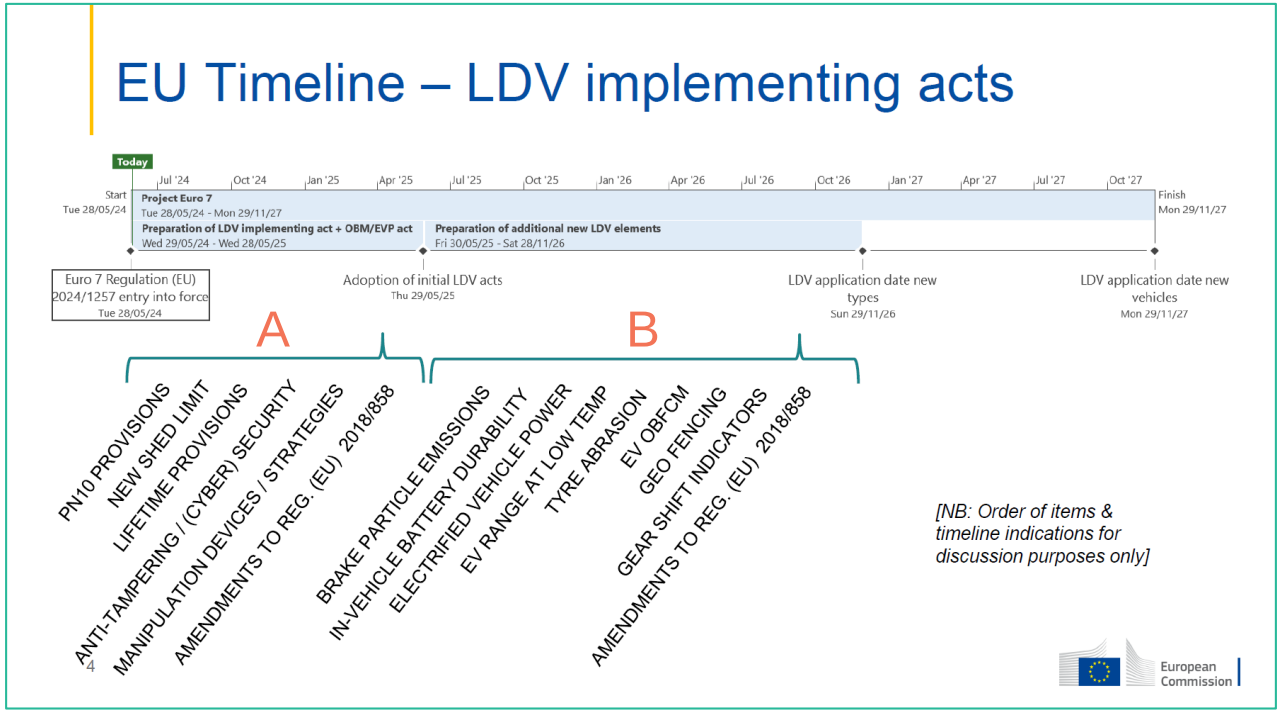
- Euro 7 regulation published in EU Official Journal on 8 May 2024

- Implementing legislation being developed by European Commission
  - Drafting by European Commission's DG GROW and DG JRC
  - Consulting stakeholders in Advisory Group on Vehicle Emissions Standards (AGVES) meetings



Euro 7 implementing legislation

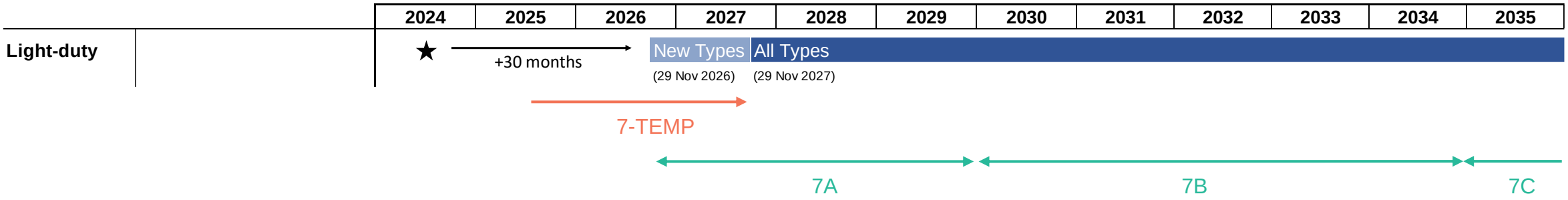
- Focus is first on light-duty vehicles
  - LDV implementing act and OBM/EVP act has been published on 5 September 2025 (A)
  - Adoption of additional LDV elements is targeted by 29 November 2026 (B)
  - Euro 7 transposition into UN Regulations in parallel



Different Euro 7 steps clarified in LDV package

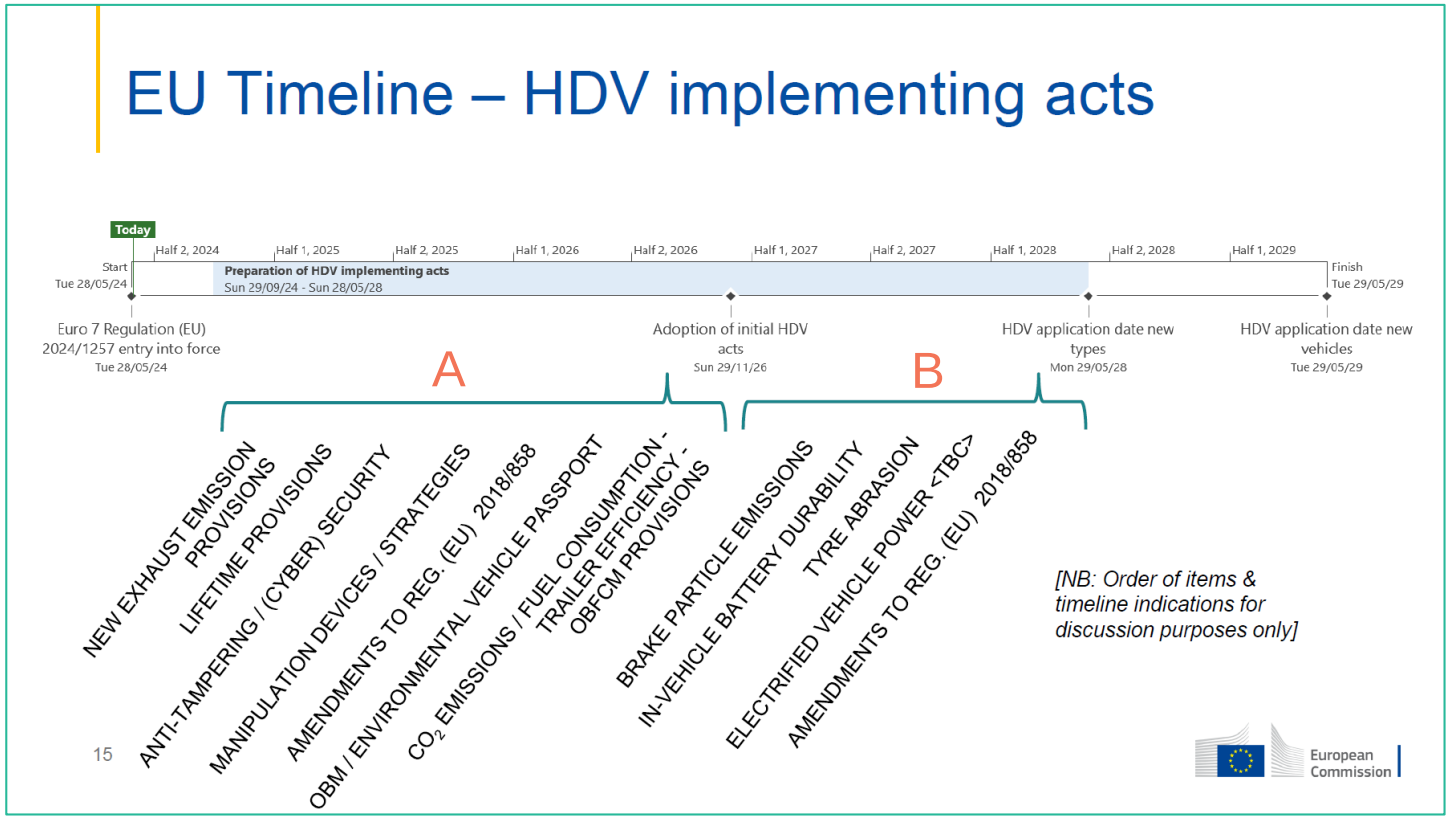
- Type approval certification numbering according to Annex I Appendix 6 (below is M1 example)
  - Euro 7-TEMP: voluntary type approval for emissions (transition when only LDV package 1 is published)
  - Euro 7A-B-C: steps in requirements for brake emissions (Regulation 2024/1257, Annex I, tables 4-8)

Emission Character[6]	Emission standard	Sub-character for this regulation (see Table 2)	Sub-character for OBM and EVP (see Table 3)	Vehicle category or product type	In-vehicle battery durability[3]	Brake emissions	EV system power[2]	EV-range at low temp.[3]	Last date of registration
TL[1]	Euro 7-TEMP	MT, MA, MC or ME	OA, OC or OE	M_1, N_1	N/A	N/A	N/A	N/A	28.11.2027
FL	Euro 7A	MA, MC[4] or ME	OA, OC or OE	M_1, N_1	UA or UB	RA or RB	SA	LA	31.12.2029[5]
GL	Euro 7B	MA or ME	OA, OC or OE	M_1, N_1	UA or UB	RE	SA	LA	31.12.2034[5]
HL	Euro 7C	MA or ME	OA, OC or OE	M_1, N_1	UA or UB	RH	SA	LA	



Euro 7 implementing legislation

- Heavy-duty Vehicles
  - Adoption of initial HDV implementing act is targeted by 29 November 2026 (A)
  - Adoption of additional HDV elements is targeted the latest by 29 May 2028 (B)



Euro 7 for heavy-duty vehicles

- Significant reduction of limit values from Euro VI
  - PN10 measurement procedure instead of PN23
  - New limits introduced for NH_3 and N_2O
  - 1.3-1.5x lower limit for WHTC/WHSC test
  - 100th percentile and budget limit from proposal deleted
- Test procedures nearly kept from Euro VI-E
  - Low power threshold is reduced from 10% to 6%
- Durability is extended
  - Main lifetime up to 300 000 km or 8 years (Cat. 1), 700 000 km or 12 years (Cat. 2)
  - Additional lifetime up to 375 000 km or 10 years (Cat. 1), 875 000 km or 15 years (Cat. 2)
    - Durability multiplier for gaseous pollutant emissions tbc by 31 December 2025

RDE limits (90th percentile)	Euro 7 proposal (10 Nov 2022)	Final Euro 7 (8 May 2024)
NOx (mg/kWh)	90	260
PM (mg/kWh)	8	8
PN10 (#/kWh)	$2x10^{11}$	$9x10^{11}$
CO (mg/kWh)	200	1950
NMOG (mg/kWh)	50	105
NH_3 (mg/kWh)	65	85
CH_4 (mg/kWh)	350	650
N_2O (mg/kWh)	100	260
HCHO (mg/kWh)	30	-

Cat. 1: N2, N3<16t, M3 <7.5t
Cat. 2: N3>16t and M3>7.5t

Euro 7 for light-duty vehicles

- Limit values kept from Euro 6e, except PN
  - Still gap between CI and PI limits
  - PN10 procedure instead of PN23
  - PN10 limits apply to all vehicles (footnote for DI only deleted)
- Test procedures kept from Euro 6e
  - Includes PEMS error margin for PN (0.34) and NOx (0.1)
- Durability is extended
  - Main lifetime up to 160 000 km or 8 years
  - Additional lifetime up to 200 000 km or 10 years
    - With 1.2 durability multiplier for gaseous pollutant emissions

	Euro 7 proposal (10 Nov 2022)	Final Euro 7 (8 May 2024)
NOx (mg/km)	60	60 (PI) – 80 (CI)
PM (mg/km)	4.5	4.5
PN10 (#/km)	$6x10^{11}$	$6x10^{11}$
CO (mg/km)	500	500 (CI) - 1000 (PI)
THC (mg/km) THC+NOx (mg/km)	100 -	100 (PI only) 170 (CI only)
NMHC (mg/km)	68	68 (PI only)
NH_3 (mg/km)	20	-
Minimum trip	2 km with cold-start budget for first 10 km	16 km

PI: Positive Ignition
CI: Compression Ignition

Reflection on Euro 7 for BS7 discussion

- Political outcome influenced by CO_2 emissions standards
  - Setting -100% (LDV) or -90% (HDV) tailpipe targets
  - These targets are under review 2025-2027, and ICE/HEV anyway on the road until 2050
  - All powertrains to fulfill future air quality requirements and contribute to transport decarbonisation
- Proposal had too much focus on worst case conditions
  - Due to wording ‘any’ for trip composition in Euro 7 proposal
  - Emission reduction opportunities missed under normal conditions
- AECC-IPA published fact sheet on myths and truths
  https://www.aecc.eu/wp-content/uploads/2023/09/2023-08-31-AECC-Factsheet.pdf

Myths and truths about
Euro 7 pollutants limits for new vehicles in the EU

Every new vehicle sold in the next decades should play its part in reducing air pollution. The robust Euro 7 rules proposed by the European Commission put EU citizens' health first and will keep the automotive sector competitive globally.

Euro 7 is ~~un~~necessary

All EU citizens will benefit: an upgrade to Euro 7 reduces health risks caused by vehicle traffic. Each € invested in Euro 7 results in a reduction of 5€ on healthcare and environment costs.

Keeping Euro 6/VI is not sufficient.
20% of distance driven in Europe is outside current test boundaries. Wider Euro 7 test methods will better capture emissions resulting from driving in different conditions.

Euro 7 limits are ~~not~~ feasible

The necessary emission control technology is already available and has been tested successfully with vehicles on the road.

Fitting the latest emission control technology can reduce truck NOx emissions by 75-96% compared to Euro VI-C and NOx from a gasoline car by 40-64% from Euro 6d.
Vehicle manufacturers are already developing new vehicles with more stringent limits than Euro 6/VI in mind.

Euro 7 will ~~not~~ make Europe competitive

China and the United States are moving ahead with more stringent standards than Euro 6/VI. Europe cannot stay behind if it wants to remain competitive.

Investing in Euro 7 comes at incremental cost
of 0.6-5.7 billion euro compared to the 59 billion euro each manufacturer is expected to invest in electrification, connectivity and automation by 2050.

Euro 7 is ~~not~~ affordable

Cars and trucks will remain affordable as equipping them with new emission control technologies comes at a very small proportion of the cost of a new vehicle.

Studies on the impact of Euro 7 estimate the additional cost of new cars to be between 104-251€ compared to Euro 6d.
Contrary to some claims, Euro 7 vehicles will not need to comply with all possible driving situations, hence automatic gearboxes and hybridisation technologies should not be counted among the cost to adapt to the new standards.

AECC ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST
IPA

www.aecc.eu www.ipa-news.com

Discover the full Euro 7 fact list and what technology can deliver.

IPA: International Platinum Group Metals Association

AECC-IPA demonstrator vehicles

- Emission control technologies perform beyond Euro 7 ambition
  - Active thermal management
  - Combination of close-coupled and underfloor components
  - Catalysed filters
  - Clean-up catalysts
- Zero-impact gaseous and particulate emissions are technically feasible under real-world driving conditions
  - Significant reduction of initial cold-start peak
  - Near-zero emissions after initial cold-start peak, also at low-load
- Results confirmed on drop-in CO_2-neutral fuels with substantial reduction in WtW and LCA CO_2 emissions

J. Demuynck, et al.; "Integrated Diesel System Achieving Ultra-Low Urban and Motorway NOx Emissions on the Road", Vienna, 2019

J. Demuynck, et al.; "Zero-Impact Emissions from a Gasoline Car with Advanced Emission Controls and E-Fuels", Vienna, 2022

D. Bosteels, et al.; "Combination of advanced emission control technologies and sustainable renewable fuels on a long-haul demonstrator truck", SIA 2022

THANK YOU!

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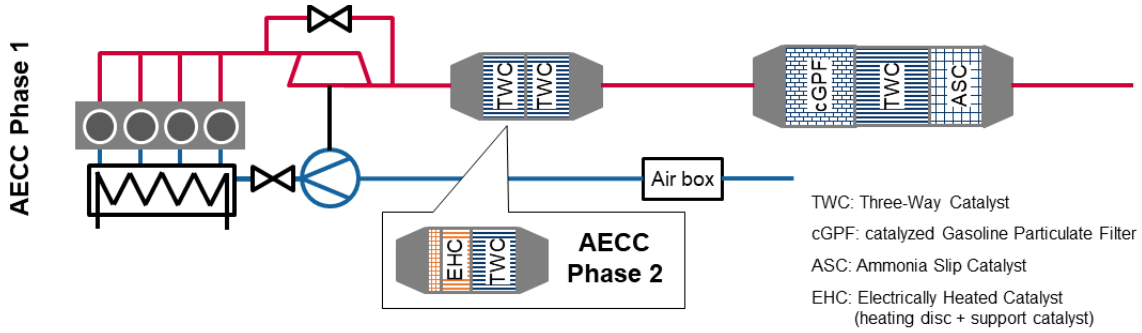
LD gasoline demonstrator concept

- Base vehicle
  - C-segment vehicle
  - 1.5l engine with 4 cylinders
  - Variable valve train and cylinder deactivation
  - 48V mild-hybrid
  - Euro 6d type-approval baseline: cc cGPF + uf TWC

- AECC emission control system
  - Phase 1: cc TWC, uf cGPF+TWC+ASC
  - Phase 2: cc EHC|TWC, uf cGPF+TWC+ASC
  - Bench aged components targeting 160k km

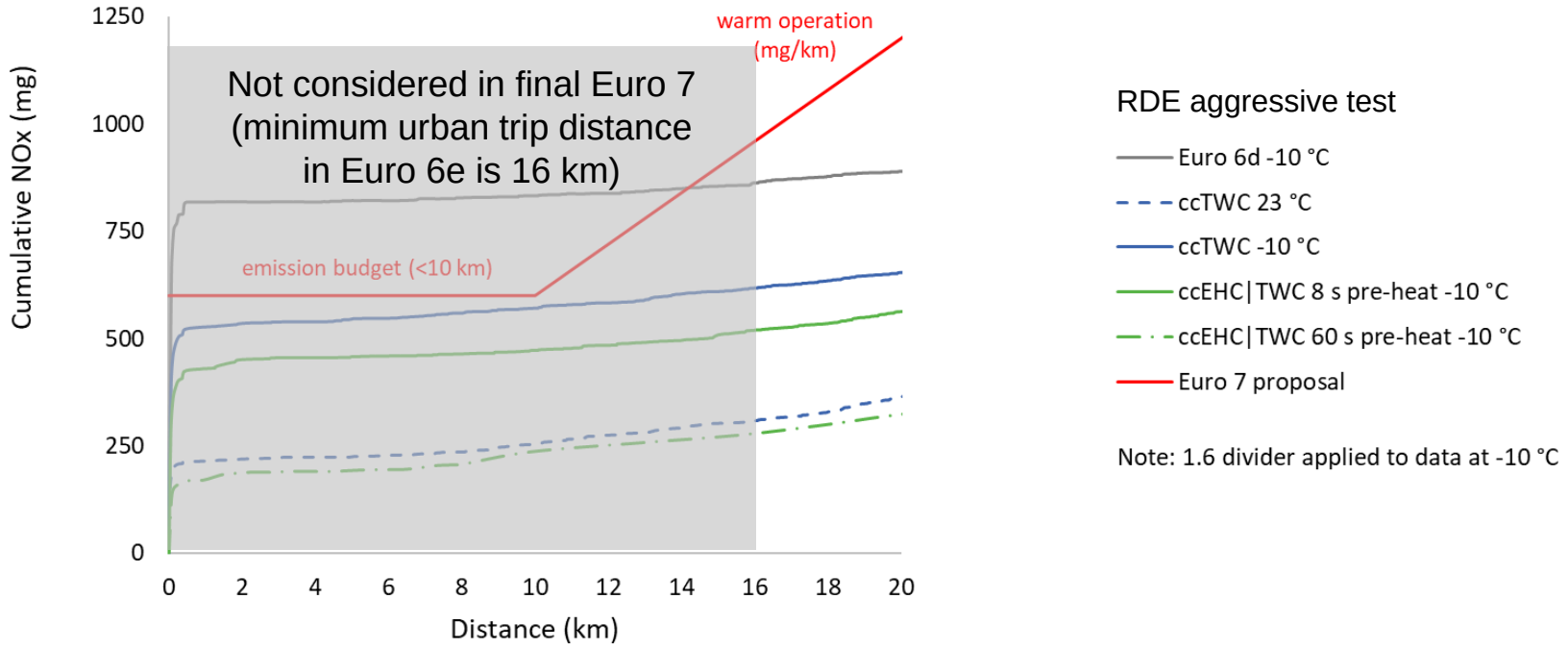


J. Demuynck, et al.; "Ultra-low Emissions of a 48V Mild-Hybrid Gasoline Vehicle with Advanced Emission Control Technologies", 15th International Conference on Engines and Vehicles, 2021
J. Demuynck, et al.; "Zero-Impact Emissions from a Gasoline Car with Advanced Emission Controls and E-Fuels" 43rd International Vienna Motor Symposium, 2022

gasoline

Gaseous emissions are mainly from initial cold-start

- Highest cold-start NOx peak remains below original Euro 7 proposal
- Near-zero emissions under warm operation on all tests
- Further potential is possible for initial cold-start NOx due to demonstrator constraints



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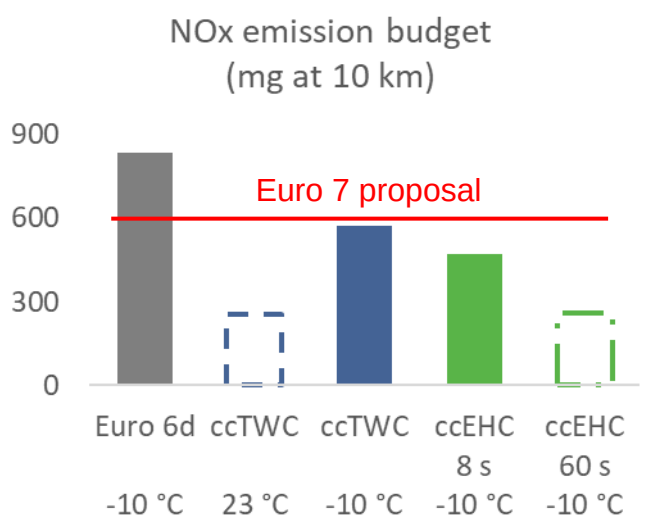
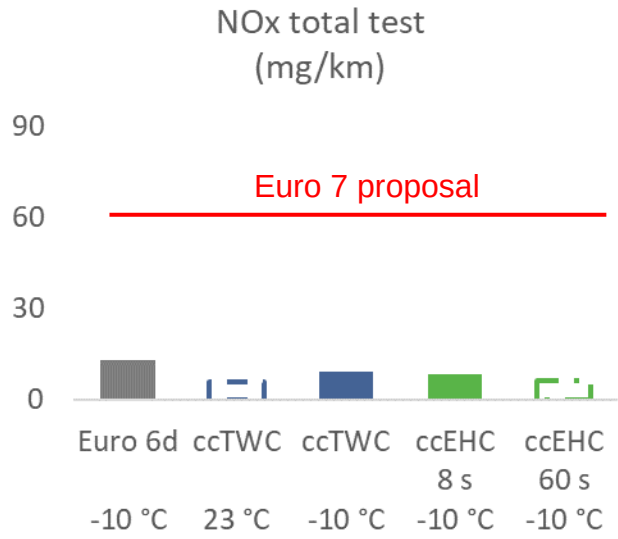


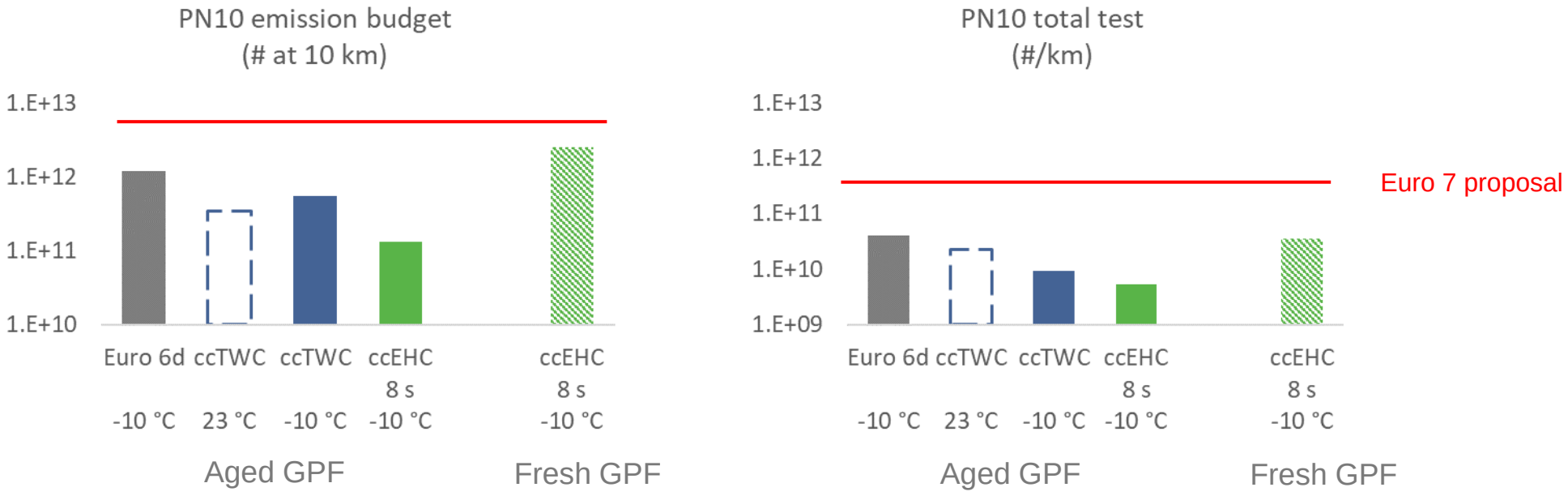


Note: RDE aggressive test results, 1.6 divider applied to data at -10 °C

gasoline

Particulate emissions are mainly from initial cold-start

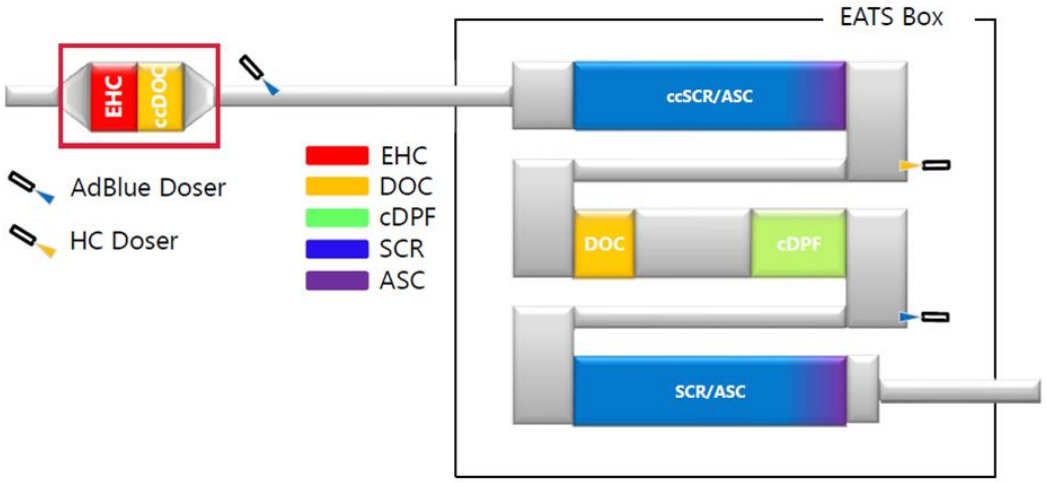
- Most data is measured with aged GPF
  - Ash and soot accumulation supports filtration efficiency
  - Test with ccEHC at -10 °C repeated with fresh GPF
- All PN10 data remains below the original Euro 7 proposal limit



Note: RDE aggressive test results, 1.6 divider applied to data at -10 °C; the fresh GPF test is not a valid test according to the Euro 7 proposal

HD diesel demonstrator concept

- Base vehicle description
  - Actros 1845 LS 4x2
  - Engine OM 471
    - Euro VI C certified
    - 12.8 litres, 6 cylinder in-line
    - High Pressure EGR + DOC + DPF + SCR
- AECC emissions control system
  - Phase 1: ccDOC, ccSCR/ASC+ ufDOC+cDPF+ SCR/ASC, twin AdBlue dosing and HC doser
  - Phase 2: additional EHC as part of the ccDOC
  - Components are hydrothermally aged targeting 500k km

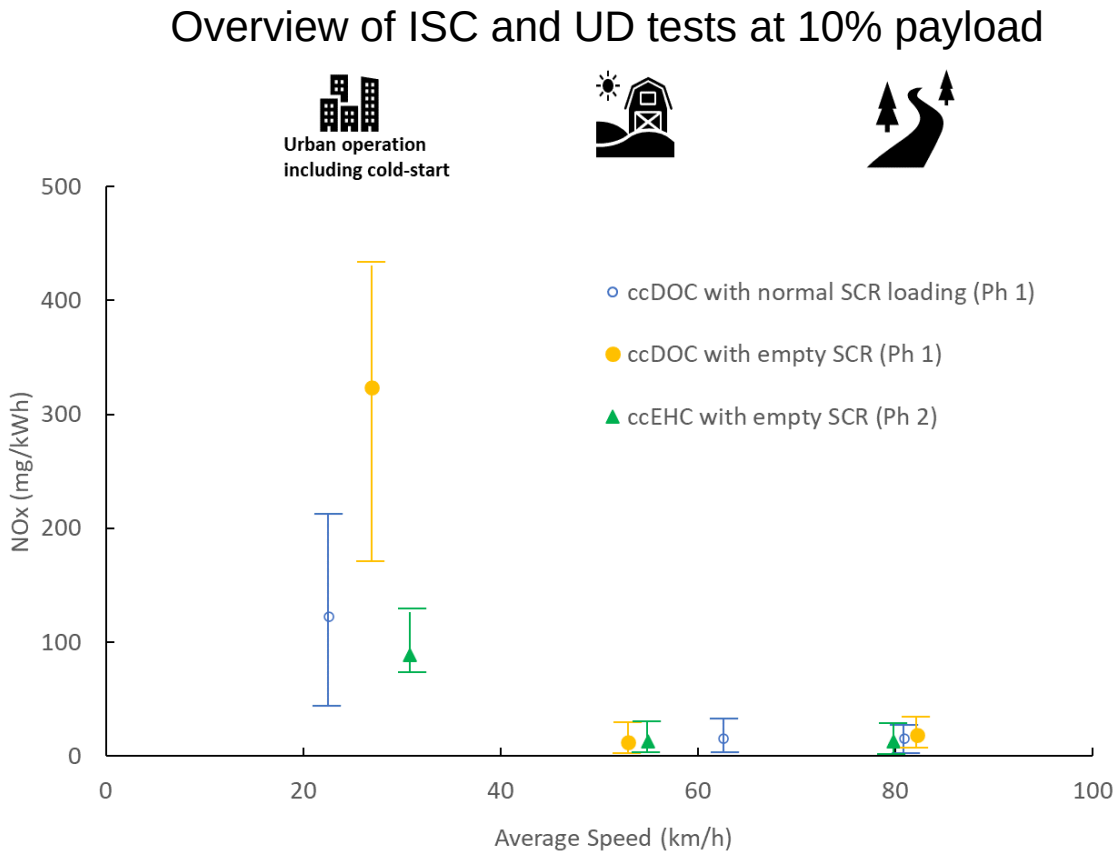


P. Mendoza Villafuerte, et al.; "Demonstration of Extremely Low NOx Emissions with Partly Close-Coupled Emission Control on a Heavy-duty Truck Application", 42nd Vienna Motor Symposium 2021
P. Mendoza Villafuerte, et al.; "Future-proof heavy-duty truck achieving ultra-low pollutant emissions", Transportation Engineering, Volume 9, September 2022, 100125, 2022

diesel

Reduction of initial cold-start emissions with EHC

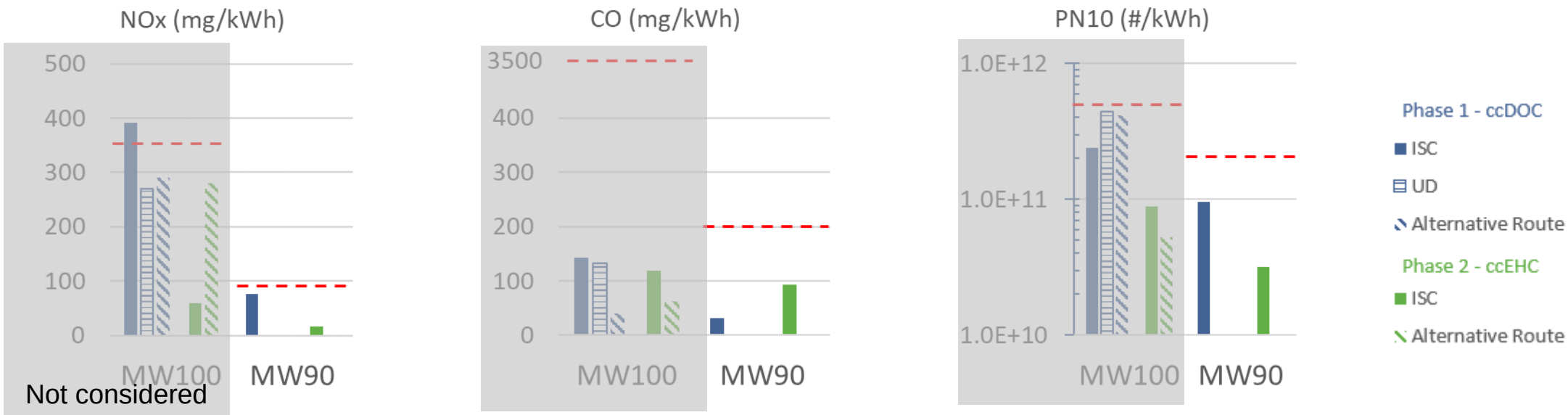
- Significant improvement of urban emissions including cold-start compared to Euro VI-D (~2000 mg/kWh) in phase 1 of the project
- Near-zero emissions under warm operation
- Impact of ammonia storage depletion procedure shows robust control is needed for AdBlue® dosing, ammonia storage and thermal management
- NOx emissions further reduced by 60-77% with EHC in phase 2 of the project
  - Faster heat-up during initial cold-start
  - Maintaining temperature during low-load or start-stop driving



diesel

All phase 2 data is below the original Euro 7 proposal limits

- All data shown is with empty SCR and partly regenerated filter at the start of the test
- All tests from phase 2 with ccEHC remain below the limits for NOx
- All tests from both phases remain below the limits for CO, NH_3, N_2O and PN10



Not considered in final Euro 7 (Euro VI-E procedures)

Note 1: only ISC reaches the 3xWHTC work threshold
100th percentile is calculated for tests where at least 1 window is available (as if it would be part of a longer test)
Note 2: Hot WHTC reference value used is 29.7 kWh, window specific emissions calculated based on actual cumulated work