Euro 7 regulation, projects data and technologies

Virtual Presentation to ECMA • 24 April 2024

AECC represents European Emissions Control Companies

- Exhaust emissions control technologies for original equipment, retrofit and aftermarket for all new cars, commercial vehicles, motorcycles, and non-road mobile machinery
  - AECC is listed in EU Transparency Register (# 78711786419-61) and has consultative status with the UN Economic and Social Council (ECOSOC)
- 2024 updated AECC Bylaws with scope covering sustainable components and systems for mobile and stationary sources

AECC team

Dirk Bosteels, MSc-MBA
Executive Director

Dr Joachim Demuynck
Sr. Technical and Scientific Manager

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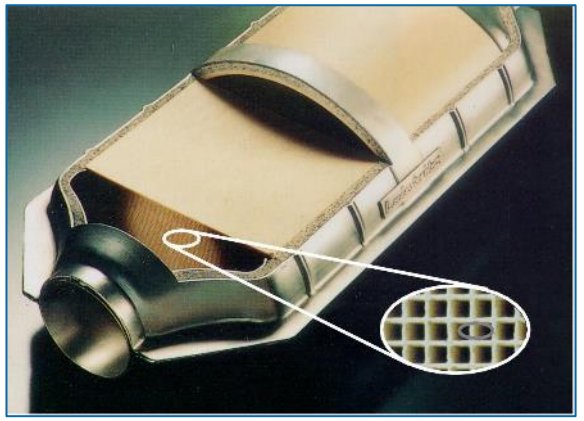
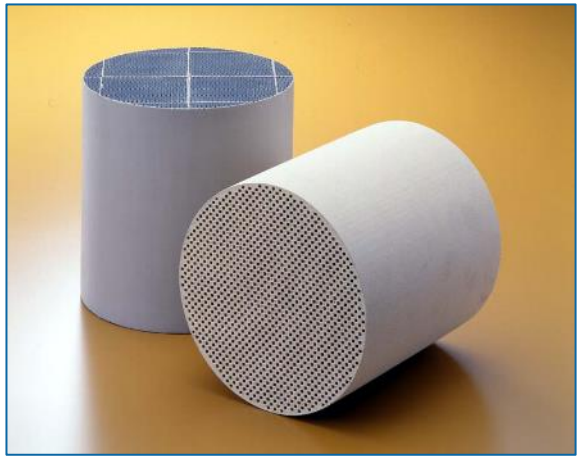
Consultant

AECC objectives

- Scientific association, working in partnership
- to foster state-of-the-art technologies that control harmful emissions from mobile sources and promote effective emissions control technologies
- to collect and disseminate information concerning regulations related to vehicle exhaust emissions
- to engage with stakeholders on emissions regulations and control at national and international level
- to sponsor scientific programmes and disseminate the results at conferences, in scientific publications, etc.

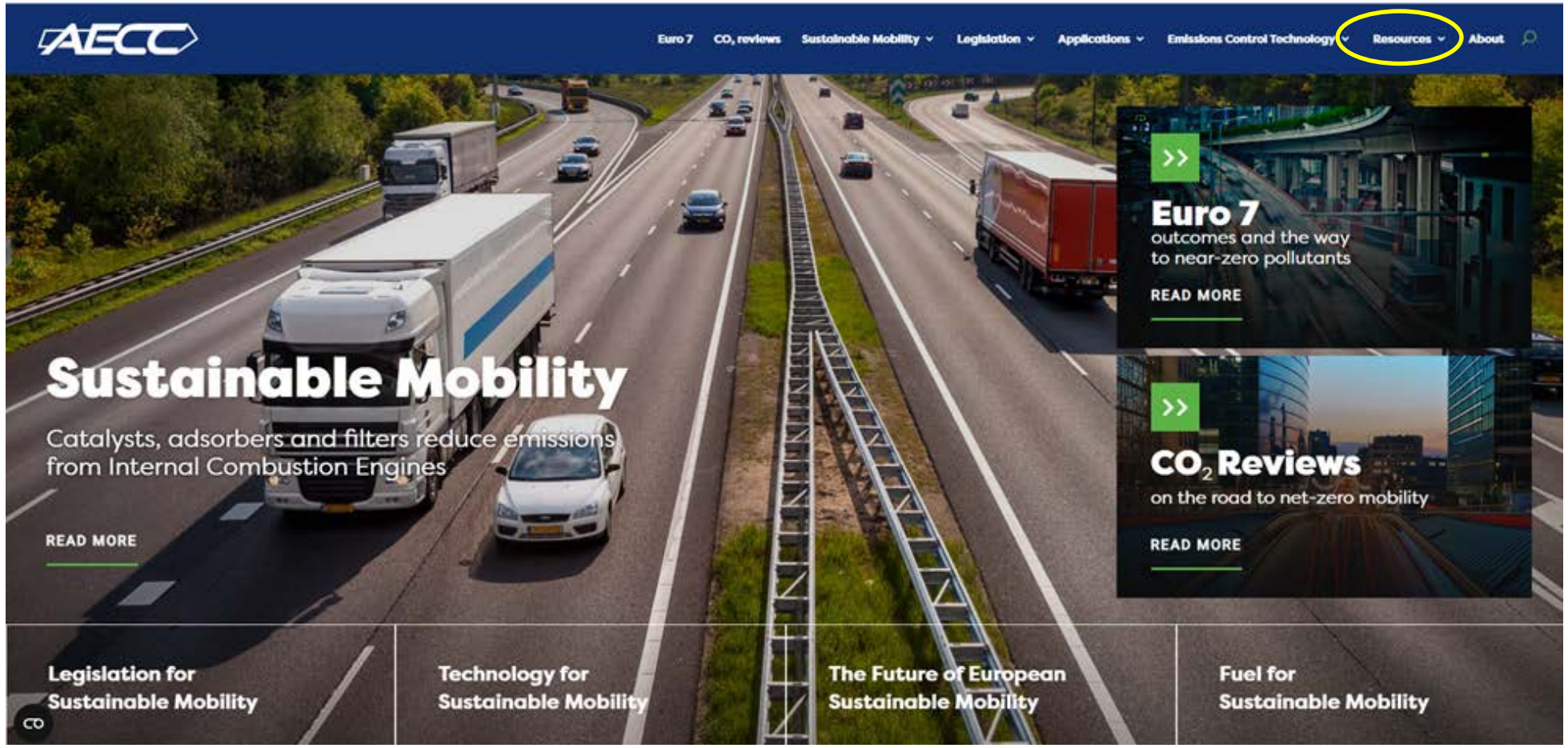




Key issues for AECC

- Future European regulations on vehicle and engine emissions
  - On-road vehicles: passenger cars and light-duty vans, heavy-duty trucks and buses, motorcycles & mopeds
  - Non-Road Mobile Machinery (NRMM) engines: construction and agricultural machines, rail and inland waterway vessels, lawnmowers, small hand-held equipment
  - Heavy-Duty Vehicle & NRMM Retrofit Emissions Controls (REC)
  - Stationary Sources Emissions (EID)
- EU Air Quality & European Green Deal
- Fuels & oils quality, incl. sustainable renewable fuels
- World harmonisation of emissions regulations and testing protocols (UNECE Agreements)
- International activities (UNEP/PCFV…)
- Support regional affiliates & Working in partnership

Our public web site www.aecc.eu



Agenda

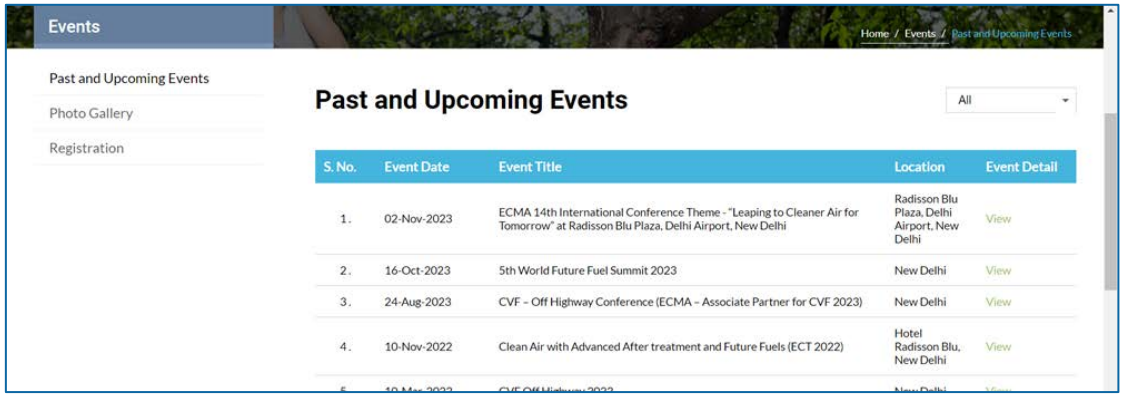
- Euro 7 update for light-duty and heavy-duty vehicles

- AECC light-duty (gasoline and diesel) and heavy-duty diesel demonstration programmes
  - Criteria pollutants with state-of-the-art emission control systems
  - GHG emissions with sustainable renewable fuels
  - Conclusions

- Outlook
  - LD and HD CO_2 review and CO_2 neutral fuels
  - H_2 ICE (Internal Combustion Engine)
  - NRMM (Non-Road Mobile Machinery)
  - Life Cycle Assessment

Previous AECC presentations

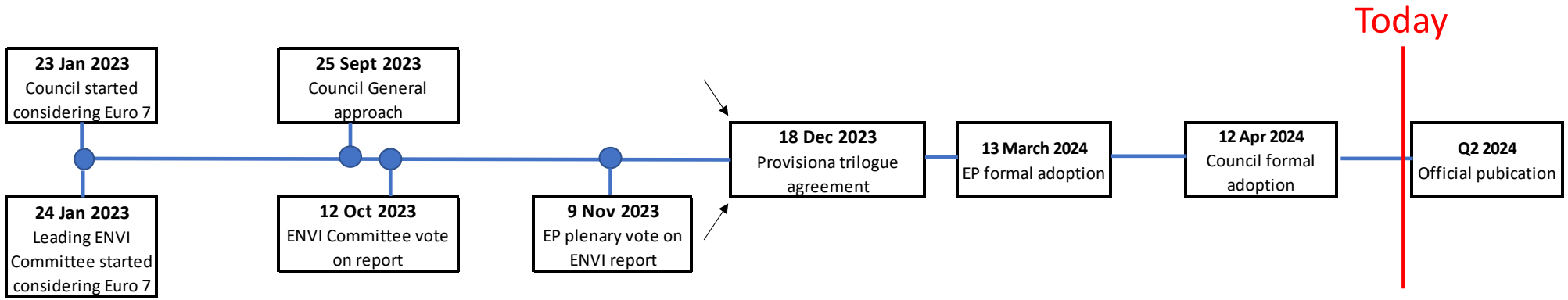
- AECC President Mr R Brück (Emitec Technologies) at ECT 2022 Conference in Nov. 2022 and
- AECC ExCo member Mr W Müller (Umicore) at ECMA International Conference in Nov. 2023



- AECC provided update on European legislative developments in January 2024

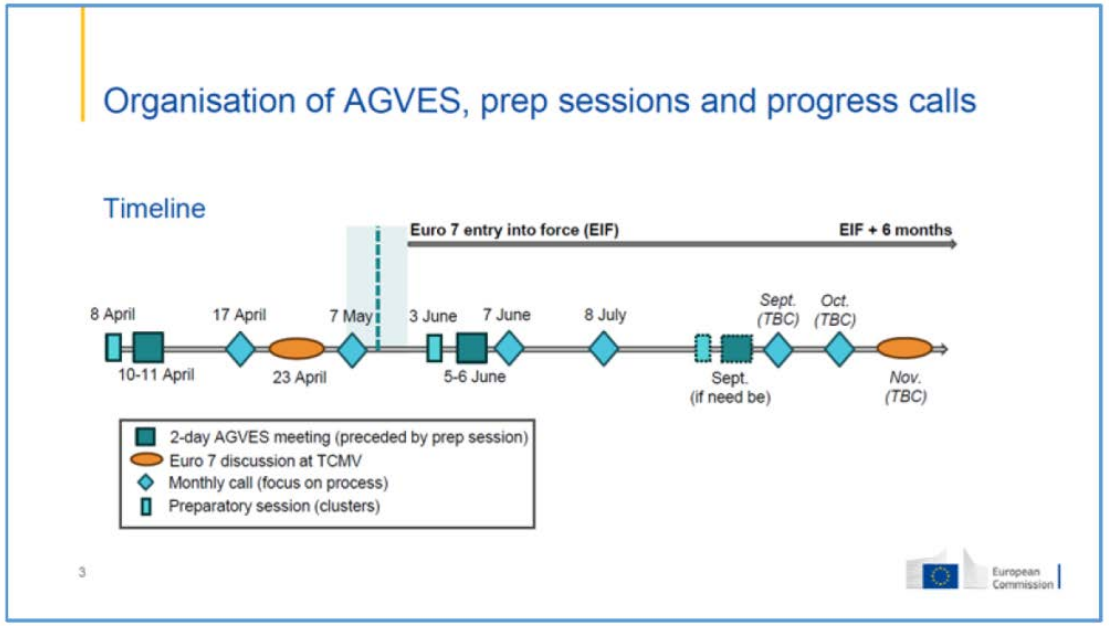
Overview of ongoing Euro 7 process

- Euro 7 proposal is in ordinary legislative procedure by EU Council (27 EU Member States) and European Parliament
  - EC Euro 7 proposal issued 10 November 2022
  - Provisional trilogue agreement reached on 18 December 2023 (Council and EP press releases)
  - Final draft text is available on the Council website here
  - Formal adoption before EU elections (June 2024); awaiting publication



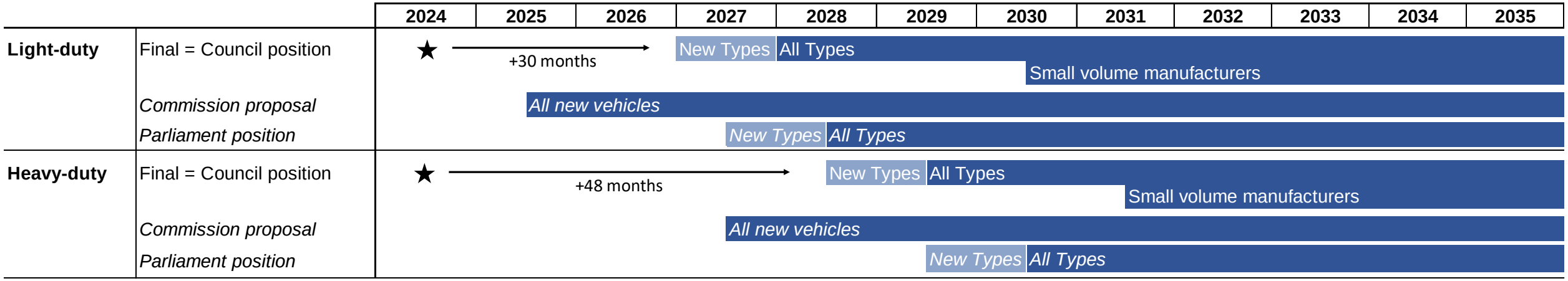
Overview of ongoing Euro 7 process

- 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
  - Little development needed for exhaust as Euro 6/VI test procedures are nearly kept
  - Content of several topics is developed at UNECE (e.g. battery durability, brakes, tyres, …)



Euro 7 implementation timeline

- Reference to entry into force of main act
- Entry into force is 20 days following publication in Official Journal



* Assuming entry into force in July 2024

** Implementation timing for new systems, components or separate technical units is same as New Types

Euro 7 for light-duty vehicles

- Limit values kept from Euro 6e
  - Not fuel-neutral !
  - Higher limits maintained for LCVs (N1 class II and III)
- Changes for Particulate Number standard
  - PN10 measurement procedure instead of PN23
  - PN10 limits apply to all vehicles, footnote for direct injection gasoline is deleted
- Test procedures kept from Euro 6e
  - Reference to UN Regulation no. 168, includes the PEMS error margins for NOx and PN in Annex 11
- 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

Table A11/2

Pollutant	*Mass of oxides of nitrogen (NO_x)*	*Number of particles (PN)*	*Mass of carbon monoxide (CO)*	*Mass of total hydrocarbons (THC)*	*Combined mass of total hydrocarbons and oxides of nitrogen (THC + NO_x)*
$Margin_{pollutant}$	0.10	0.34	*Not yet specified*	*Not yet specified*	*Not yet specified*

Reflection on Euro 7 discussion for light-duty vehicles

- Influenced by CO_2 emissions standards
  - Setting -100% tailpipe target by 2035
  - But even then, ICE will be on the road until 2050
  - All powertrains to fulfill future air quality requirements
- Concern was too much focus on worst case conditions
  - Due to wording ‘any’ for test conditions in Euro 7 proposal
- AECC 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.

Euro 7 for heavy-duty vehicles

- Significant reduction of limit values
  - ~50% reduction for already regulated pollutants
- New limits introduced for NH_3 and N_2O
- PN10 measurement procedure instead of PN23
- Test procedures nearly kept from Euro VI-E
  - MAW 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

	WHSC/WHTC (/kWh)	RDE (/kWh)
NOx (mg)	200	260
PM (mg)	8	-
PN (10 nm, #)	$6x10^{11}$	$9x10^{11}$
CO (mg)	1500	1950
NMOG (mg)	80	105
NH_3 (mg)	60	85
CH_4 (mg)	500	650
N_2O (mg)	200	260

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

Options and obligations for manufacturers

- Options (Article 5)
  - '7G' geofencing – driver warning system to stop vehicle within 5 km if not charged in geofencing area
  - '7ext' – N2 vehicles between 3.5 and 5 tonnes originating from N1 to get N1 Type Approval
- Obligations concerning emission type-approval (Article 7)
  - Demonstrate compliance by performing the tests specified in tables 1, 3, 4a, 5, 7 and 9 of Annex V
  - Conformity of Production: components and separate technical units shall be selected at the premises of the manufacturer by the approval authority or the manufacturer
  - In-service conformity shall be checked for the durability periods (table 1 of Annex IV)
  - Manufacturer to provide signed declaration for compliance
    - As regards the RDE, CO_2 ambient temperature correction, OBD, OBM, emission and battery durability, continuous or periodic regeneration, anti-tampering and crankcase requirements as specified in Annex V
    - On the use of geofencing option when the manufacturer selects it
  - The national authorities may test the vehicle type to verify its conformity during conformity of production, in-service conformity or market surveillance as specified in Annex V

On-Board Monitoring (OBM)

- Definition (Article 3 (38))
  - Monitoring exhaust emissions
  - Detecting exhaust emission exceedances
  - Capable of communicating information together with the State of Health information off-board
- Capable of (Article 6 (6))
  - Monitoring and registering all exhaust emissions of NOx, NH_3 & PM if there is a limit
    → not NH_3 for LDVs
  - Detecting exceedances of 2.5 times the limit or higher
  - Communicating the data
    - Via the OBD port for roadworthiness tests and technical roadside inspections
    - Anonymously over the air for monitoring compliance of vehicle types
  - Triggering the driver warning system, to induce timely repairs, without preventing completing ongoing trip

Environment Vehicle Passport (EVP)

- Displaying following information of the vehicle at the moment of registration (Article 3 (71))
  - Level of pollutant emission limits
  - CO_2 emissions
  - Fuel consumption
  - Electric energy consumption
  - Electric range
  - Engine or electric motor power
  - Battery durability and other related values
- Extracting relevant data from sources such as certificate of conformity or type-approval documentation, available for display in vehicle, via QR code and transmitted from on-board to off-board (Article 7(4))

Role of Commission and Third parties (Article 13)

- In-service conformity and market surveillance checks to verify compliance of vehicles, components and separate technical units
  - Set out in Tables 2, 4, 4b, 6, 8, and 10 of Annex V
  - Shall be performed by the Commission in accordance with Article 9 of Regulation (EU) 2018/858
  - May be performed by third parties in accordance with Article 13(10) of that Regulation
- Manufacturers shall make available the data required to perform such checks in accordance with Articles 9(5) and 13(10) of Regulation (EU) 2018/858

Review provisions

- Commission can adopt delegated acts to take into account technical progress (Article 15-16)
  - Test conditions for M2, M3, N2, N3 vehicles, based on data collected when testing Euro 7 vehicles
  - Setting emission limit for formaldehyde from M2, M3, N2 and N3 vehicles according to Article 18-2-e
  - Introducing additional options and designations based on innovative technologies for manufacturers
  - Special rules for small volume manufacturers
  - And other items including non-exhaust
- In case a proposal is made for CO_2-neutral fuels, Euro 7 needs to be amended to include the possibility to type approve such vehicles (Recital 18)
- Reporting and review (Article 18)
  - 31 December 2025 – durability performance of heavy-duty vehicles
  - 31 December 2027 – appropriateness to set formaldehyde limit from M2, M3, N2 and N3 vehicles
  - 31 December 2027 – list of non-exhaust topics
  - 1 September 2031 – general evaluation of exhaust and non-exhaust emission reductions achieved

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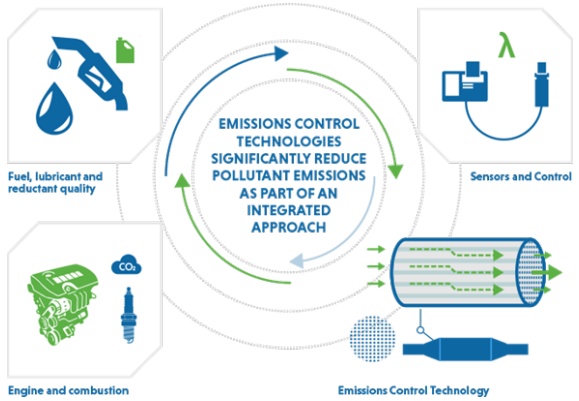
AECC demo data on criteria pollutants and GHG emissions

- Demonstrators show ultra-low pollutant emissions with emission control technologies in an integrated approach
- Tests show compatibility with drop-in sustainable renewable fuels, with substantial reduction in WtW CO_2 emissions
- Acknowledgement of external project partners



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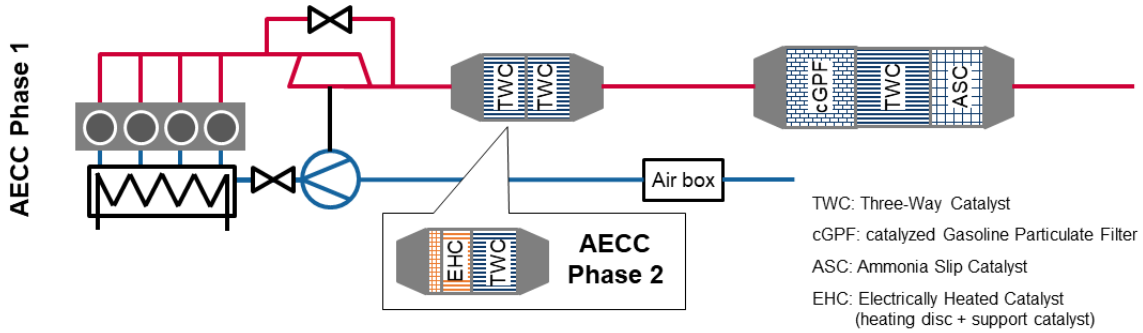
IPA FEV BASF We create chemistry CORNING cefic sector group NESTE aramco

AGU Sector Group

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

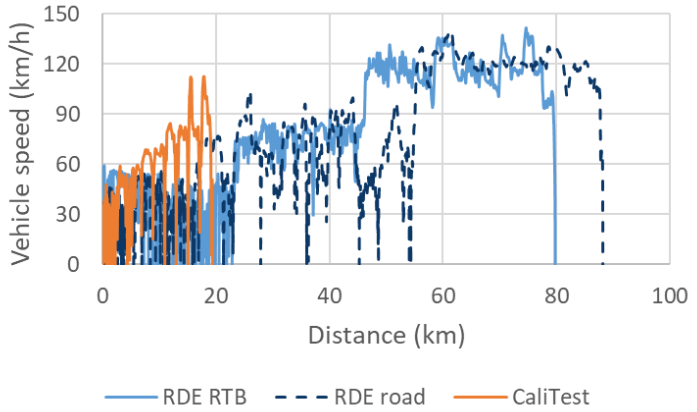
- AECC emission control system
  - Phase 1: cc TWC, uf cGPF+TWC+ASC
  - Phase 2: cc EHC|TWC, uf cGPF+TWC+ASC
  - Bench aged components targeting 160k km

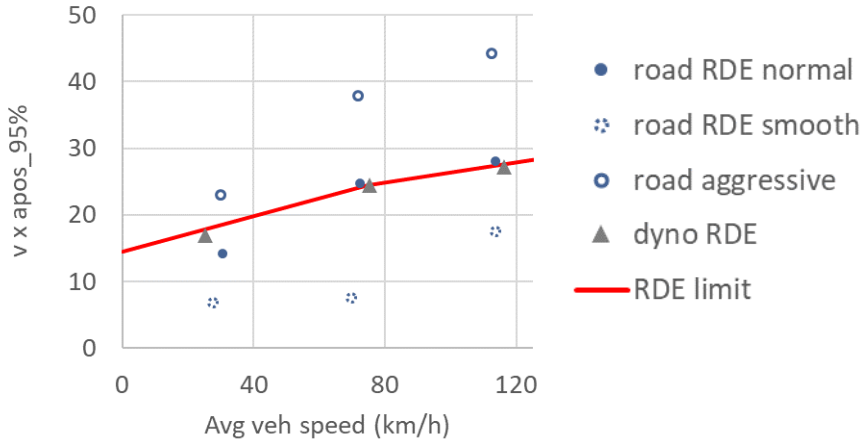


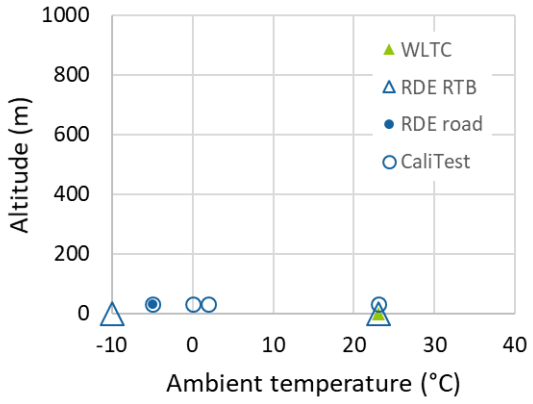
J. Demuynck, et al.; "Ultra-low Emissions of a 48V Mild-Hybrid Gasoline Vehicle with Advanced Emission Control Technologies", 15th International Conference on Engines and Vehicles, 2021
J. Demuynck, et al.; "Zero-Impact Emissions from a Gasoline Car with Advanced Emission Controls and E-Fuels" 43rd International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

LD gasoline demonstrator testing

- Tests conducted to characterise the emission performance
  - Road
    - RDE ~90 km
    - Calibration test (CaliTest) ~20 km
  - Chassis dyno
    - WLTC
    - RDE aggressive
- Exploring beyond Euro 6 RDE boundary conditions for
  - Ambient temperature
  - Driving style



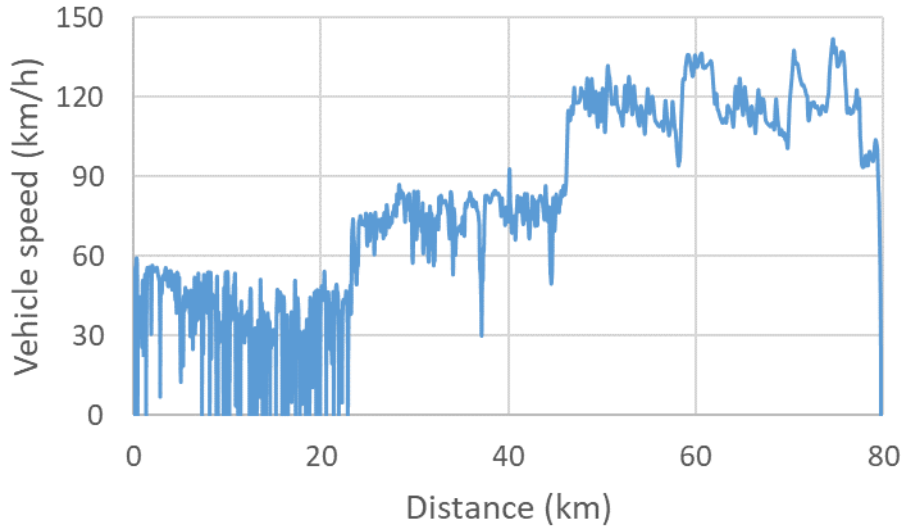


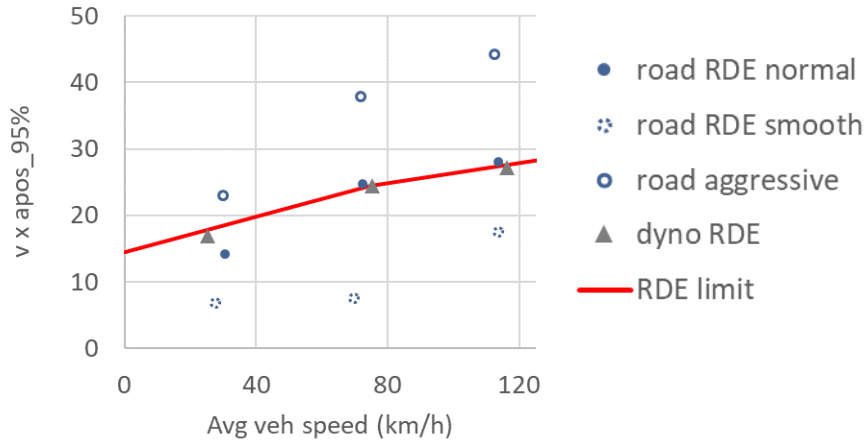


gasoline

Phase 2 with ccEHC focused on RDE aggressive test

- RDE aggressive test is conducted on the chassis dyno
  - At Euro 6 RDE boundary for v x a_{pos}
  - 3s of idling between key-on and drive-off
  - First acceleration immediately to 60 km/h
  - Maximum average wheel power during first 2 kilometers after the initial cold-start is ~15%

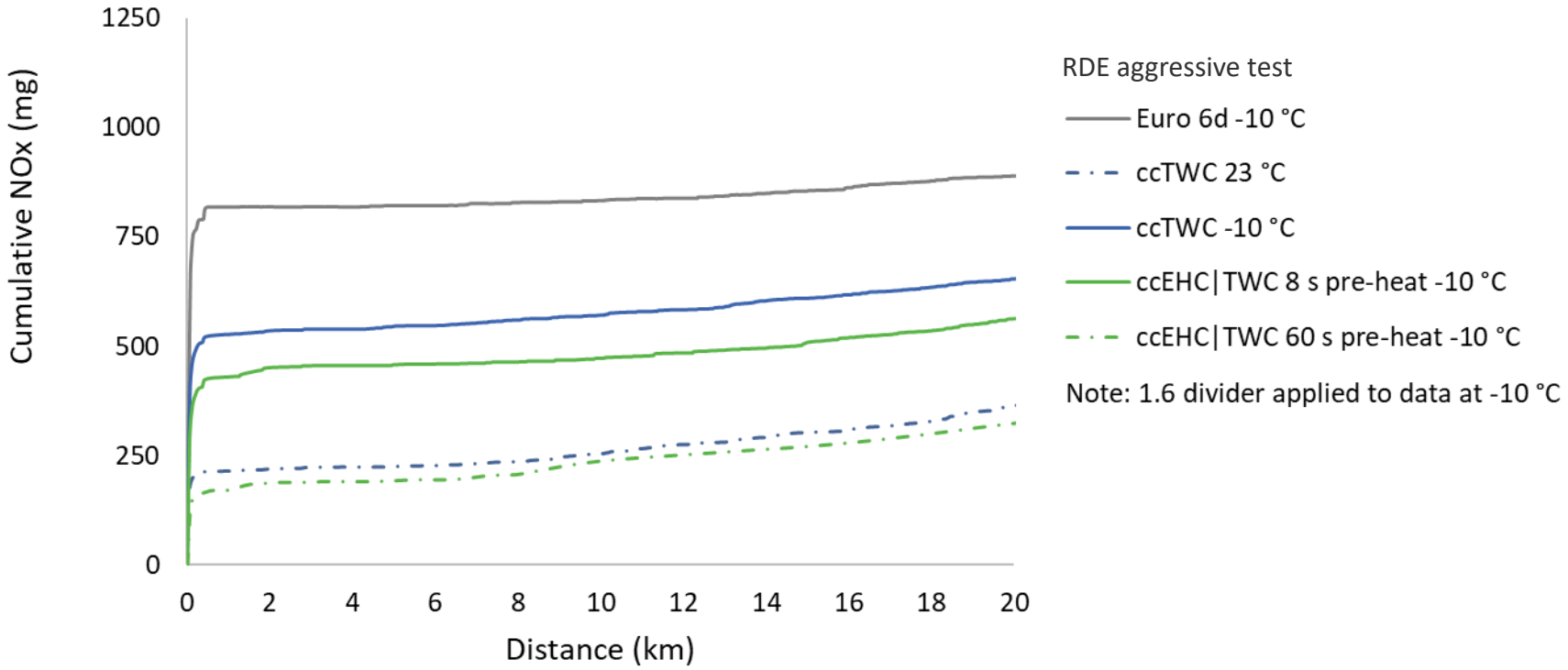




gasoline

Gaseous emissions are mainly from initial cold-start

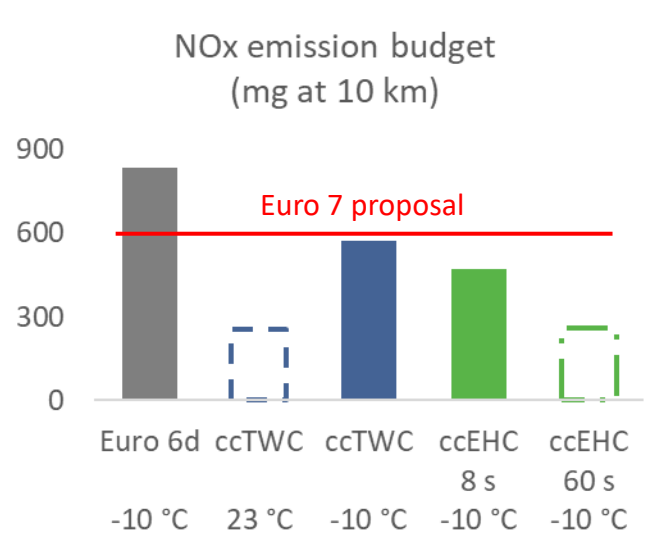
- Cold-start NOx peak influenced by test condition and emission control system
- Near-zero emissions under warm operation on all tests

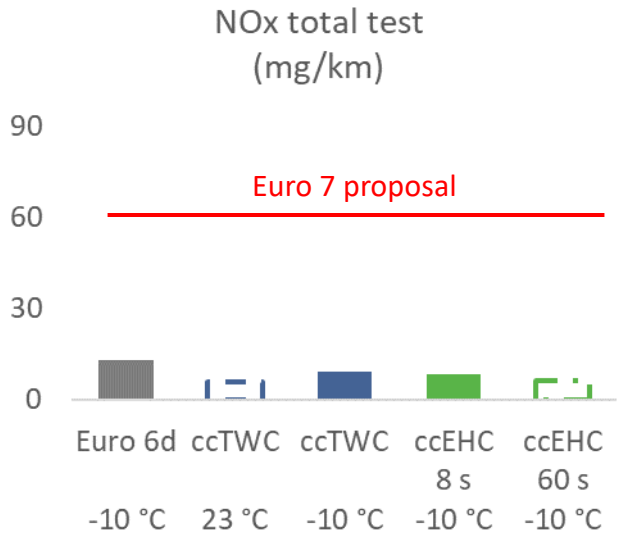


gasoline

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



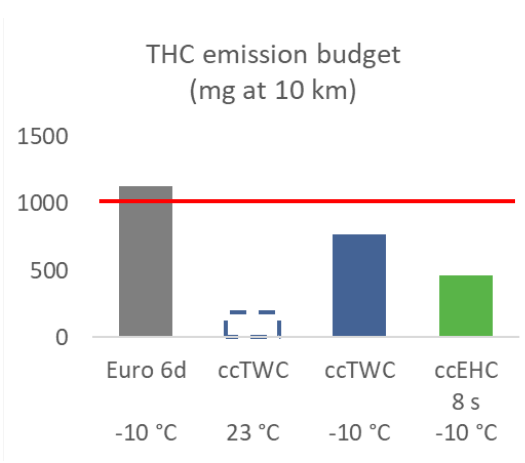


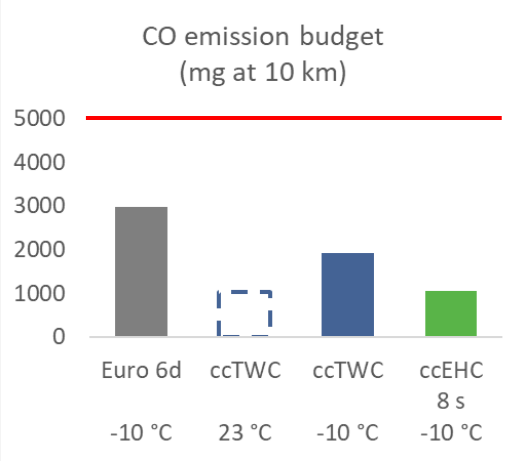
Note: RDE aggressive test results, 1.6 divider applied to data at -10 °C

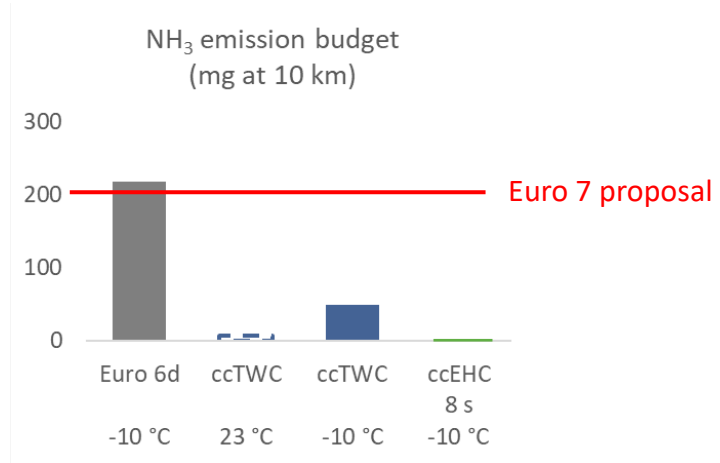
gasoline

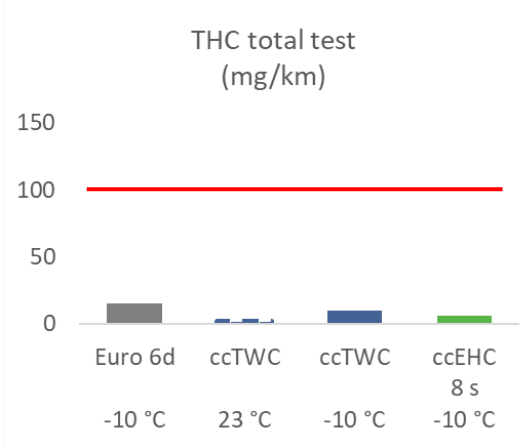
Gaseous emissions are mainly from initial cold-start

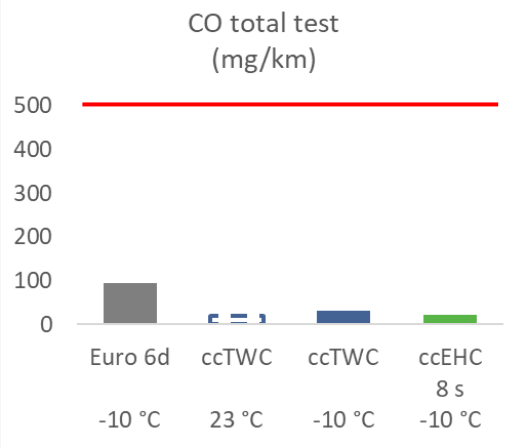
- Tests are significantly below the original Euro 7 proposal limits for THC, CO and NH_3
  - Emission budget
  - Total test result

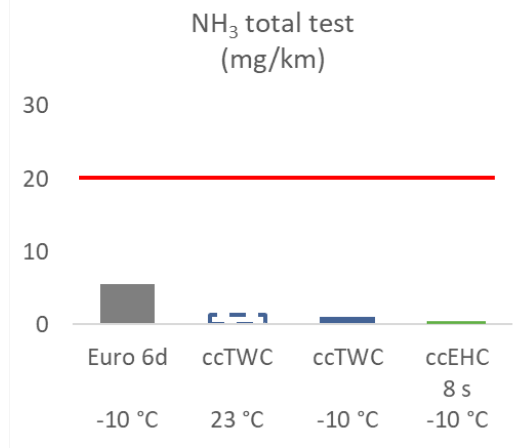










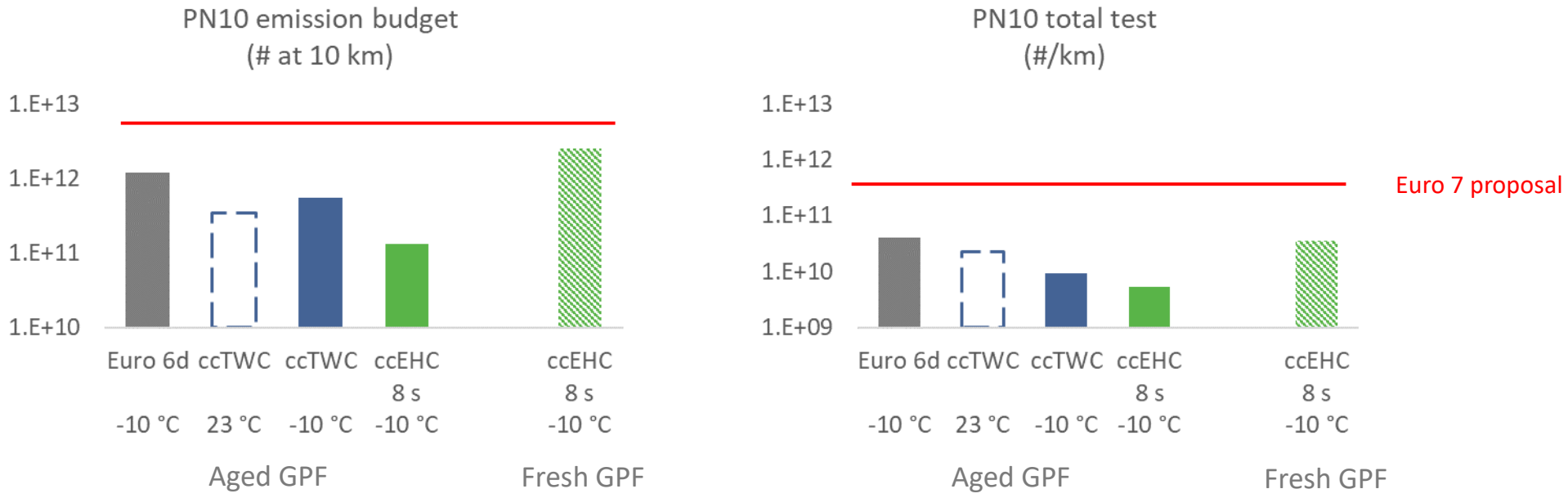


Note: RDE aggressive test results, 1.6 divider applied to data at -10 °C

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

Ignition

Engine load: 23 %

Vehicle speed: 26 km/h

500

0

NOx

1550 ppm

30 s or 150 m to near-zero emissions

Video available at https://youtu.be/qoG0GxF8X-k

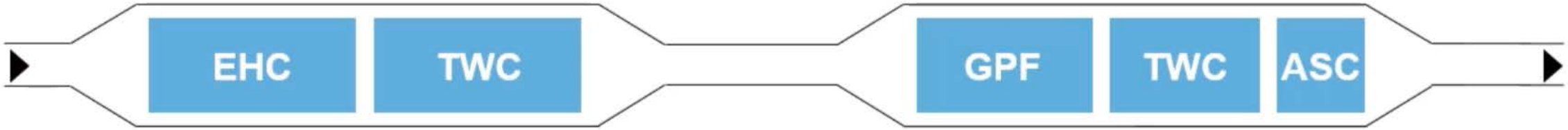
More videos available on YouTube (AECC eu): https://www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ

500

0

NOx

0 ppm



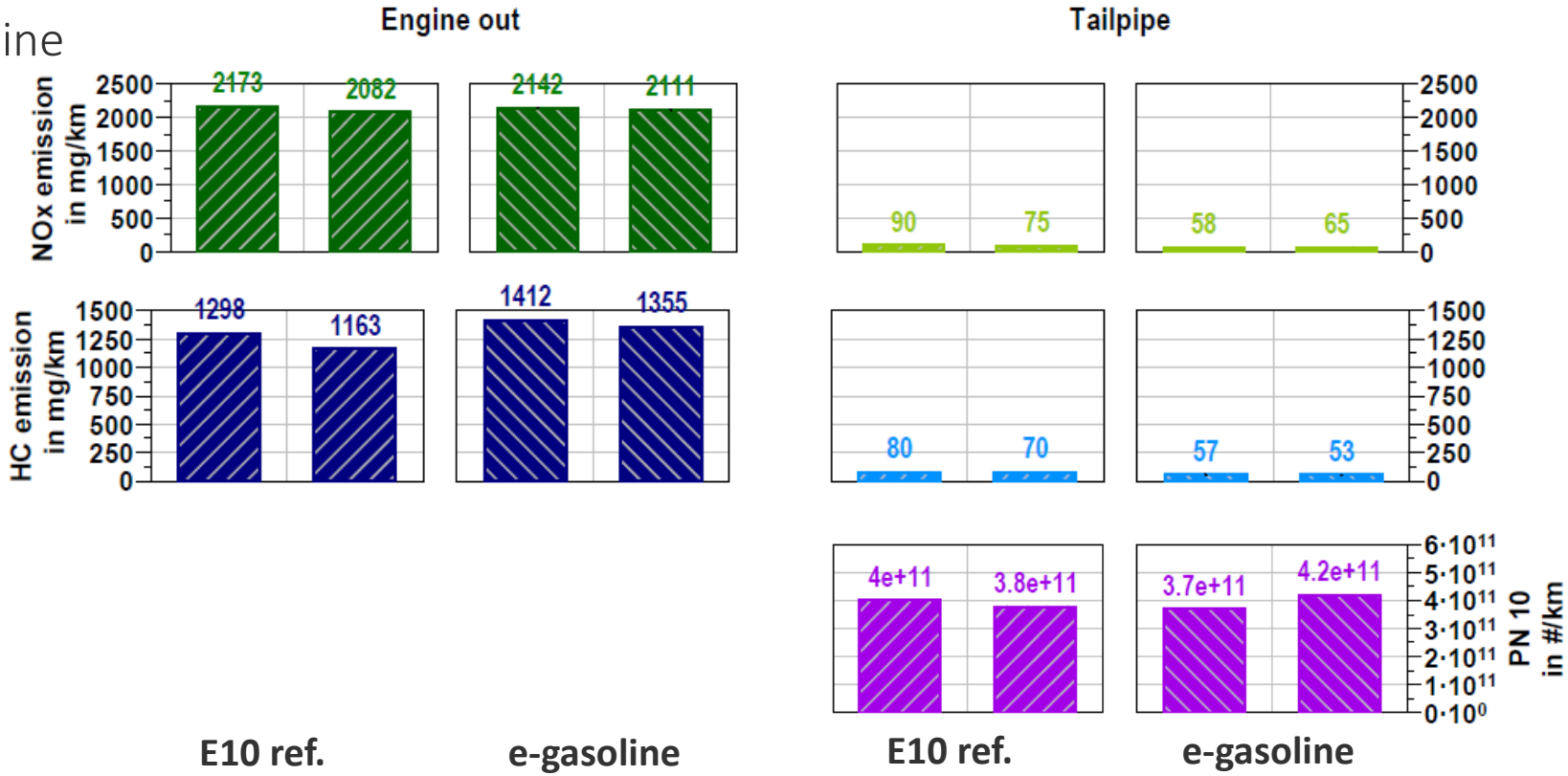
Engine catalyst heating

EHC heating

Closed-loop lambda control

LD gasoline demonstrator with sustainable renewable fuels

- Ultra-low pollutant emissions confirmed
  - Emissions on E10 and e-gasoline plotted after 10 km including the initial cold-start
  - Blue Gasoline results available in publication



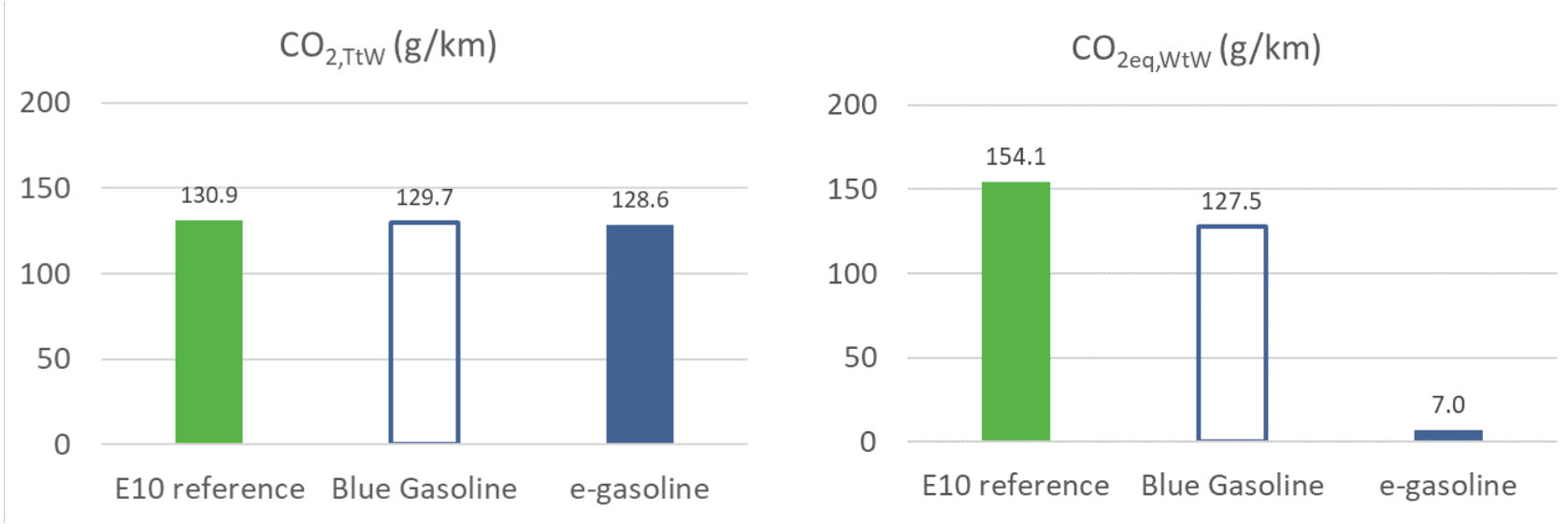
Note: RDE aggressive test results at -10 °C after 10 km (1.6 divider not applied), 2 test repeats on E10 reference fuel and e-gasoline

J. Demuynck, et al.; "Zero-Impact Emissions from a Gasoline Car with Advanced Emission Controls and E-Fuels" 43rd International Vienna Motor Symposium, 2022
J. Demuynck, et al.; "Advanced Emission Controls and E-fuels on a Gasoline Car for Zero-Impact Emissions", SAE paper 2022-01-1014, 2022

gasoline

LD gasoline demonstrator with sustainable renewable fuels

- Blue Gasoline already offers today significant reduction of -17% WtW CO_2 emissions
- E-gasoline has the potential to nearly eliminate WtW CO_2 emissions



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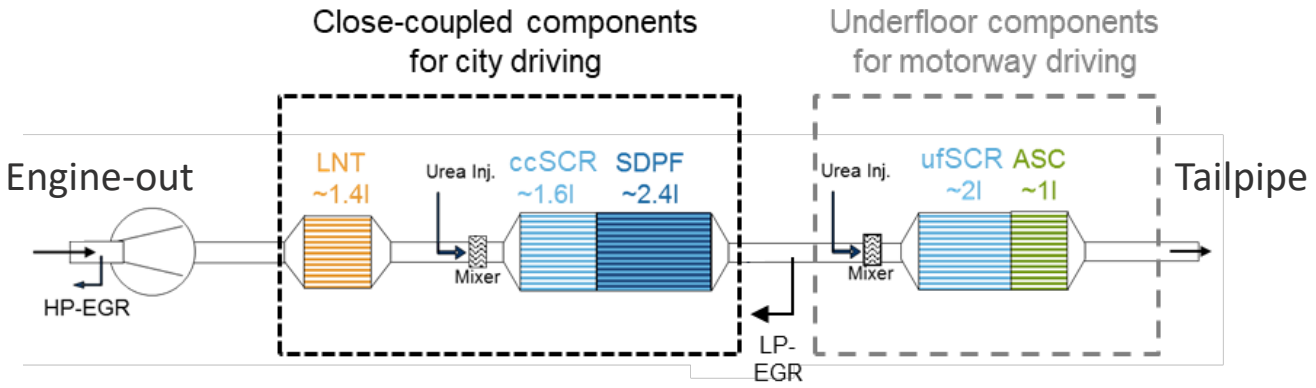
J. Demuynck, et al.; "Advanced Emission Controls and E-fuels on a Gasoline Car for Zero-Impact Emissions", SAE paper 2022-01-1014, 2022

LD diesel demonstrator concept

- Base vehicle
  - C-segment vehicle
  - 1.5l engine with 4 cylinders
  - 48V mild-hybrid system
  - Euro 6b type-approval

- Emission control system
  - LNT + SCR|SDPF + SCR|ASC
  - Hydrothermally aged components targeting 160k km



J. Demuynck, et al.; "Integrated Diesel System Achieving Ultra-Low Urban and Motorway NOx Emissions on the Road", 40th Vienna Motor Symposium, 2019
https://www.aecc.eu/wp-content/uploads/2020/07/190516-AECC-IAV-IPA-Integrated-Diesel-System-achieving-Ultra-Low-NOx-on-the-road-Vienna-Symposium.pdf
Joint MTZ publication with Bosch, Vitesco, FEV and IAV https://www.aecc.eu/wp-content/uploads/2020/09/200901-modern-diesel-MTZ.pdf
Videos of instantaneous conversion performance available at www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ

Engine load: 61 % Vehicle speed: 28 km/h

500
0
NOx
673 ppm

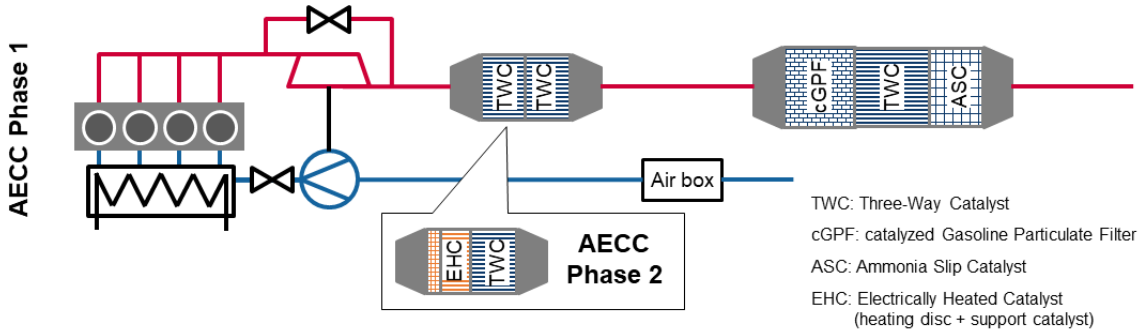
Near-zero emissions in city driving

More videos available on YouTube (AECC eu):
https://www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ

500
0
NOx
0 ppm

Conclusions light-duty vehicles

- Available emission control technologies used
  - Active thermal management
  - TWC, close-coupled and underfloor
  - Catalysed GPF
  - ASC



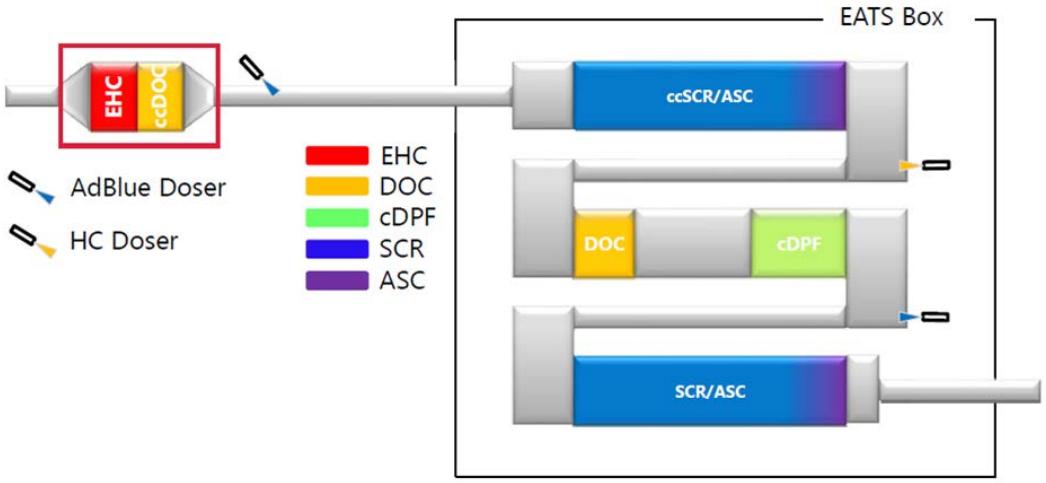
- Ultra-low gaseous and particulate emissions are technically feasible under real-world driving conditions
  - Significant reduction of initial cold-start peak
  - Near-zero emissions after initial cold-start peak

- In combination with near-zero Well-to-Wheel CO_2 emissions using sustainable renewable fuels

diesel

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

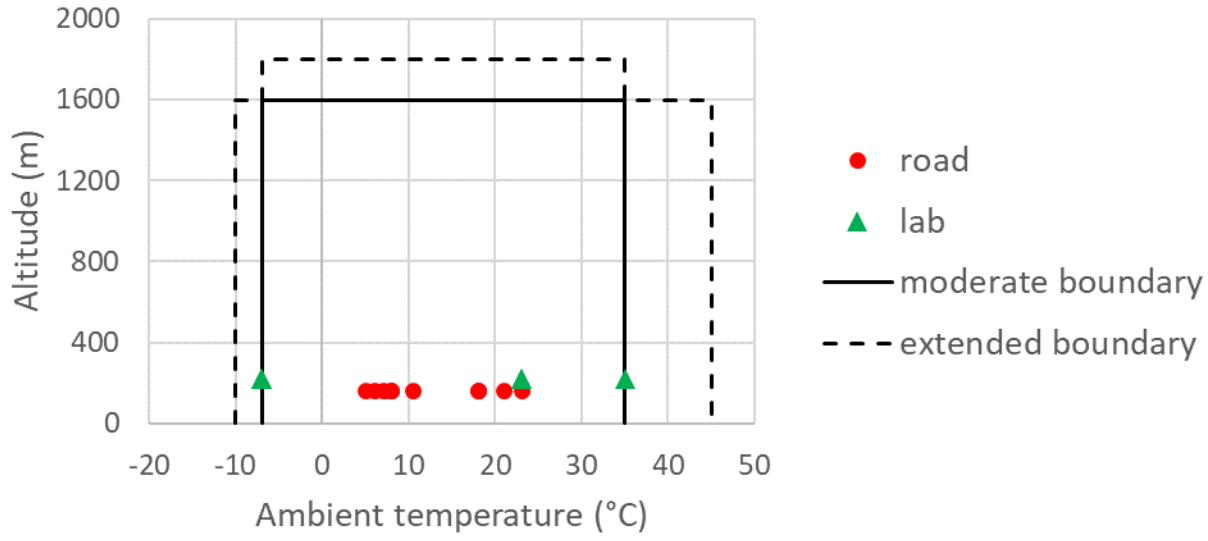


P. Mendoza Villafuerte, et al.; "Demonstration of Extremely Low NOx Emissions with Partly Close-Coupled Emission Control on a Heavy-duty Truck Application", 42nd Vienna Motor Symposium 2021
P. Mendoza Villafuerte, et al.; "Future-proof heavy-duty truck achieving ultra-low pollutant emissions", Transportation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

diesel

Focus was on low load and challenging cold-start

- Up to boundary of normal area covered for
  - Ambient temperature
  - Payload: 10% (focus) – 50% – 100%
- Different tests conducted to vary trip composition
  - Additional challenge covered by starting with empty SCR and partially regenerated filter



Test type	Test	Project phase
Road	In-Service Conformity (ISC)	ccDOC and ccEHC
	Urban Delivery (UD)	
	Alternative Route	
Lab	Real-World Test	ccDOC
	Urban Delivery	
	JRC RDE	
	TU Graz low-load	

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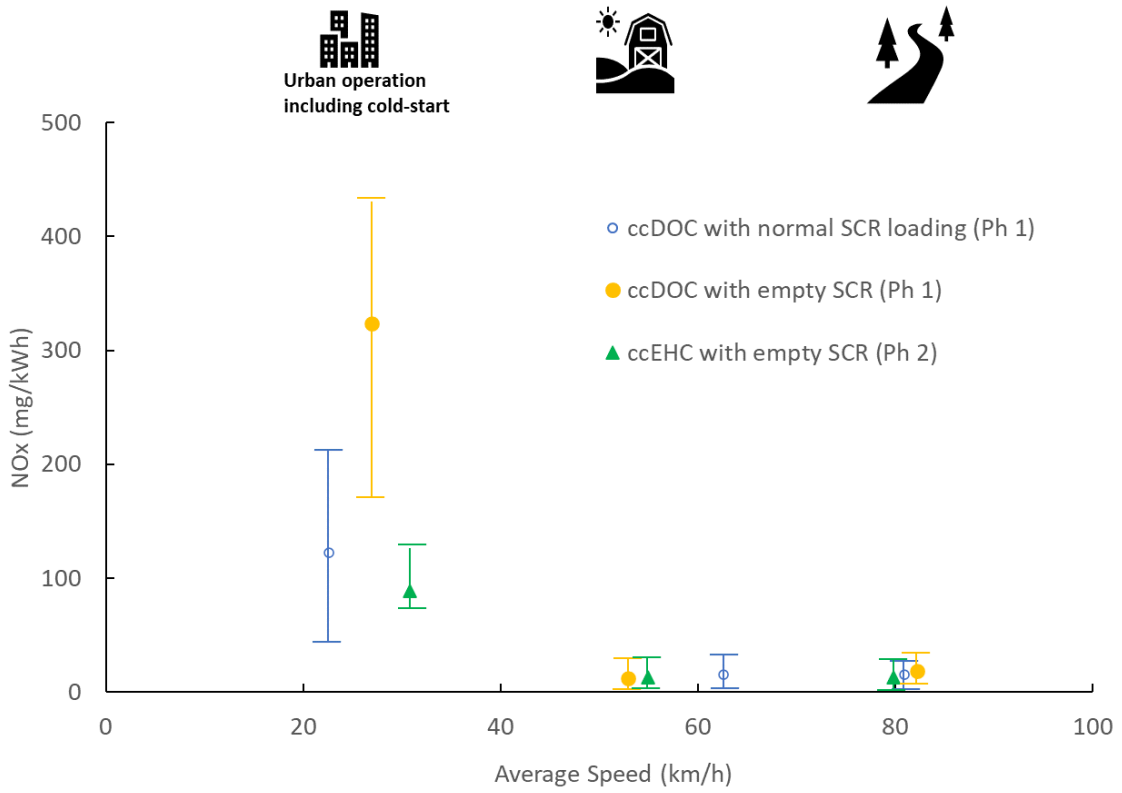
Reduction of initial cold-start emissions with EHC

- Significant improvement of urban emissions including cold-start compared to Euro VI-D 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

Overview of ISC and UD tests at 10% payload



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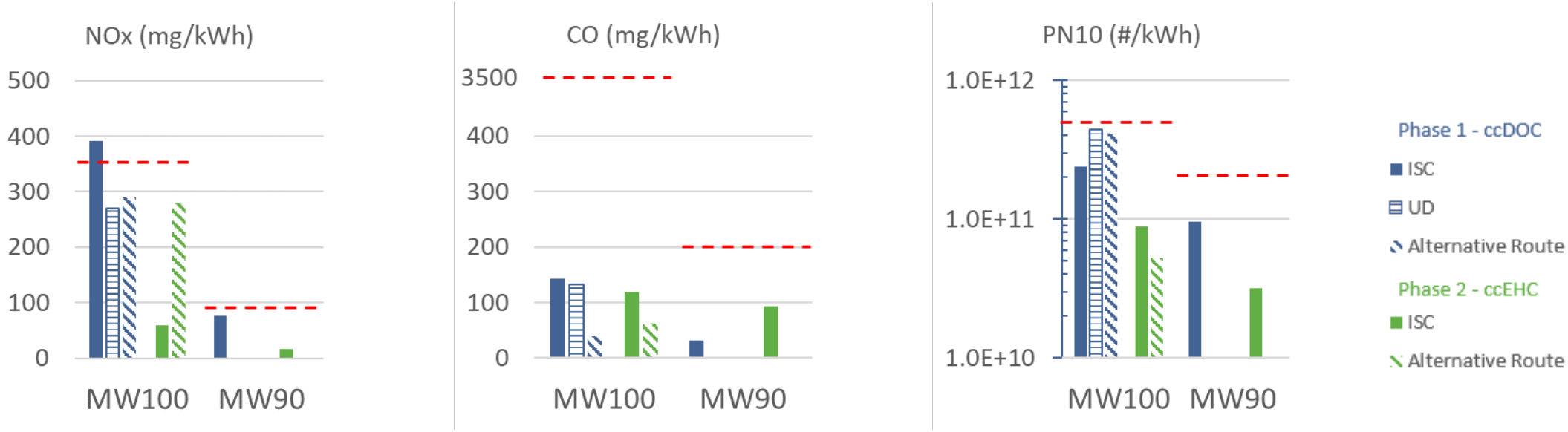
All phase 2 data is below the original Euro 7 proposal limits

- 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



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

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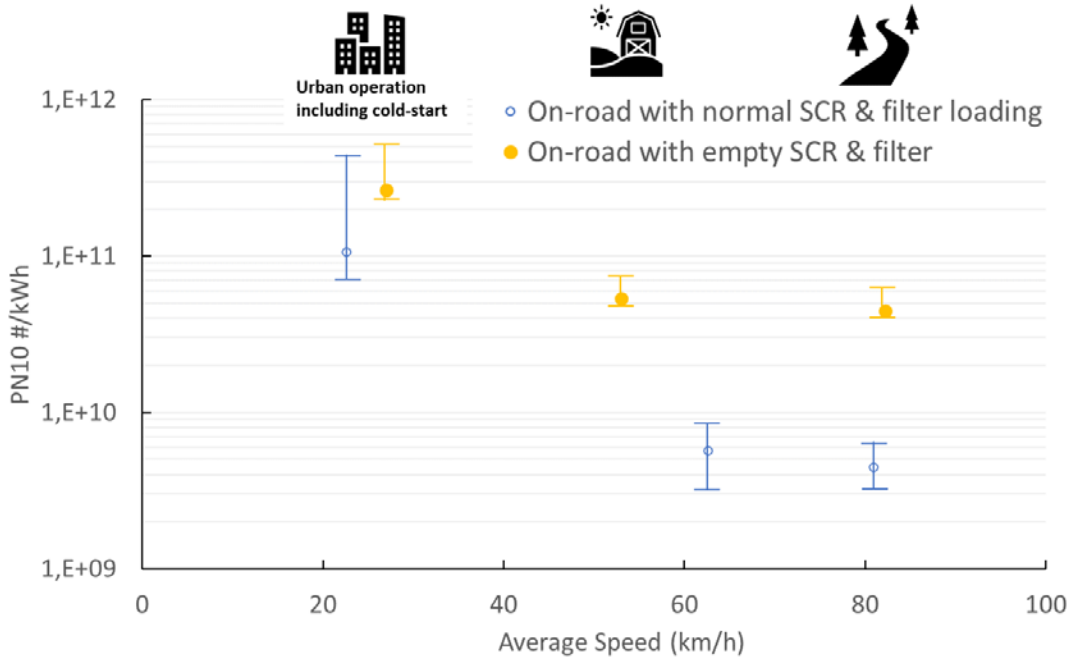
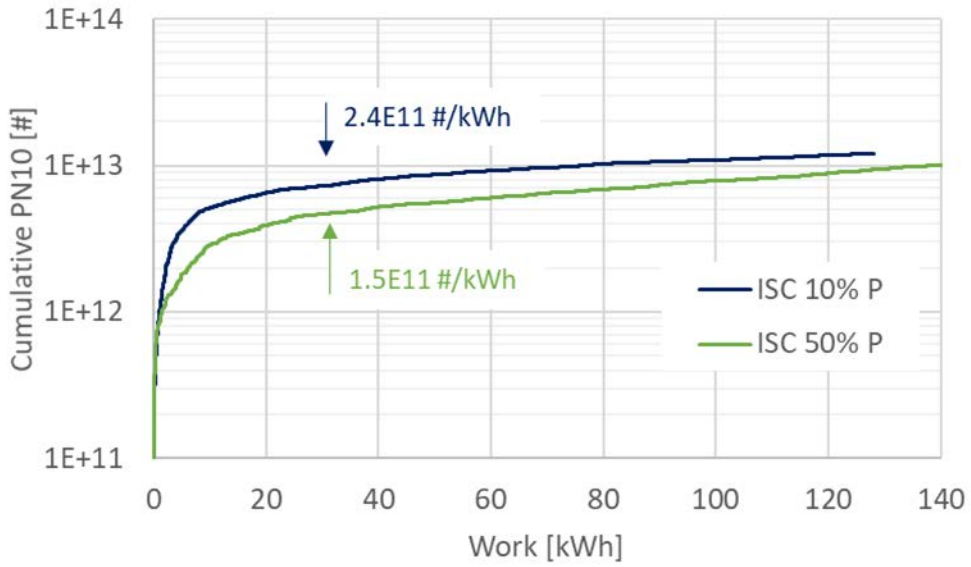
Good control of particulate emissions

- Low PN10[1,2] emissions are achieved at urban delivery and in service conformity trips[3]
- Temperature, payload and trip profile can impact these emissions





[1] The results are reported as measured
[2] Test conducted are not covering all possible critical conditions for PN
[3] Tests were conducted with empty SCRs' ammonia storage and passively regenerated DPF unless indicated otherwise. ISC 10% PL conducted at 21°C, ISC 50% PL conducted at 18°C

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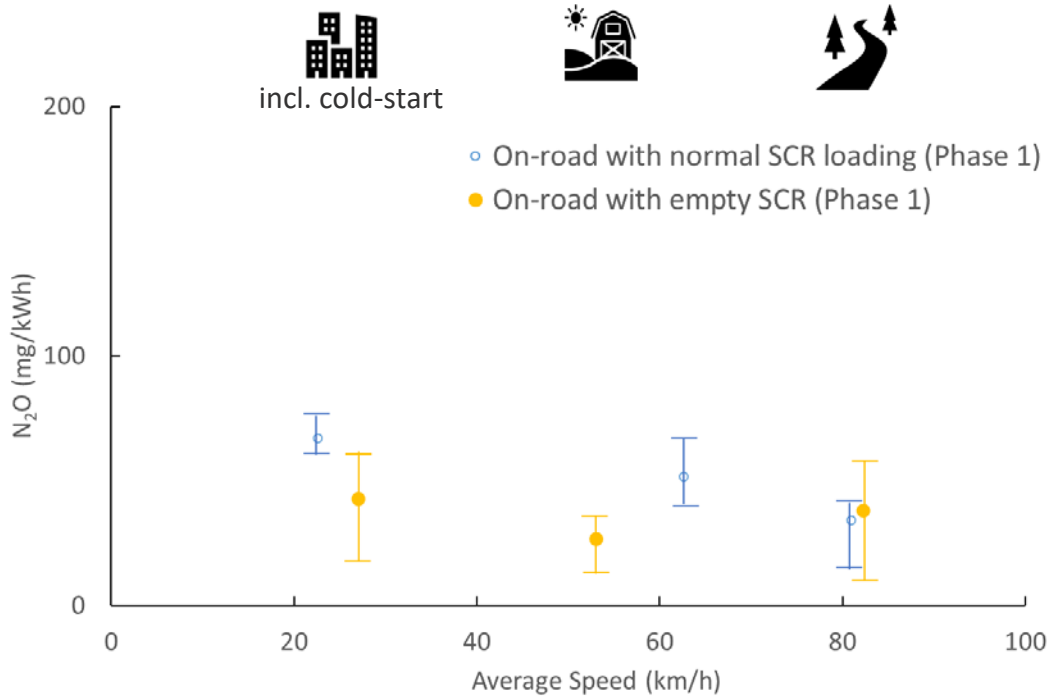
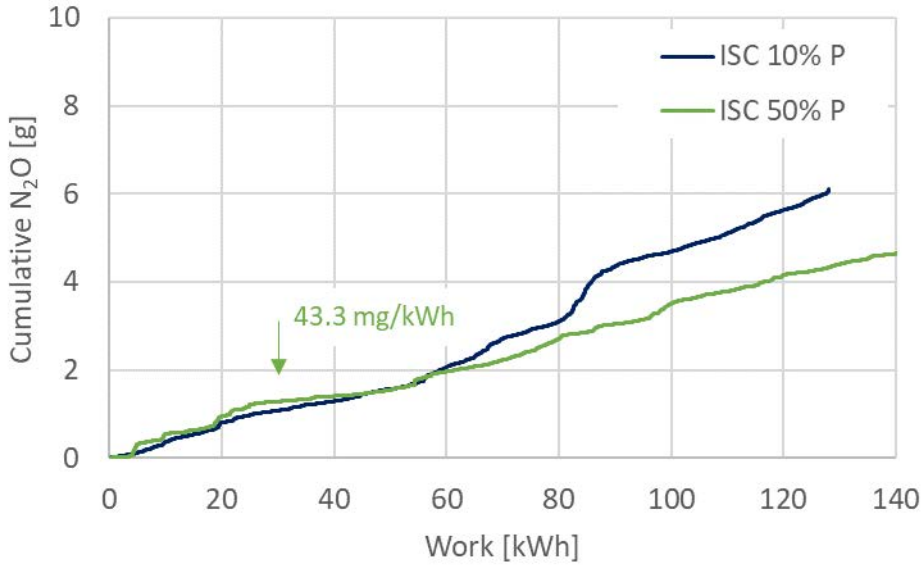
Good control of non-regulated emissions

- N_2O emissions are kept to low levels
- Near-zero NH_3 emissions have been achieved due to the AdBlue® dosing control in combination with the implementation of an ASC after each SCR





[1] The results are reported as measured

[2] Tests were conducted with empty SCRs' ammonia storage and passively regenerated DPF unless indicated otherwise. ISC 10% PL conducted at 21°C, ISC 50% PL conducted at 18°C

Near-zero emissions within 2 km after motorway cold-start

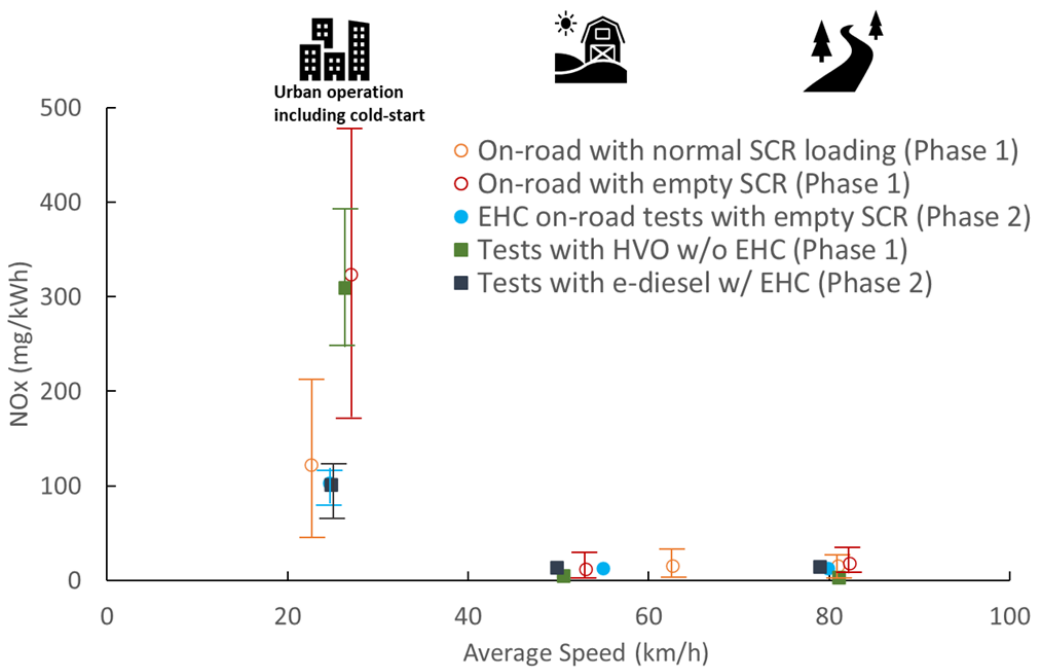
See video at https://youtu.be/LAMV3RZCTB0

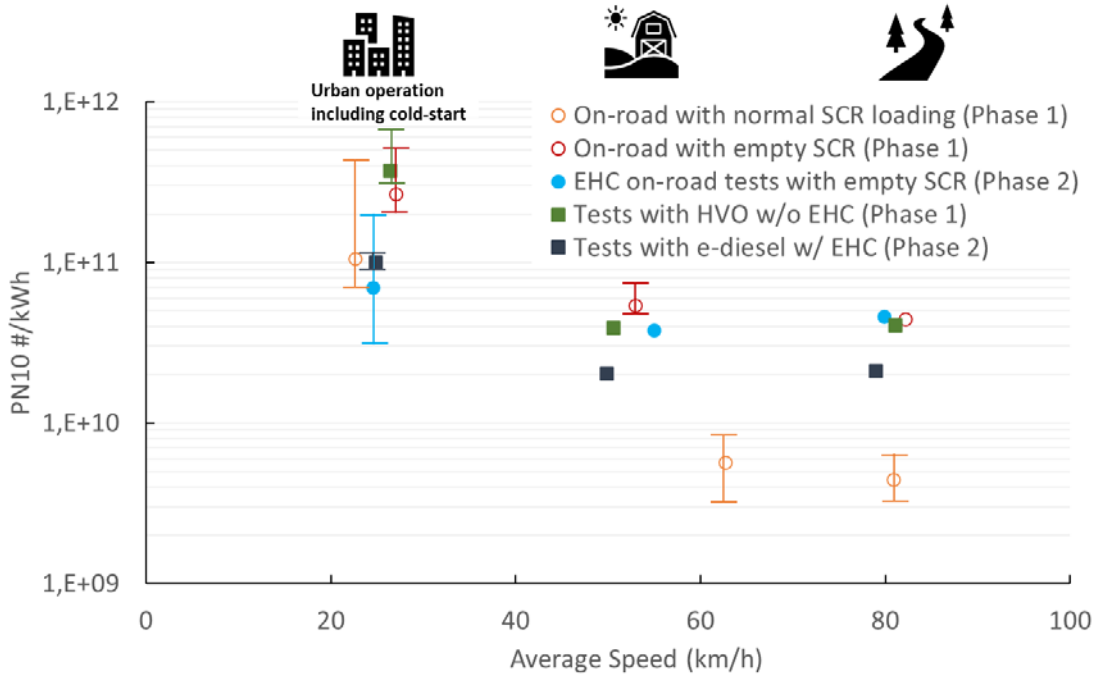
More videos available on YouTube (AECC eu): https://www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ

diesel

HD diesel demonstrator with sustainable renewable fuels

- Ultra low-pollutant emissions confirmed on HVO and e-diesel

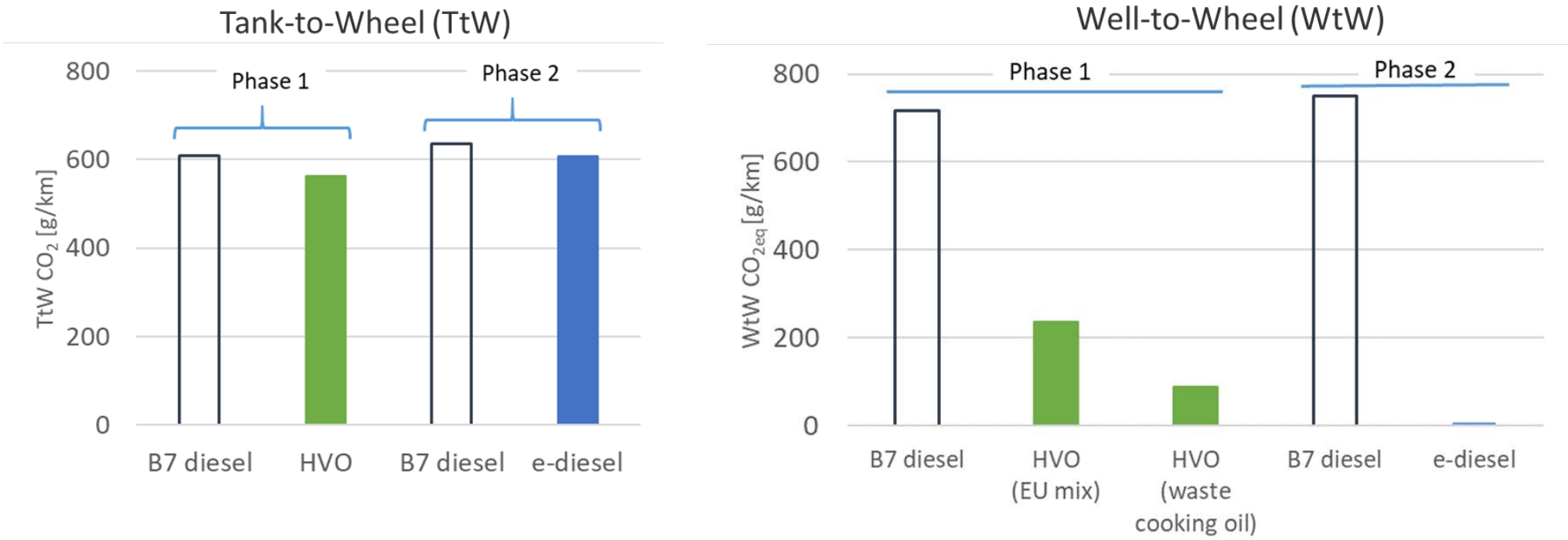




D. Bosteels, et al.; "Combination of advanced emission control technologies and sustainable renewable fuels on a long-haul demonstrator truck", SIA Powertrain & Energy conference, 2022

HD diesel demonstrator with sustainable renewable fuels

- HVO already offers today up to 90% WtW CO_2 emissions reduction
- E-diesel has the potential to nearly eliminate WtW CO_2 emissions

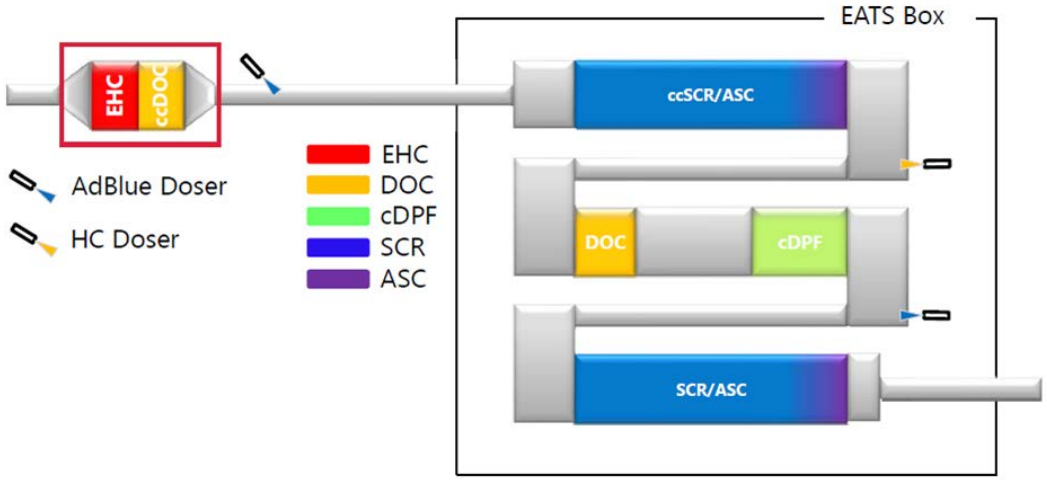


D. Bosteels, et al.; "Combination of advanced emission control technologies and sustainable renewable fuels on a long-haul demonstrator truck", SIA Powertrain & Energy conference, 2022

diesel

Conclusions heavy-duty vehicle

- Available emission control technologies used
  - Close-coupled layout
  - Active thermal management
  - Dual-dosing SCR with ASC
  - Catalysed DPF



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Agenda

- Euro 7 update for light-duty and heavy-duty vehicles

- AECC light-duty (gasoline and diesel) and heavy-duty diesel demonstration programmes
  - Criteria pollutants with state-of-the-art emission control systems
  - GHG emissions with sustainable renewable fuels
  - Conclusions

- Outlook
  - LD and HD CO_2 review and CO_2 neutral fuels
  - H_2 ICE (Internal Combustion Engine)
  - NRMM (Non-Road Mobile Machinery)
  - Life Cycle Assessment

Light-duty CO_2 review and CO_2 neutral fuels

- European Commission will publish progress report in 2025 and review legislation in 2026
- Development of procedures ongoing for vehicles running exclusively on CO_2 neutral fuels
  - Draft Commission proposal is being discussed at Technical Committee on Motor Vehicles (TCMV)
  - Definitions
    - Type of fuel: current draft only covers Renewable Fuels of Non-Biological Origin (RFNBO, i.e. e-fuel)
    - Minimum GHG reduction threshold: current draft requires -100% according to Renewable Energy Directive
  - Relying on OEM to ensure
    - Vehicles are equipped with a fueling monitoring and inducement system
    - Protection from tampering for the whole lifetime of the vehicle
  - Draft text also defines CO_2 emission of H_2 ICE is not to be measured

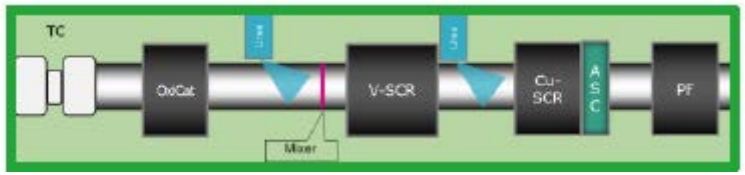
Heavy-duty CO_2 review and CO_2 neutral fuels

- European Parliament and Council reached provisional trilogue agreement on 18 January 2024
  - CO_2 reduction targets
    - -45% from 2030, -65% from 2035, -90% from 2040
    - Urban buses: -90% by 2030, -100% by 2035; inter-urban buses are exempted
    - -7.5% for trailers and -10% for semi-trailers, from 2030
  - Review of the regulation is requested in 2027
    - Expansion of the scope to small lorries
    - Role of a Carbon Correction Factor (CCF) in the transition towards zero-emission HDVs
- Formal adoption process is ongoing
  - EP adopted on 10 April
  - Recital 13b added on CO_2 neutral fuels

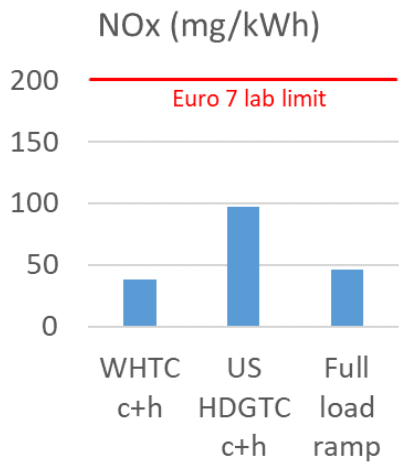
> (13b) *Following consultation with stakeholders, the Commission will, within a year from entry into force of this regulation, assess the role of a methodology for registering HDV exclusively running on CO_2 neutral fuels, in conformity with Union law and with Union climate neutrality objective;*

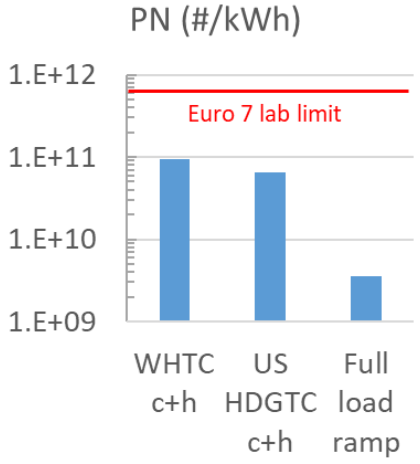
H_2 Internal Combustion Engine (ICE)

- Type approval procedures are being adopted at UNECE for HD and NRMM
- AECC is looking into emission control requirements
  - Publications will follow in 2024 from demo project of Aramco and ActBlue France at AVL
    - System investigated



    - All results are below Euro 7 limits

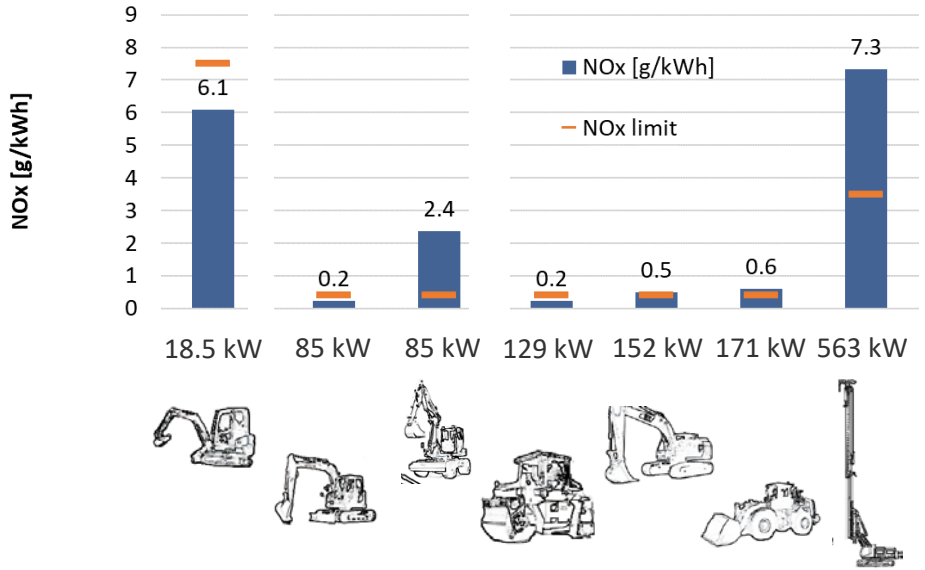


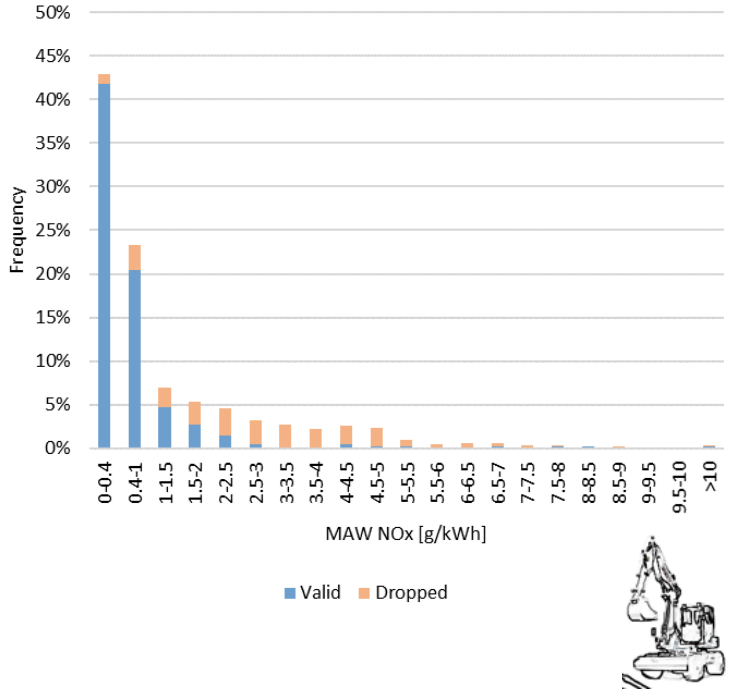


NRMM: Non-Road Mobile Machinery

Non-Road Mobile Machinery (NRMM)

- AECC is looking into demonstration activities
- AECC and TNO looked at real-world NOx emissions of Stage V machines in the field
  - Large variation in average real-world NOx emissions
  - NRMM regulation does not consider a substantial share of the real working conditions

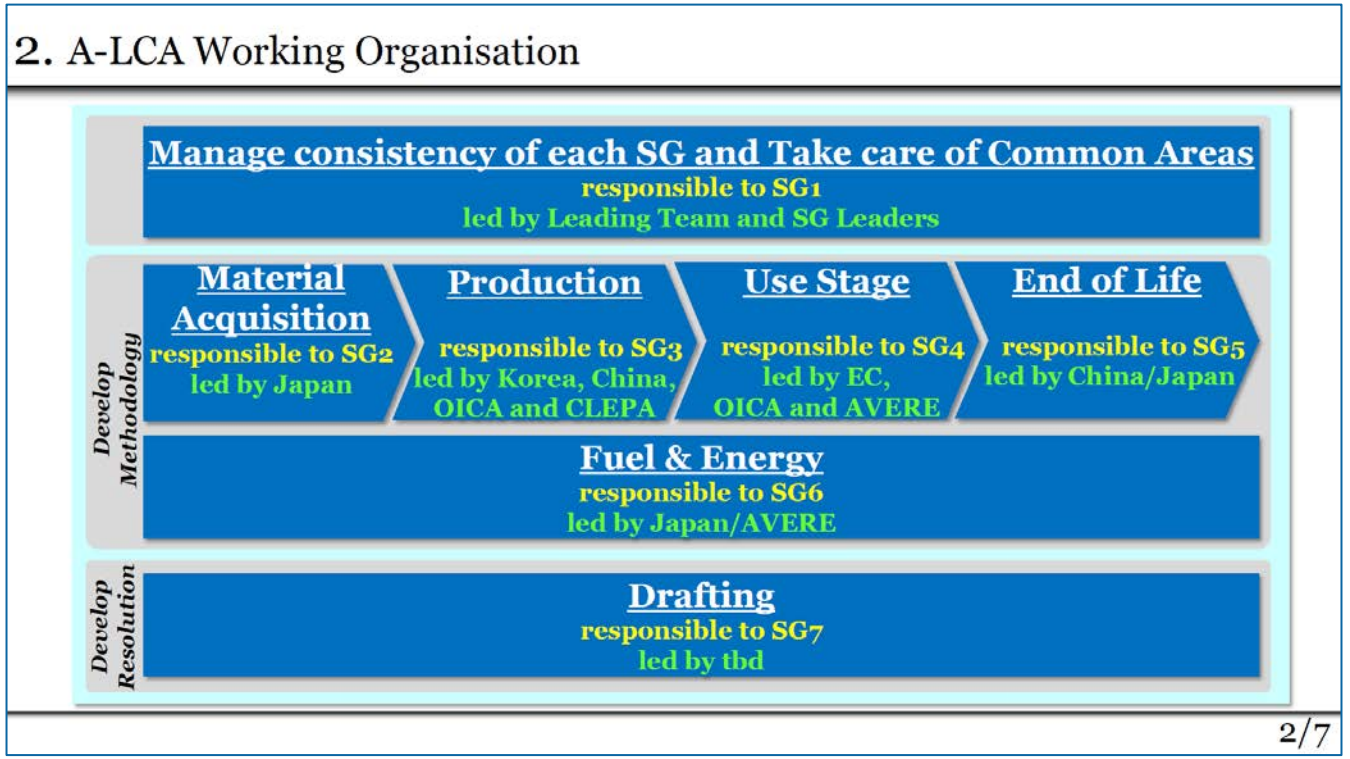




R. Vermeulen, et al.; "Real-World NOx emissions of Stage V NRMM", Transport and Air Pollution Conference, 2023

Automotive Life-Cycle Assessment (A-LCA)

- AECC is part of the Informal Working Group on A-LCA at UNECE



- AECC will extend its Well-to-Wheel studies to LCA for LDV and HDV

THANK YOU

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@AECC_eu
AECC (Association for Emissions Control by Catalyst)
AECC eu

Additional references

- AECC fact sheet on myths and truths about Euro 7
- Implementation of available and affordable emission control systems
  - Cost assessment of engineering houses
    - LD demo vehicles
    - HD demo vehicle
  - Provided as input to European Commission impact assessment
- Emission control systems are designed for minimised impact on backpressure
  - See Q&A document of AECC-IPA Technical Seminar on Euro 7