AECC position on Euro 7 and AECC demonstration projects

Dirk Bosteels •

Nationales Fachgespräch zur Post-Euro 6/VI Abgasgesetzgebung •
12 November 2020

ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

Association for Emissions Control by Catalyst (AECC AISBL)

AECC members : European Emissions Control companies

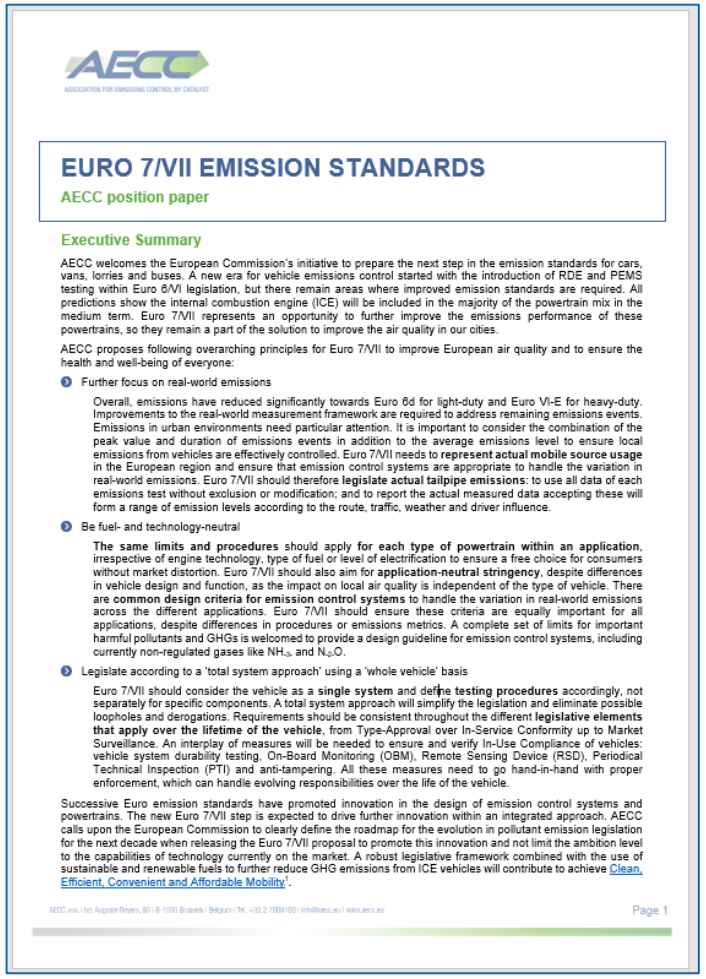
- Exhaust emissions control technologies for original equipment, retrofit and aftermarket for all new cars, commercial vehicles, motorcycles, and non-road mobile machinery
  - AECC is # 78711786419-61 in EU Transparency Register and has consultative status with the UN Economic and Social Council (ECOSOC)

Agenda

- AECC position on Euro 7/VII
- AECC demonstration projects
  - Light-duty diesel
  - Light-duty gasoline
  - Heavy-duty diesel
- Conclusion and outlook

AECC position on Euro 7

- AECC position on Euro 7/VII published on 9 July 2020
  www.aecc.eu/wp-content/uploads/2020/07/200709-AECC-position-on-Euro-7.pdf
  - Further focus on real-world emissions
  - Be fuel- and technology-neutral
  - Legislate according to a ‘total system approach’ using a ‘whole vehicle basis



AECC

ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

EURO 7/VII EMISSION STANDARDS

AECC position paper

Executive Summary

AECC welcomes the European Commission’s initiative to prepare the next step in the emission standards for cars, vans, lorries and buses. A new era for vehicle emissions control started with the introduction of RDE and PEMS testing within Euro 6/VI legislation, but there remain areas where improved emission standards are required. All predictions show the internal combustion engine (ICE) will be included in the majority of the powertrain mix in the medium term. Euro 7/VII represents an opportunity to further improve the emissions performance of these powertrains, so they remain a part of the solution to improve the air quality in our cities.

AECC proposes following overarching principles for Euro 7/VII to improve European air quality and to ensure the health and well-being of everyone:

- Further focus on real-world emissions

  Overall, emissions have reduced significantly towards Euro 6d for light-duty and Euro VI-E for heavy-duty. Improvements to the real-world measurement framework are required to address remaining emissions events. Emissions in urban environments need particular attention. It is important to consider the combination of the peak value and duration of emissions events in addition to the average emissions level to ensure local emissions from vehicles are effectively controlled. Euro 7/VII needs to **represent actual mobile source usage** in the European region and ensure that emission control systems are appropriate to handle the variation in real-world emissions. Euro 7/VII should therefore **legislate actual tailpipe emissions**: to use all data of each emissions test without exclusion or modification; and to report the actual measured data accepting these will form a range of emission levels according to the route, traffic, weather and driver influence.

- Be fuel- and technology-neutral

  The same limits and procedures should apply **for each type of powertrain within an application**, irrespective of engine technology, type of fuel or level of electrification to ensure a free choice for consumers without market distortion. Euro 7/VII should also aim for **application-neutral stringency**, despite differences in vehicle design and function, as the impact on local air quality is independent of the type of vehicle. There are **common design criteria for emission control systems** to handle the variation in real-world emissions across the different applications. Euro 7/VII should ensure these criteria are equally important for all applications, despite differences in procedures or emissions metrics. A complete set of limits for important harmful pollutants and GHGs is welcomed to provide a design guideline for emission control systems, including currently non-regulated gases like NH_3 and N_2O.

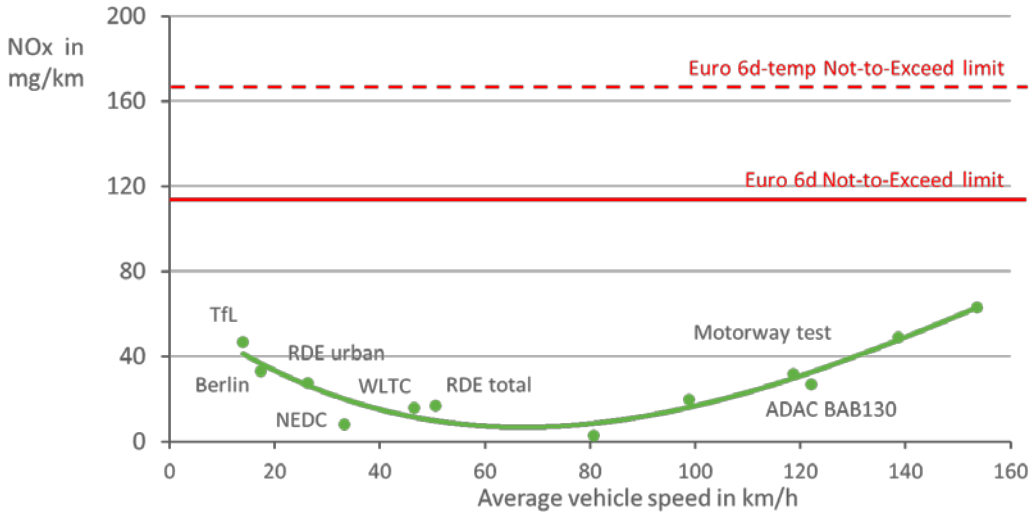
- Legislate according to a ‘total system approach’ using a ‘whole vehicle’ basis

  Euro 7/VII should consider the vehicle as a **single system** and define **testing procedures** accordingly, not separately for specific components. A total system approach will simplify the legislation and eliminate possible loopholes and derogations. Requirements should be consistent throughout the different **legislative elements that apply over the lifetime of the vehicle**, from Type-Approval over In-Service Conformity up to Market Surveillance. An interplay of measures will be needed to ensure and verify In-Use Compliance of vehicles: vehicle system durability testing, On-Board Monitoring (OBM), Remote Sensing Device (RSD), Periodical Technical Inspection (PTI) and anti-tampering. All these measures need to go hand-in-hand with proper enforcement, which can handle evolving responsibilities over the life of the vehicle.

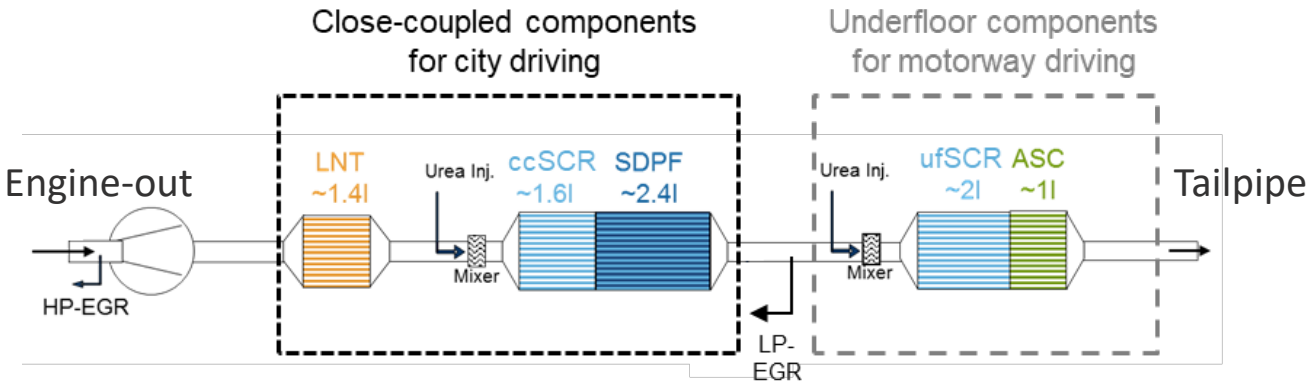
Successive Euro emission standards have promoted innovation in the design of emission control systems and powertrains. The new Euro 7/VII step is expected to drive further innovation within an integrated approach. AECC calls upon the European Commission to clearly define the roadmap for the evolution in pollutant emission legislation for the next decade when releasing the Euro 7/VII proposal to promote this innovation and not limit the ambition level to the capabilities of technology currently on the market. A robust legislative framework combined with the use of sustainable and renewable fuels to further reduce GHG emissions from ICE vehicles will contribute to achieve ‘Clean, Efficient, Convenient and Affordable Mobility’.

Ultra-low NOx emissions diesel demonstrator

- Objective: demonstrate low NOx emissions over wide range of driving conditions

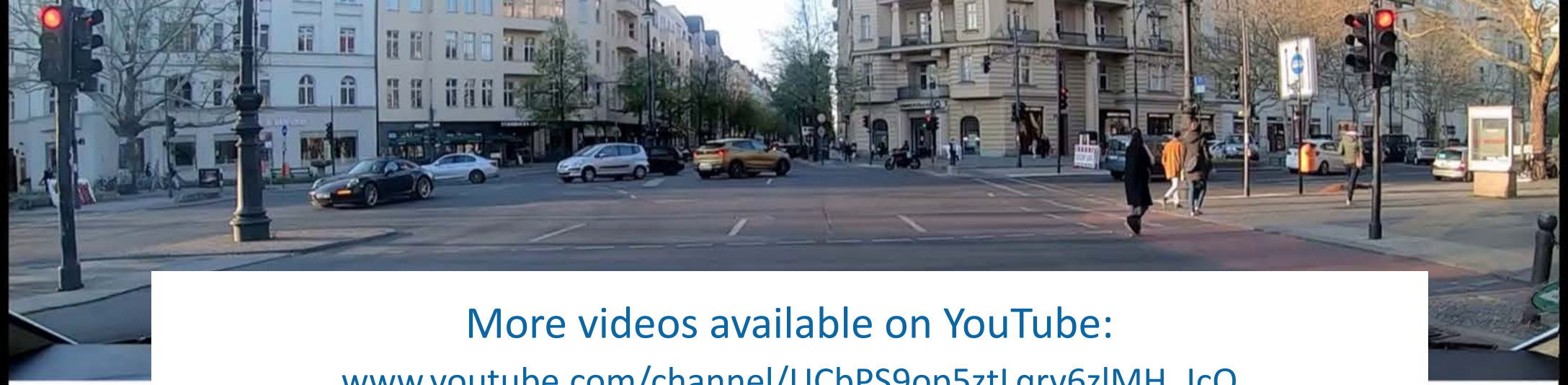


- Emission control system based on serial components: LNT + dual-SCR supported by 48V mild-hybrid



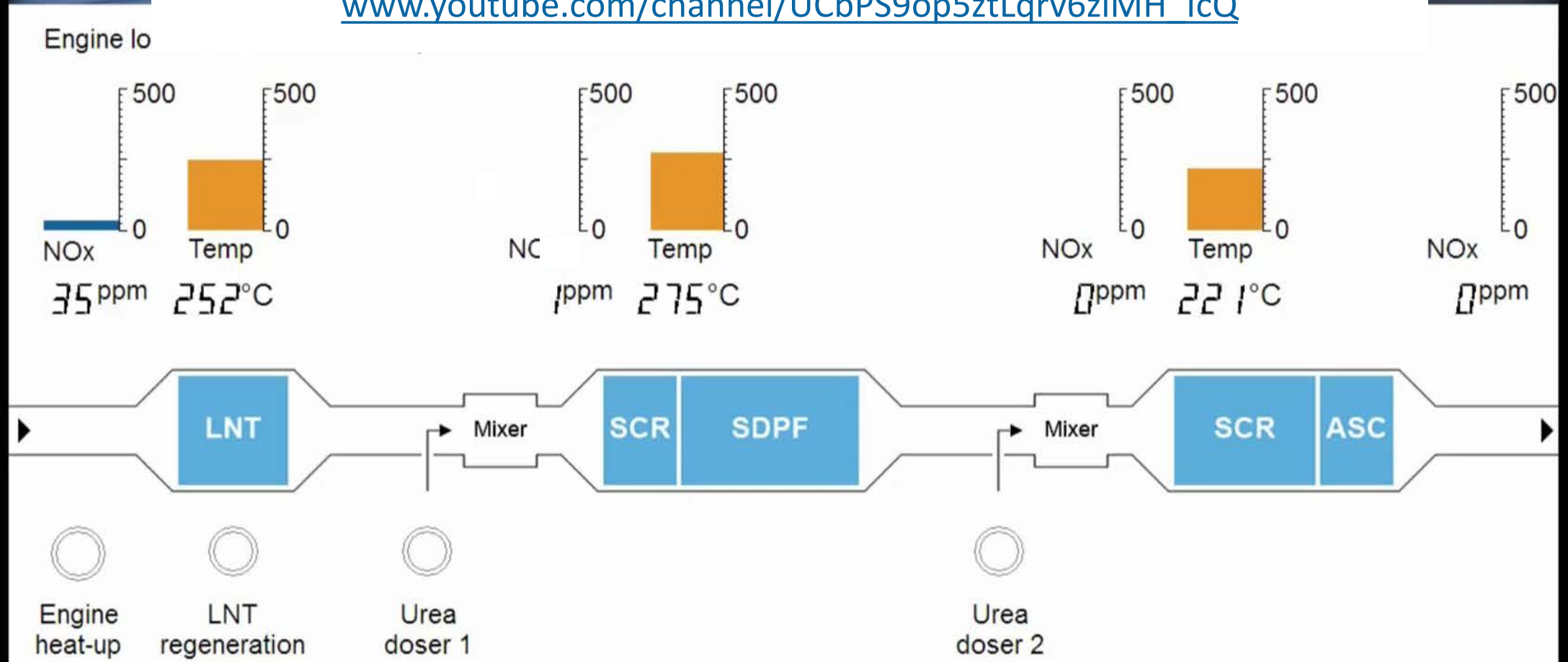
Note: hydrothermal aged components used

1) *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/2019/04/190516-AECC-IAV-IPA-Integrated-Diesel-System-achieving-Ultra-Low-NOx-on-the-road-Vienna-Symposium.pdf
2) joint MTZ publication with Bosch, Vitesco, FEV and IAV https://www.aecc.eu/wp-content/uploads/2020/09/200901-modern-diesel-MTZ.pdf



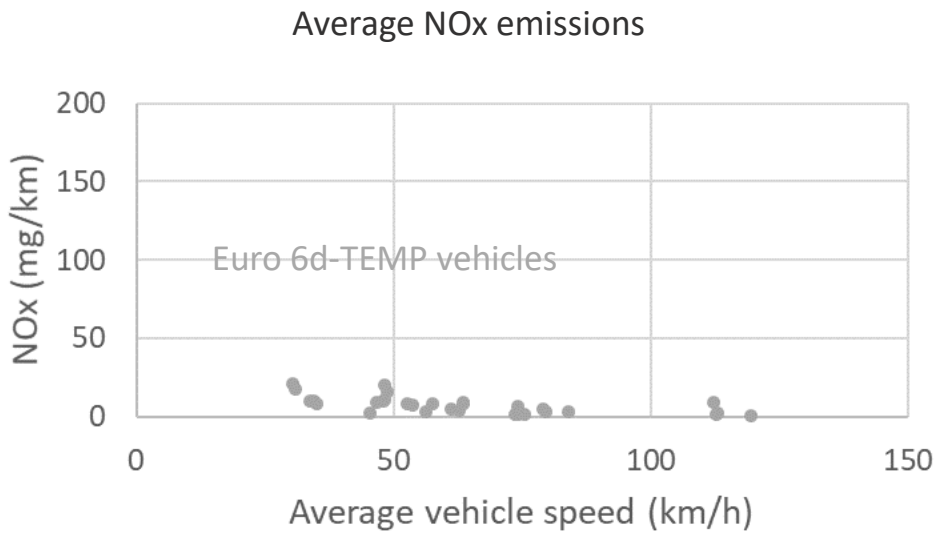
More videos available on YouTube:

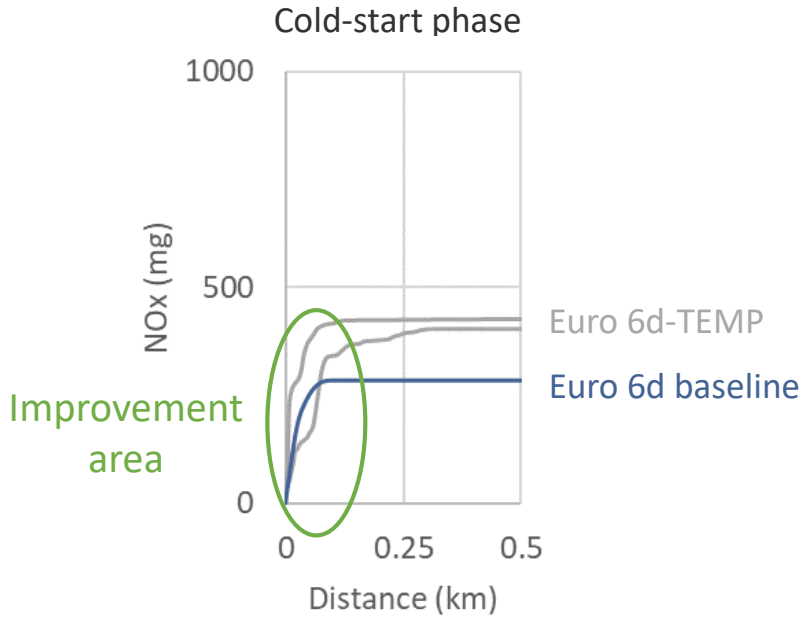
www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ



Light-duty gasoline demonstrator

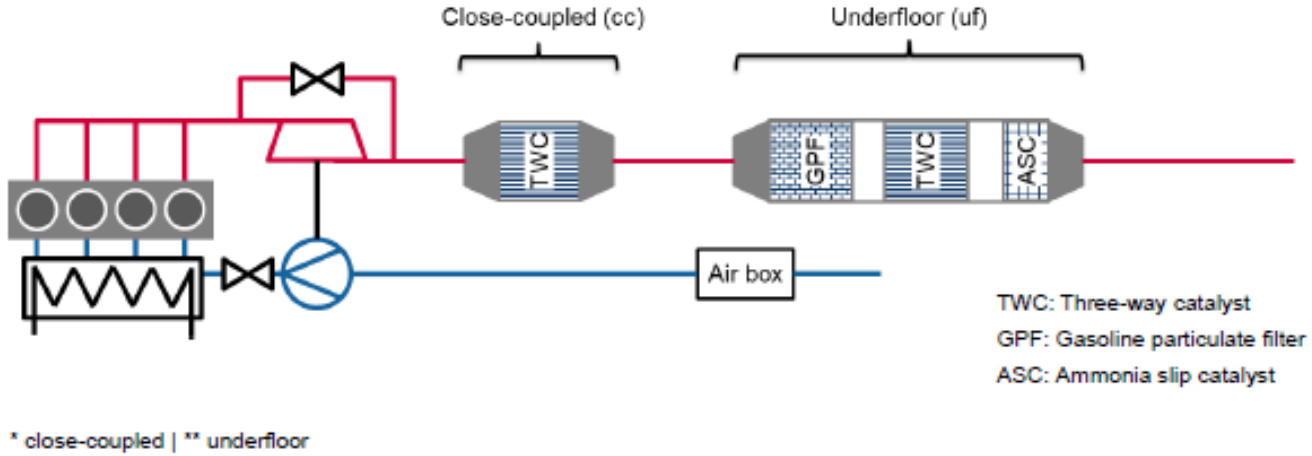
- Euro 6d(-TEMP) data shows ultra-low NOx emissions
- AECC demonstrator to also show low pollutant emissions for areas of improvement with minimal impact on CO_2 emissions
  - Earlier light-off to further improve cold-start emissions
  - Well controlled emissions of currently non-regulated pollutants (NH_3, N_2O, sub-23 nm PN)





Light-duty gasoline demonstrator

- Demonstrator concept
  - C-segment, 1.5l GDI, 48V mild-hybrid
  - ccTWC + ufGPF-TWC-ASC



- Schedule and status
  - Baseline Euro 6d and preliminary result with AECC system measured
  - Full data by Q1 2021

Milestone 1
28 Aug 2020
Preparatory activities

Milestone 1b
6 Nov 2020
baseline + preliminary AECC system

Milestone 2
18 Dec 2020
Engine bench

Milestone 3a
5 Feb 2021
Veh calib 1

Milestone 3b
19 Mar 2021
Veh calib 2

Milestone 4
16 Apr 2021
Final report

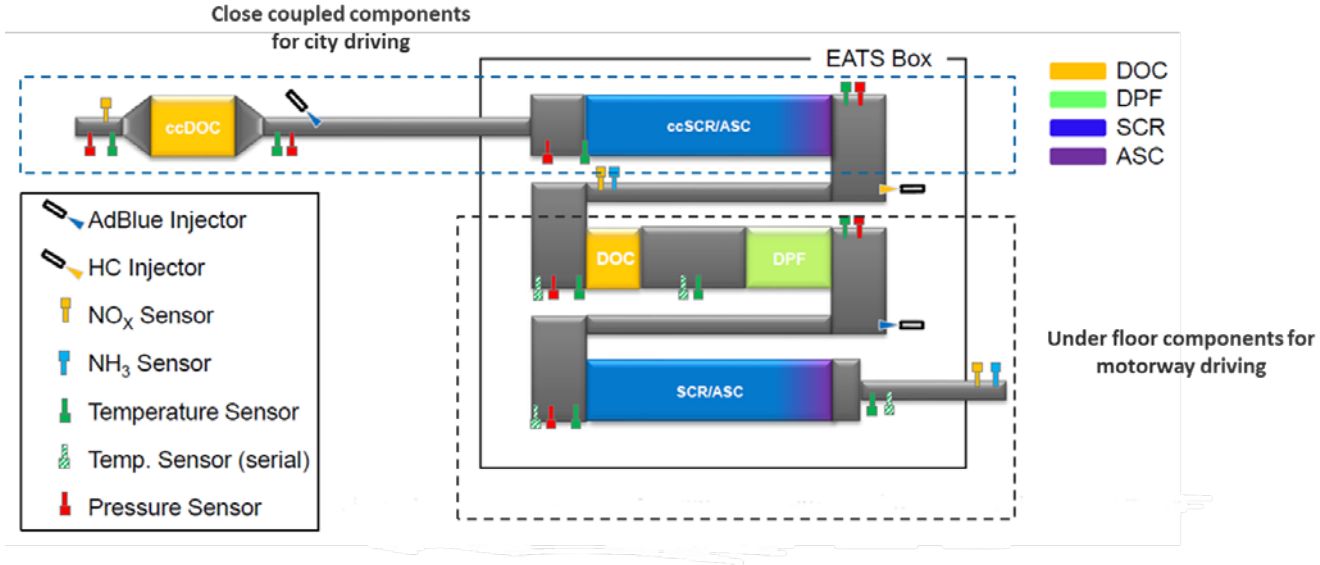
Heavy-duty Diesel demonstrator

- Objective: demonstrate improved urban performance with minimal impact on CO_2
  - Implementation of emissions control technology to address critical high emissions operation - cold start, city start & delivery operation
  - Total catalyst and filter volume of appropriate size to cope with peak engine pollutant emissions flow
- Focus on on-road measurements
  - All calibration will be performed on the road, and PEMS testing will be used to verify and complement results
    - Tests will be run using an In-service conformity designed route
    - Real world operation trips will also be conducted
    - Different payloads will be considered
    - Critical conditions will be studied
  - Both regulated and unregulated pollutants will be measured (N_2O, NH_3 and PN_{10})

Heavy-duty Diesel demonstrator

- Demonstrator concept
  - Long-haul, 390hp, 12.8 l engine
  - ccDOC + ccSCR, DOC+cDPF+SCR

Automotive Grade Urea Sector Group



- Status
  - SCR calibration work is being performed
  - Preliminary results by beginning of November, full data Q1 2021

Milestone 1
15 Oct 2020
Vehicle Build-up

Milestone 2
30 Oct 2020
Calibration Loop 1

Milestone 3
16 Nov 2020
Calibration Loop 2

Milestone 4
18 Dec 2020
Calibration Loop 3

Milestone 5
12 Feb 2021
PEMS testing results

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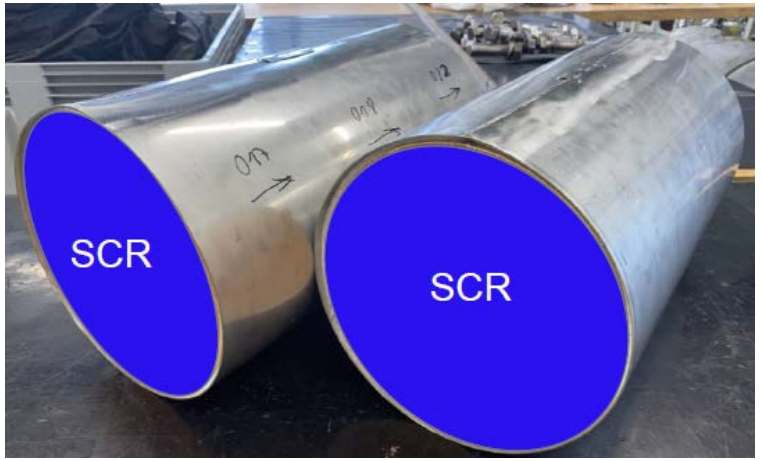
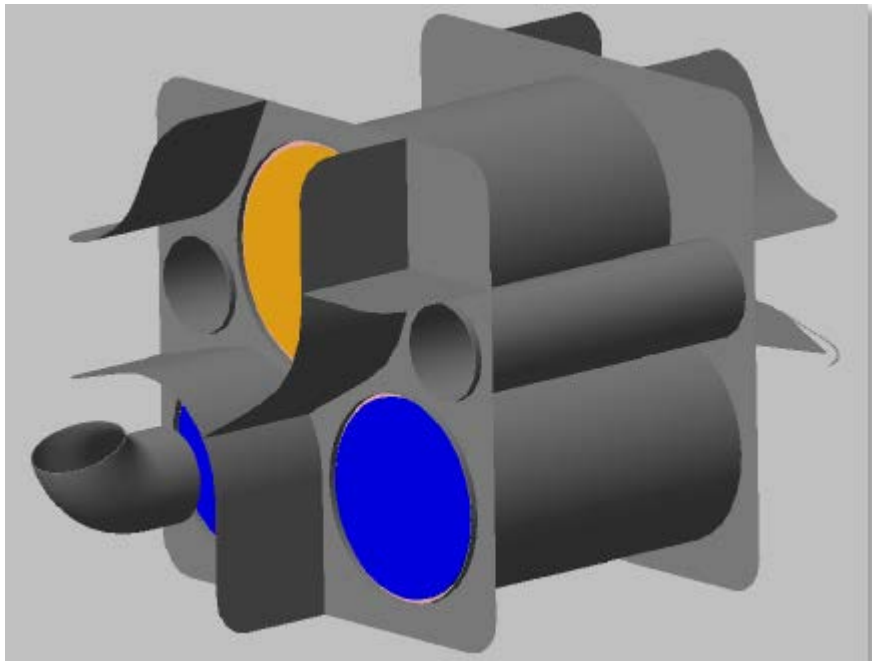
HDD demonstrator ongoing work

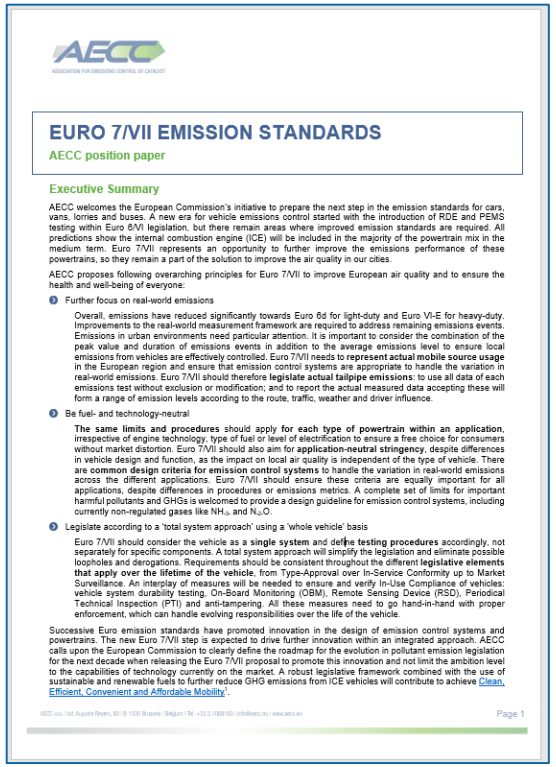
Demo Vehicle build up





Conclusion and outlook

- AECC position on Euro 7/VII published in July 2020
  www.aecc.eu/wp-content/uploads/2020/07/200709-AECC-position-on-Euro-7.pdf
  - Further focus on real-world emissions
  - Be fuel- and technology-neutral
  - Legislate according to a ‘total system approach’ using a ‘whole vehicle basis’
- AECC demonstrated technical feasibility for Euro 7 in projects on
  - Light-duty diesel vehicle
  - Light-duty gasoline vehicle
  - Heavy-duty diesel truck
- AECC will continue to demonstrate that technologies are available today to effectively control emissions from ICE under real-world operation to improve air quality



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