Introduction to Euro 7 and current status

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ECMA workshop on Euro 7 • 11 April 2023

AECC
ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

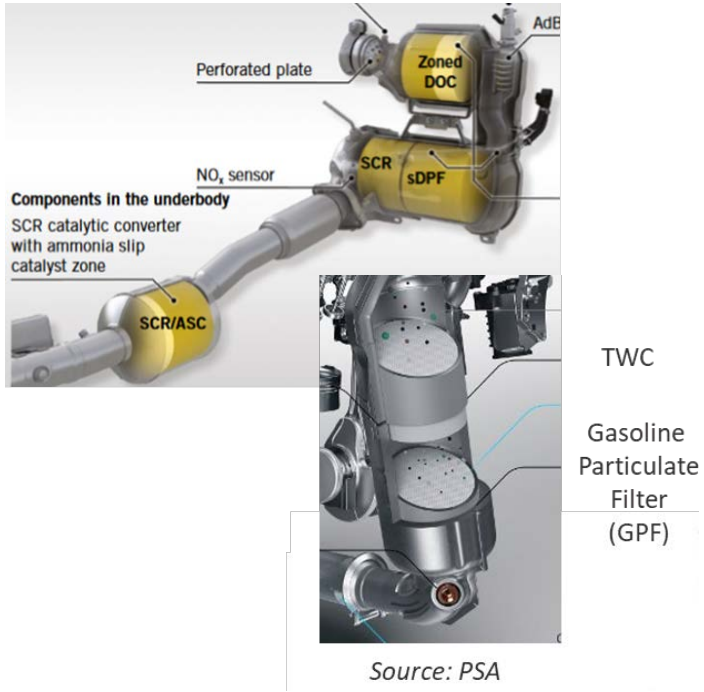
Association for Emissions Control by Catalyst (AECC AISBL)

AECC members : European Emissions Control companies

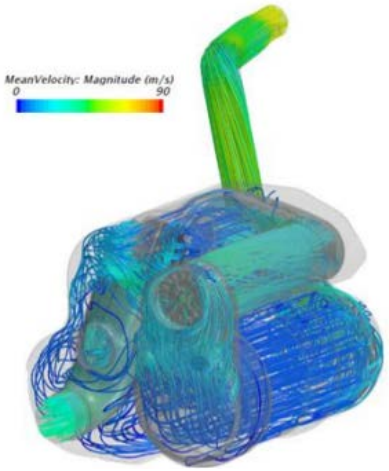
- Exhaust emissions control technologies for original equipment, retrofit and aftermarket for all new cars, commercial vehicles, motorcycles, and non-road mobile machinery
  - AECC is listed in EU Transparency Register (# 78711786419-61) and has consultative status with the UN Economic and Social Council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

Euro 6/VI significantly reduced impact on air quality

- Evolution in emission control systems
  - LD diesel - combination of deNOx technologies
  - LD gasoline - introduction of particulate filter
  - HD diesel - compact design of SCR and filter

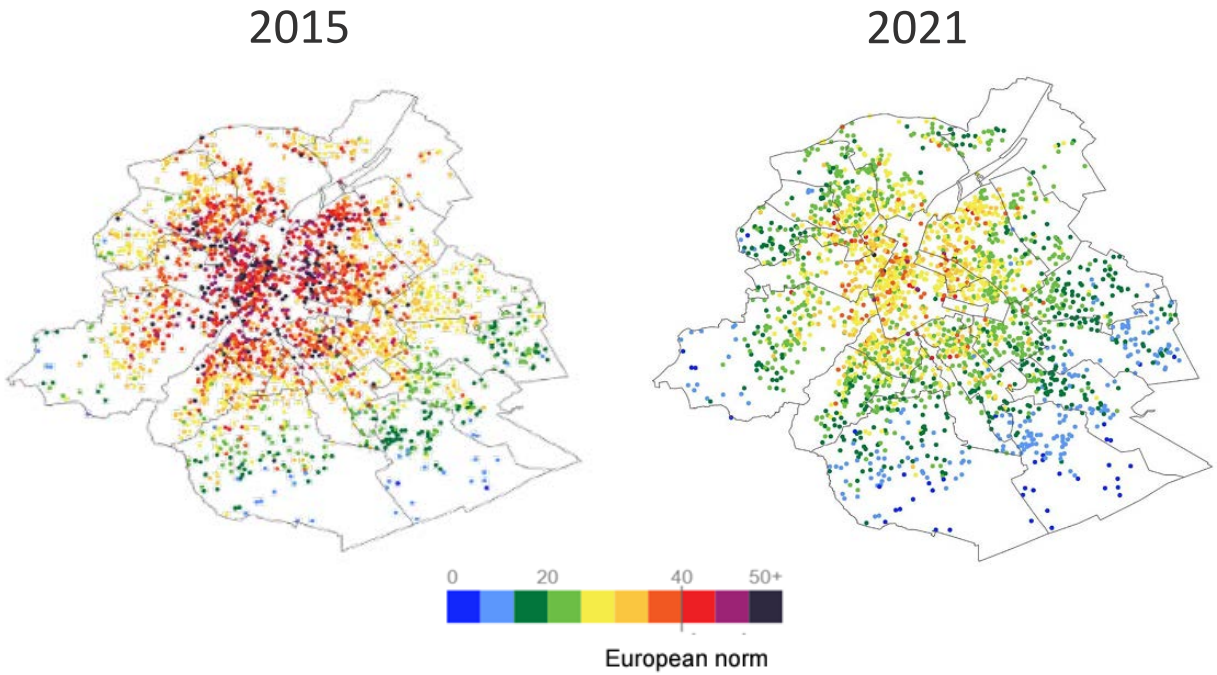


Source: PSA



Source: Daimler 2022

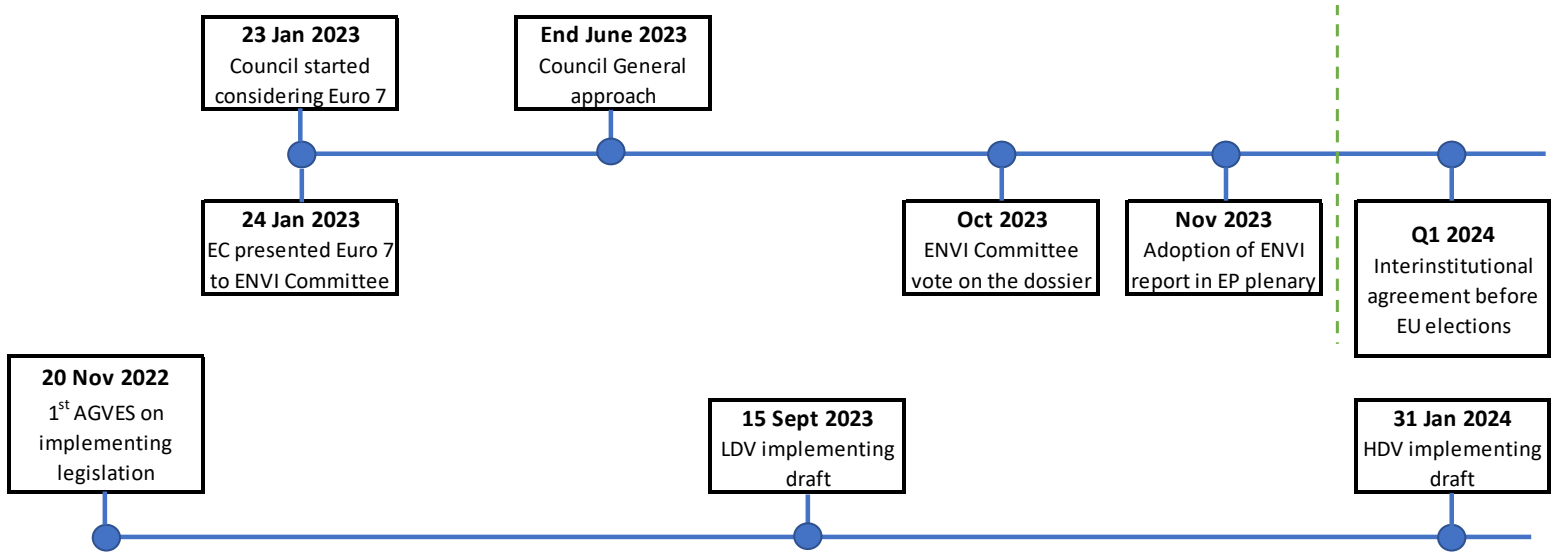
- Several reports about improved air quality
- Example of NO_2 in Brussels



Source: CurieuzenAir report air quality in Brussels, 2022

Further evolution expected towards Euro 7

- The European Commission published the Euro 7 proposal on 10 November 2022
- Two parallel processes have started
  - The ordinary legislative process by European Parliament and Council to discuss the proposal
  - Development of implementing legislation by the European Commission involving
    - AGVES expert working group
    - CLOVE consortium



Tentative timeline based on preliminary information

Euro 7 Implementing Regulations
1. LDV Vehicle Types
2. HDV Vehicle Types
3. HDV Engines
4. OBM/OBD systems
5. Anti-tampering, security and cybersecurity systems
6. Replacement pollution control systems types and their parts
7. Brake system types and their replacement parts;
8. Tyre types in respect to tyre abrasion
9. CO_2 + range determination for LDV
10. CO_2 + range determination for HDV

Euro 7 proposal for cars and vans

- Entry into force as of 1/7/2025
- Driving conditions
  - Focus on on-road driving
  - Definition of normal and extended area
  - Procedures to be further defined by implementing legislation
- Lifetime
  - Main: up to 160k km or 8 years
  - Additional: up to 200k km or 10 years

	Normal	Extended*
Ambient temperature	0 to 35 °C	-10 to 0 °C or 35 to 45 °C
Ambient altitude	0 to 700 m	700 to 1800 m
Max speed	<145 km/h	145 to 160 km/h
Towing or aerodynamic modifications	Not allowed	Allowed according to manufacturer specifications and up to the regulated speed
Auxiliaries	Possible as per normal use	-
Max. avg. wheel power during first 2 km after cold-start	<20% of max	>20% of max
Trip composition	Any	-
Min. mileage	10000 km	3000 to 10000 km

* The same emission strategy shall be used when a vehicle is run outside those conditions, unless there is a technical reason approved by the type approval authority

Euro 7 proposal for cars and vans

- Fuel-neutral limits
  - Lowest Euro 6 level for currently regulated pollutants
  - New limit for NH_3
  - Emissions budget for trips < 10 km (= mg/km limit x 10 km)
  - Extended driving divider: emissions / 1.6
  - Additional lifetime: limit x 1.2 (for gaseous pollutants)
  - Additional requirements for
    - Evaporative emissions
    - Brake and tyre particulate emissions
    - Battery durability

	M_1, N_1 (/km)	N_1 PMR < 35 kW/t (/km)	M_1, N_1 cold-start budget (/trip)	N_1 PMR < 35 kW/t cold-start budget (/trip)
NOx in mg	60	75	600	750
PM in mg	4.5		45	
PN in # (>10 nm)	$6x10^{11}$		$6x10^{12}$	
CO in mg	500	630	5000	6300
THC in mg	100	130	1000	1300
NMHC in mg	68	90	680	900
NH_3 in mg	20		200	

Euro 7 proposal for trucks & buses

- Entry into force as of 1/7/2027
- Driving conditions
  - Focus on on-road driving
  - Definition of normal and extended area
  - Some differences with cars and vans
  - Procedures to be further defined by implementing legislation
- Lifetime
  - Main: up to 300k km or 8 years (cat. 1), 700k km or 15 years (cat. 2)
  - Additional: up to 375k km (cat. 1), 875k km (cat. 2)

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

	Normal	Extended
Ambient temperature	-7 to 35 °C	-10 to -7 °C or 35 to 45 °C
Ambient altitude	0 to 1600 m	1600 to 1800 m
Towing or aerodynamic modifications	Allowed according to manufacturer specifications and up to the regulated speed	
Vehicle payload	>10%	<10%
Auxiliaries	Possible as per normal use	-
ICE loading at cold-start	Any	-
Trip composition	As per usual use	-
Min. mileage	5000 km (<16t) 10000 km (>16t)	3000 to 5000 km (<16t) 3000 to 10000 km (>16t)

* The same emission strategy shall be used when a vehicle is run outside those conditions, unless there is a technical reason approved by the type approval authority

Euro 7 proposal for trucks & buses

- Fuel-neutral limits
  - Emissions budget for trips < 3x WHTC
  - Extended driving divider: emissions / 2
  - Multiplier for additional lifetime tbd
  - NOx idle limit, in case engine does not shut down after 300 sec of continuous idling operation: 5000 mg/h

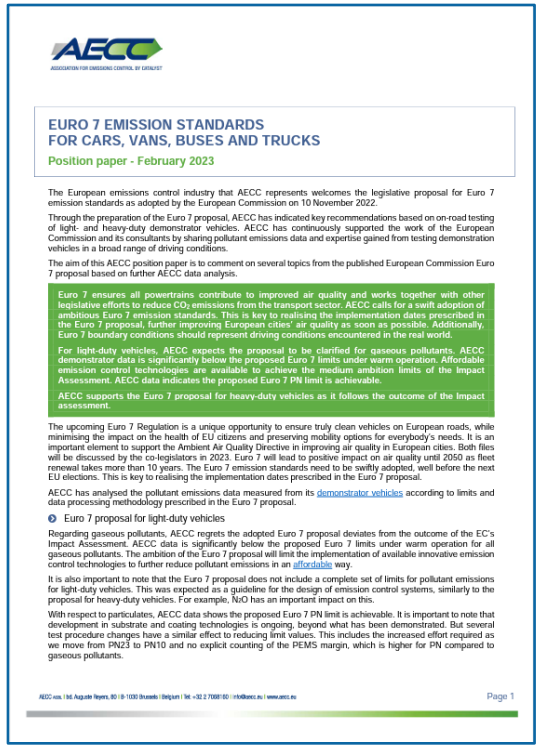
	Cold emissions (MW100) (/kWh)	Hot emissions (MW90) (/kWh)	Emissions budget for trips less than 3xWHTC (/kWh)
NOx (mg)	350	90	150
PM (mg)	12	8	10
PN (10 nm, #)	$5x10^{11}$	$2x10^{11}$	$3x10^{11}$
CO (mg)	3500	200	2700
NMOG (mg)	200	50	75
NH_3 (mg)	65	65	70
CH_4 (mg)	500	350	500
N_2O (mg)	160	100	140
HCHO (mg)	30	30	

MW: Moving Window, 90th or 100th percentile

AECC position paper on Euro 7 proposal, February 2023

https://www.aecc.eu/wp-content/uploads/2023/02/230209-AECC-position-on-Euro7_final.pdf

- Euro 7 ensures all powertrains contribute to improved air quality
  - Works together with other legislative efforts to reduce CO_2 emissions from the transport sector
- AECC calls for a swift adoption to get Euro 7 well before the next EU elections
- For Light-duty vehicles
  - AECC data indicates the proposed Euro 7 limits are achievable
  - Development in substrate and coating technologies are ongoing beyond what is demonstrated in AECC projects
- For Heavy-duty vehicles
  - AECC supports the Euro 7 proposal, following the outcome of the Impact Assessment and AECC demonstrator data



AECC

ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

EURO 7 EMISSION STANDARDS FOR CARS, VANS, BUSES AND TRUCKS

Position paper - February 2023

The European emissions control industry that AECC represents welcomes the legislative proposal for Euro 7 emission standards as adopted by the European Commission on 10 November 2022.

Through the preparation of the Euro 7 proposal, AECC has indicated key recommendations based on on-road testing of light- and heavy-duty demonstrator vehicles. AECC has continuously supported the work of the European Commission and its consultants by sharing pollutant emissions data and expertise gained from testing demonstration vehicles in a broad range of driving conditions.

The aim of this AECC position paper is to comment on several topics from the published European Commission Euro 7 proposal based on further AECC data analysis.

Euro 7 ensures all powertrains contribute to improved air quality and works together with other legislative efforts to reduce CO_2 emissions from the transport sector. AECC calls for a swift adoption of ambitious Euro 7 emission standards. This is key to realising the implementation dates prescribed in the Euro 7 proposal, further improving European cities' air quality as soon as possible. Additionally, Euro 7 boundary conditions should represent driving conditions encountered in the real world.

For light-duty vehicles, AECC expects the proposal to be clarified for gaseous pollutants. AECC demonstrator data is significantly below the proposed Euro 7 limits under warm operation. Affordable emission control technologies are available to achieve the medium ambition limits of the Impact Assessment. AECC data indicates the proposed Euro 7 PN limit is achievable.

AECC supports the Euro 7 proposal for heavy-duty vehicles as it follows the outcome of the Impact assessment.

The upcoming Euro 7 Regulation is a unique opportunity to ensure truly clean vehicles on European roads, while minimising the impact on the health of EU citizens and preserving mobility options for everybody's needs. It is an important element to support the Ambient Air Quality Directive in improving air quality in European cities. Both files will be discussed by the co-legislators in 2023. Euro 7 will lead to positive impact on air quality until 2050 as fleet renewal takes more than 10 years. The Euro 7 emission standards need to be swiftly adopted, well before the next EU elections. This is key to realising the implementation dates prescribed in the Euro 7 proposal.

AECC has analysed the pollutant emissions data measured from its demonstrator vehicles according to limits and data processing methodology prescribed in the Euro 7 proposal.

- Euro 7 proposal for light-duty vehicles

Regarding gaseous pollutants, AECC regrets the adopted Euro 7 proposal deviates from the outcome of the EC's Impact Assessment. AECC data is significantly below the proposed Euro 7 limits under warm operation for all gaseous pollutants. The ambition of the Euro 7 proposal will limit the implementation of available innovative emission control technologies to further reduce pollutant emissions in an affordable way.

It is also important to note that the Euro 7 proposal does not include a complete set of limits for pollutant emissions for light-duty vehicles. This was expected as a guideline for the design of emission control systems, similarly to the proposal for heavy-duty vehicles. For example, N_2O has an important impact on this.

With respect to particulates, AECC data shows the proposed Euro 7 PN limit is achievable. It is important to note that development in substrate and coating technologies is ongoing, beyond what has been demonstrated. But several test procedure changes have a similar effect to reducing limit values. This includes the increased effort required as we move from PN23 to PN10 and no explicit counting of the PEMS margin, which is higher for PN compared to gaseous pollutants.

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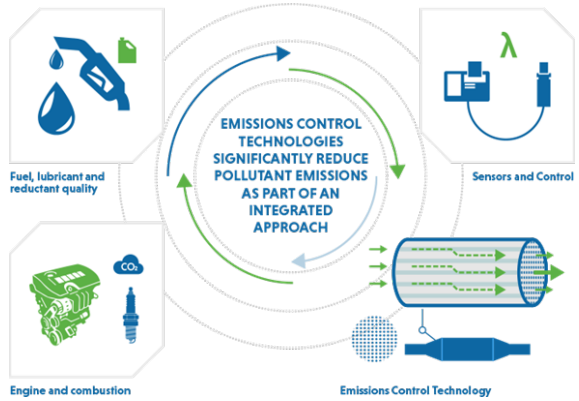
AECC demo data supports Euro 7 and CO_2 discussions

- 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 Well-to-Wheel CO_2 emissions



IPA IAV Concawe

IPA IAV DENSO CATALER BOSCH aramco PORSCHE

IPA FEV CORNING cefic sector group

Automotive Grade Urea Sector Group

NESTE aramco

AECC ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

Ignition

Engine load: 0 %

Vehicle speed: 0 km/h

500

0

NOx

2 ppm

30 s or 150 m to near-zero emissions

500

0

NOx

0 ppm

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

EHC

TWC

GPF

TWC

ASC

Engine catalyst heating

EHC heating

Closed-loop lambda control

THANK YOU !

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