

# 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  $\text{NH}_3$  and  $\text{N}_2\text{O}$ .

#### ➤ 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](#)<sup>1</sup>.

## Introduction

The European Commission released on 27 March 2020 a combined evaluation roadmap for the development of post-Euro 6/VI emission standards for cars, vans, lorries and buses. The emissions control industry that AECC represents, responded to the public consultation on [6 May 2020](#). AECC welcomes the opportunity to provide further input to the discussions in the Advisory Group on Vehicle Emission Standards (AGVES).

**AECC welcomes the EU Commission's legislative initiative to prepare a proposal for the next emission standards for cars, vans, lorries and buses. A new era for vehicle emissions control started under Euro 6/VI with the introduction of RDE (Euro 6d-TEMP) and PEMS testing (Euro VI-A) within the legislation, but there remain areas where improvements to the emission standards are required.**

Successive Euro emission standards have set stricter limits on the amount of pollutant emissions a vehicle can emit. Data from type approval and independent third party testing confirms Euro 6d-TEMP<sup>2,3</sup> and Euro VI-C<sup>4</sup> vehicles overall have low on-road emissions. But there remain areas where improvements to the emission standards are required. It is important to address these in a next emission standard because a combination of advanced combustion engine and electric power sources in various forms of hybrid and plug-in vehicles are predicted to dominate the powertrain mix beyond the next decade.

Euro 7/VII represents an opportunity to enhance the emissions performance of these powertrains, so they remain a part of the solution to improve the air quality in our cities and ensure the health and well-being of everyone. It should guarantee an economically and socially acceptable manner for European citizens to have mobility options which are accessible and affordable. No-one should be left behind, ensuring a just transition for the European industry and consumers.

AECC regularly demonstrates the emission reductions that are feasible through advanced emission control systems. The use of these technologies allows for progress towards zero-impact on air quality by ensuring low pollutant emissions in real world driving, including in the urban environment. This has been shown and demonstrated in real-world operation in [AECC technical projects](#)<sup>5</sup>. These technologies are already available and compatible with sustainable and renewable fuels. Therefore, they are part of the pathway towards zero emission and carbon-neutral mobility on a lifecycle basis in 2050. Moreover, and consistent with the circular economy principles, precious metals used in emission control catalysts can be recycled. Recycling rates are increasing, further contributing to the sustainability and affordability of future road vehicles. AECC is committed to the long-term 2050 objectives as expressed in the European Green Deal<sup>6</sup>.

## Overarching principles for Euro 7/VII

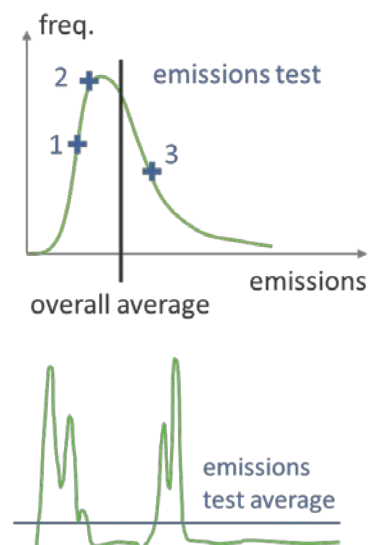
**AECC considers that next steps in the emission legislation should aim to fulfil the following overarching principles to improve European air quality and to ensure the health and well-being of everyone: to further focus on real-world emissions, to be fuel- and technology-neutral and to legislate according to a 'total system approach' using a 'whole vehicle' basis.**

### ➤ Further focus on real-world emissions

Supplementary consideration of actual real-world emissions is key. Euro 7/VII should build further on the success of Real Driving Emissions (RDE) for Euro 6d light-duty passenger cars and vans. 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. 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 citizens are protected from local poor air quality, particularly in urban and residential areas.

Actual mobile source usage in the European Union should be represented. Emissions fluctuate in real-world operation depending on the driving conditions, e.g. due to the impact of the ambient condition, the trip composition or the driving dynamics. Euro 7/VII should ensure that emission control systems are appropriate to handle such variation in real-world emissions. AECC acknowledges that imposing the same requirements up to the most extreme driving conditions might not be the best cost/benefit scenario but legislation must cover all conditions commonly experienced in populated areas to be effective, including road gradient changes, real acceleration rates and vehicle loadings.

For a realistic impact assessment of emissions on air quality and the exposure of individuals to vehicle emissions, additional effort is needed to legislate the actual tailpipe emissions without layers of exclusions and averaging. The reported test values need to accurately reflect actual tailpipe emissions. It is not possible to cover all aspects of real-world operation in one emissions test. Consequently, test-to-test variation should be allowed for different driving conditions. Each individual test should comply with the legislation, e.g. test 1-2-3 as illustrated here. Vehicle design will ensure the maximum value complies by taking into account the effect of the vehicle and its allowable mass, powertrain technology package, response to driving demands and the capability of the emission control system.



All data of each emissions test should be used and reported without exclusion or modification. Effective legislation must ensure that the remaining emission peaks are properly controlled by designing the testing protocol to apply appropriate averaging of emissions over the emissions test, or part of it. Important aspects to consider for appropriate averaging are, for example, separate evaluation for specific driving conditions (especially urban) on top of the total test average, definition of the minimum evaluation distance, etc. Challenging conditions should not be overcompensated by the rest of the test.

The actual measured data should be reported without applying normalisation for a variation in the driving conditions, accepting these will form a range of emission levels according to the route, traffic, weather and driver influence.

Emissions in urban environments need particular attention. The measurement framework should represent realistic city driving distances. Near-zero impact emissions are feasible for any modern powertrain as well as zero emissions for electrified (hybrid) powertrains using geo-fencing.

No matter whether the vehicle is a light- or heavy-duty one, the same general principles should apply. It is acknowledged that the actual approach might differ to cover real-world operation for each application, but this must not be used to allow disproportionate emission contributions from different sectors.

#### ➤ Fuel- and technology-neutral emission standards

The same procedures and limits should apply for each type of powertrain within an application, irrespective of engine technology (e.g. compression or positive ignition, direct or port-fuel injection), type of fuel (e.g. gasoline, diesel, CNG, LNG), and level of electrification (e.g. mild-hybrid, full hybrid, plug-in hybrid). Limits should be derived from air quality or individual exposure requirements to be truly neutral to allow free consumer choice and avoid market distortion.

Euro 7 should also aim for application-neutral stringency for every type of vehicle. There are differences between types of vehicles with respect to vehicle design and function, but 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. The most important common design criterium is the general set-up of the emission control system layout to have low emissions over a wide range of driving conditions. No matter whether it is a car, van, truck or bus, it is important the emission control system has a combination of



- Close-coupled catalysts for cold-start and low speed/load driving in the city incl. thermal management;
- Underfloor catalysts for high speed/load driving on the motorway;
- Appropriate total catalyst and filter volume to cope with peak engine pollutant flow.

Euro 7/VII requirements should ensure these criteria are equally important for all applications. The aim should be to have minimised pollutant emissions independent of type of vehicle. This does not per se mean that procedures and emissions metrics have to be the same, but there should be a way to judge the similar stringency despite these differences.

It has to be noted that some important harmful pollutants, such as ammonia (NH<sub>3</sub>) and sub-23 nm particles, as well as GHGs other than CO<sub>2</sub>, such as methane and N<sub>2</sub>O, are currently not considered in either pollutant emission or CO<sub>2</sub> legislations. The interplay of different components within the powertrain within an integrated approach, including

the usage of current emission control technologies, enable the decoupling of both types of emission and hence there is no technical contradiction between stringent standards for both harmful pollutants and GHGs. A complete set of limits, including for example currently non-regulated gases  $\text{NH}_3$  and  $\text{N}_2\text{O}$ , would be welcomed to provide a design guideline for pollutant emission control systems. The renewed Particulate Measurement Protocol (PMP) will enable the measurement and verification of the emissions of sub-23nm ultrafine particles at the vehicle tailpipe.

No matter what the powertrain technology is, the same overall performance requirements should apply for a holistic approach. Hybrid powertrains enable zero emissions driving in urban centres and low GHG and pollutant emissions otherwise. The electricity that is consumed by chargeable hybrid electric vehicles or electric vehicles has to be green and has to come from carbon-free or renewable sources. For the new and existing fleets, the use of more sustainable fuels and renewable e-fuels with the existing fuel infrastructure will have an immediate effect towards a low-carbon society. Recent and coming AECC projects investigate the capabilities of technologies and measures for vehicle emissions control to address the next step in emission standards. Test are conducted with conventional and 100% renewable fuels. Overall, a well-to-wheel approach should be used for comparison of technologies with a coverage of the entire lifecycle in the long term.

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

Euro 7/VII should consider the emissions that come out of the vehicle as emissions generated by a single system. This means that vehicle emissions should be below the limit, no matter what the powertrain technology package is. AECC believes it is the OEM responsibility with the support of its suppliers to ensure the correct technology package is put together to achieve the overall targets. With a focus on total vehicle emissions compliance, there would not be a need for compliance procedures for specific components, whether it is related to the combustion engine, electric motor, emissions control, gearbox, etc. A total system approach will also help to preserve neutrality and it will simplify the legislation. Less complex legislation would also eliminate possible loopholes and derogations. The natural response to avoid loopholes is to add procedures, but this actually increases the risk for extra loopholes. Removing procedures by focusing on a total system approach using actual tailpipe emissions would better address this. In other words, focus should be on the pollutant emissions that come out of the tailpipe and these should always be below the limit.

A total vehicle system approach needs to go hand in hand with a robust In-Use Compliance procedure, consisting of In-Service Conformity, Market Surveillance testing and Periodic Technical Inspection for the vehicle fleet on European roads.

Requirements should be consistent throughout the different legislative elements, from type approval up to the end of life. Tailpipe emissions have to be kept low during the lifetime of the vehicle. Several measures are to be taken for controlling the operation of the vehicle’s integrated emission control system such as vehicle system durability testing, on-board monitoring (OBM) using state-of-the-art sensors, periodic technical inspection, anti-tampering measures, high-quality replacement components and the use of remote sensing to identify emission outliers.

The interplay of all these measures during type approval, In-Service Conformity, Market Surveillance, and vehicle maintenance and inspection programs will be key to ensure lifetime compliance. All these measures need to go hand-in-hand with proper enforcement, which can handle evolving responsibilities over the life of the vehicle, beyond that of the OEM’s warranty, to ensure every vehicle on the road remains compliant.

The discussion about the durability requirement consists of three elements 1) defining the lifetime mileage as the vehicle design criteria; 2) stricter controls to ensure proper functioning of the vehicle system during its lifetime; and 3) strict measures to address vehicles that no longer meet emission requirements. Vehicle emissions should be considered in the same way as other safety features such as brakes and steering which must continue to function if the vehicle is allowed to be used.

## Roadmap for the next decade

AECC welcomes the ambition of the Commission to consider a comprehensive range of options to improve emission standards in one step but is also keen to ensure that complexity does not get in the way of implementation.

Successive Euro emission standards have promoted innovation in the design of emission control systems and led to substantial reductions in real-world vehicle emissions. Additional emission reductions are possible with technologies that are available today. Furthermore, the new Euro 7/VII legislation will drive further innovation within an integrated approach for e.g. catalyst and filter technology design, system layout design and system control. 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.

AECC considers two important aspects to be addressed for both light-duty and heavy-duty applications: 1) the definition of the real-world emissions measurement framework and 2) setting emission limits to ensure the health and well-being of everyone. The priority between modifying the measurement framework and emission limit reduction could change over the decade and differ between light- and heavy-duty depending on the Euro 6/VI starting point. Different steps could be taken as part of the roadmap for the next decade. These steps should be clearly defined from the beginning to provide direction to the automotive industry, enabling development to be planned in advance.

## Outlook and conclusions

AECC remains committed to support the legislators and decision makers with sound scientific and technical data to make informed decisions on the future Euro 7/VII emission standards.

Recent and ongoing AECC technical projects, conducted at reputable independent European test institutes and often in partnership with key industry players, demonstrate the technical feasibility of modern emission control systems. The AECC projects indicate the reduction levels of various pollutant emissions that are technically feasible today. These emission levels provide further benefits to society, while staying economically viable for the auto industry.

AECC will continue to provide robust scientific data and to facilitate informed discussions on how to improve local air quality whilst maintaining the global competitiveness of the European automotive industry through the further integration of modern emission control technologies within the vehicle powertrain system.

Should you need more information, you can contact AECC at [info@aecc.eu](mailto:info@aecc.eu).

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## References

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- <sup>6</sup> AECC Open letter on EGD  
<https://www.aecc.eu/wp-content/uploads/2020/01/200124-AECC-open-letter-on-Green-Deal.pdf>

*AECC is an international non-profit scientific association of European companies operating worldwide in the research, development, testing and manufacture of key technologies for emissions control. Their products are the ceramic substrates for catalysts and filters; catalysts (substrates with catalytic materials incorporated or coated); adsorbers; filter-based technologies to control engine particulate emissions; and speciality materials incorporated into the catalyst or filter. Members' technology is integrated in the exhaust emissions control systems of cars, commercial vehicles, buses, non-road mobile machinery and motorcycles in Europe. More information on AECC can be found at [www.aecc.eu](http://www.aecc.eu) and [www.dieselinformation.aecc.eu](http://www.dieselinformation.aecc.eu).*

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