

NEWSLETTER

International Regulatory Developments

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EUROPE

State of the European Union Speech

On 13 September, European Commission President von der Leyen gave the annual State of the European Union (SOTEU) address in the European Parliament.

With regard to the European Green Deal, Ms von der Leyen stated that the Commission remains committed, will stay ambitious and will stick to its growth strategy while striving for a fair and just transition.

She said the European Green Deal provides the necessary frame, incentives and investment. A series of Clean Transition Dialogues will start with industry from September, with the core aim being to support every sector in building its business model for the decarbonisation of industry.

The Commission President went on to say that fairness in the global economy is important and entire industries and communities depend on it. Referring specifically to the electric vehicles sector, she said it is a crucial industry for the clean economy, with a huge potential for Europe. But global markets are now 'flooded' with cheaper Chinese electric cars whose price is kept artificially low by huge state subsidies.

As this is distorting the EU market, Ms von der Leyen announced that the Commission is launching an anti-subsidy investigation into electric vehicles coming from China.

The SOTEU address can be read in full at ec.europa.eu/commission/presscorner/detail/en/speech.

European Council Position on Euro 7

On 25 September 2023, the European Council adopted its position ('General Approach') on the proposed Euro 7 regulation for the type-approval of motor vehicles and engines, and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability.

The press release states that Europe's 'position is to continue the path of leading the mobility of the future and adopting realistic emissions levels for the vehicles of the next decade while helping our industry make the definitive leap towards clean cars in 2035.' It goes on to say that 'The Spanish presidency has been sensitive to the different demands and requests of the member states and we believe that, with this proposal, we achieved broad support, a balance in the investment costs of the manufacturing brands and we improve the environmental benefits derived from the regulation.'

Commenting that the Council position strikes a balance between stringent requirements for vehicle emissions and additional investments for the industry, at a moment when European car manufacturers are undergoing a transformation towards the production of zero-emission cars, the release

confirms that the general approach keeps the existing emission limits and test conditions for light-duty vehicles. In the case of heavy-duty vehicles, emission limits are lower and test conditions 'slightly adjusted'.

Key: PI = Positive Ignition, CI = Compression Ignition

Table 2: Euro 7 exhaust emission limits for M₁, M₂, N₁ and N₂ vehicles with internal combustion engine and internal combustion engines used in those vehicles

Pollutant emissions	WHSC (CI) and WHFC (CI and PI)	Cold emissions ²¹	Hot-emissions ²²	Emission budget for all trips less than 3*WHFC-long	Real Driving Emissions (RDE)	Optional idle emission limits ²³
	per L/kWh				per L/kWh	per L/kWh
NO _x in mg	220	350	90	150	200	5000
PM in mg	8	12	8	10	-	-
PN ₁₀ 23 in #	6 x 10 ¹¹	5 x 10 ¹¹	2 x 10 ¹¹	3 x 10 ¹¹	9 x 10 ¹¹	-
CO in mg	1500	2500	200	2700	1950	-
NMOC in mg	80	200	50	75	105	-
NH ₃ in mg	65	65	65	70	85	-
CH ₄ in mg	500	500	250	500	650	-
NO in mg	200	160	100	140	260	-
HCHO in mg	30	30	30	-	40	-

Euro 7 also contains a special provision on urban buses to ensure coherence with the newly proposed 2030 zero-emissions target for these vehicles.

This General Approach formalises the Council's negotiating position. It provides the Council presidency with a mandate for negotiations with the European Parliament, which will start as soon as the Parliament adopts its position.

The press release is available to read at consilium.europa.eu/en/press/pr/2023/09/25/euro-7-council-adopts-position-on-emissions-from-cars-vans-buses-and-trucks/ with the Council's General Approach at data.consilium.europa.eu/doc/document/ST-13084-2023-INIT/en/pdf.

Revised Date for ENVI Committee Vote on Euro 7 Proposal

On 6 September 2023, the Environment (ENVI) Committee of the European Parliament revised the date of its debate and vote on the proposal for type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7) and repealing Regulations (EC) 715/2007 and (EC) 595/2009.

The EP's ENVI committee will now consider the dossier on 12 October. The plenary vote is expected during the session in Brussels on 8 and 9 November 2023.

The updated ENVI document (see page 13) is at europarl.europa.eu/cmsdata/274408/envi-work-in-progress-06092023.pdf.

Adoption of Position on Air Quality in European Parliament

On 13 September 2023, the European Parliament adopted its position on a revised law to improve air quality in the EU in order to achieve a clean and healthy environment for European citizens.

363 MEPs voted in favour, 226 against and 46 abstained on the vote which sets a stricter 2035 limit and target values for several pollutants including particulate matter (PM2.5,

PM10), NO₂ (nitrogen dioxide), SO₂ (sulphur dioxide) and O₃ (ozone). The new rules would ensure air quality in the EU is not harmful to human health, natural ecosystems and biodiversity and would align EU rules with the most recent World Health Organization (WHO) Air Quality Guidelines. MEPs also stress that the air quality standards proposed by the Commission should be an intermediate objective to be reached as soon as possible, and by 2030 at the latest.

The text underlines the need to increase the number of air quality sampling points. MEPs also want to harmonise currently fragmented and unintuitive air quality indices across the EU. Indices must be comparable, clear and publicly available, with hourly updates so citizens can protect themselves during high levels of air pollution (and before obligatory alert thresholds are reached).

MEPs propose that in addition to air quality plans, which are required when EU countries exceed limits, all member states would also have to create air quality roadmaps that set out short- and long-term measures in order to comply with the new limit values.

Parliament is now ready to start negotiations with Council on the final shape of the law.

The Parliament's press release can be found at europarl.europa.eu/news/en/press-room/20230911IPR04915/air-pollution-meps-want-strict-limits-to-achieve-zero-pollution.

TRAN Committee Vote on Heavy-Duty CO₂ Standards Regulation

On 19 September 2023, the Transport and Tourism (TRAN) Committee of the European Parliament voted on the published compromise amendments (CAs) on the Regulation strengthening CO₂ emission performance standards for heavy-duty vehicles.

The committee voted on the CAs, accepting CA1, CA2A, CA3A, CA4A, CA5A, CA6A and CA6. These include proposals to recognise the role of sustainable renewable fuels via a Carbon Correction Factor (CCF), and to reduce the ambition of CO₂ reduction. These would be reduced by 30% from 2030, 50% from 2035 and 75% from 2040. For urban buses, the proposed share of zero-emission vehicles is 80% from 2030, progressively resulting in 100% in line with the market and the enabling conditions.

The TRAN amendments also specify that infrastructure should be in place to ensure vehicle manufacturers can achieve these targets, and that there should be no penalties for failing to meet targets if it is not in place.

TRAN's compromise amendments were passed by 29 votes to 11, with three abstentions.

The TRAN compromise amendments are at europarl.europa.eu/meetdocs/2014_2019/plmrep/COMMITTEES/TRAN/DV/2023/09-18/Compromiseamendments-HDVs_EN.pdf.

European Parliament Approval of Renewable Energy Directive

On 12 September 2023, the European Parliament voted to approve the update of the Renewable Energy Directive (RED). This raises the share of renewables in the EU's final energy consumption to 42.5% by 2030. Member States should strive to achieve 45%.

In the transport sector, renewables deployment should lead to a 14.5% reduction by 2030 in greenhouse gas emissions, by using a greater share of advanced biofuels and a more ambitious quota for renewable fuels of non-biological origin, such as hydrogen.

The legislation was adopted with 470 votes to 120, with 40 abstentions. It will now have to be formally endorsed by Council in order to come into law.

The European Parliament press release is at europarl.europa.eu/news/en/pressroom/20230911IPR04926/meps-back-plans-to-boost-use-of-renewable-energy.

Publication of Alternative Fuels Infrastructure Directive

On 22 September 2023, Regulation 2023/1804 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94 was published in the Official Journal of the European Union (for details see AECC Newsletter of July 2023).

The Regulation will enter into force 20 days after publication and shall apply from 13 April 2024.

The full text of the Regulation can be found at eurlex.europa.eu/legalcontent/EN/TXT/?uri=uriserv%3AOJ.L_.2023.234.01.0001.01.ENG&toc=OJ%3AL%3A2023%3A234%3.

UK Delay to Phase-Out of ICE Cars

On 20 September 2023, the UK Prime Minister Rishi Sunak announced that the government is "going to ease the transition to electric vehicles." He said that he is "aligning our approach with countries like Germany, France, Spain, Italy, Australia, Canada, Sweden, and US states such as California, New York and Massachusetts", meaning that there will no longer be a requirement that only hybrid or battery electric vehicles will be available for sale from 2030.

On 28 September, the government set out the percentage of new zero emission cars manufacturers will be required to produce each year up to 2030. The zero emission vehicle (ZEV) mandate means the country will have what the government describes as the most ambitious regulatory framework for the switch to electric vehicles (EVs) in the world. This requires 80% of new cars and 70% of new vans sold in Great Britain to be zero emission by 2030, increasing to 100% by 2035.

Mr Sunak’s speech can be read in full at [gov.uk/government/speeches/pm-speech-on-net-zero-20-september-2023](https://www.gov.uk/government/speeches/pm-speech-on-net-zero-20-september-2023).

The subsequent clarification is at [gov.uk/government/news/government-sets-out-path-to-zero-emission-vehicles-by-2035](https://www.gov.uk/government/news/government-sets-out-path-to-zero-emission-vehicles-by-2035).

NORTH AMERICA

Vote in US House of Representatives on ICE Phase-Out

On 14 September 2023, the US House of Representatives on Thursday passed a bill targeting states’ efforts to phase out gas-powered cars.

The legislation, which passed the House 222-190, would bar states from limiting the sales of gasoline-powered cars and rescind any federal approvals for states to do so that were issued since the start of 2022.

The bill does not explicitly mention California, however, under the Clean Air Act, the state can pursue clean car rules that are stricter than those from the federal government if they get permission from the Environmental Protection Agency (EPA).

Despite its House passage, the Republican-led legislation is not expected to advance or become law. It would face opposition in the Democratic-led Senate, and on 12 September the White House released a statement outlining its opposition. The statement says that the Administration ‘strongly opposes’ passage of H.R. 1435. It goes on to say that ‘Congress acted to preserve California’s authority to regulate emissions from vehicles over 50 years ago and repeatedly ratified and strengthened that authority in subsequent enactments. Congress protected the state’s authority to address its unique and ongoing air quality challenges and to give other states the option to adopt the innovative clean car and truck technologies California pioneered. H.R. 1435 would restrict the ability of California and its citizens to address its severe air pollution challenges.’

Further information is available at thehill.com/policy/energy-environment/4204977-house-passes-bill-targeting-californias-ev-mandate/, and whitehouse.gov/wp-content/uploads/2023/09/HR-1435-SAP.pdf.

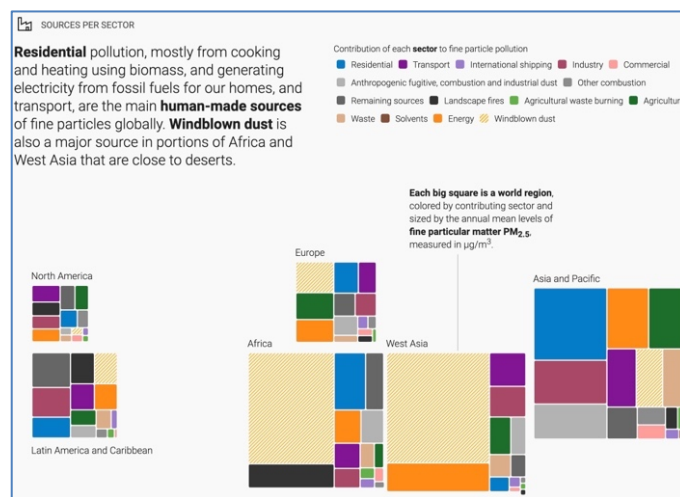
UNITED NATIONS

International Day of Clean Air for Blue Skies

The UN’s International Day of Clean Air for blue skies took place on 7 September 2023.

Under the banner #TogetherForCleanAir, the UN stressed the need to build multistakeholder partnerships, bolster investment and embrace our shared responsibility to address air pollution.

Throughout the day, the International Day of Clean Air for blue skies website featured updates focusing on the ways to reduce air pollution, the sources, health impacts and measurement of pollution, and initiatives that are helping to improve air quality.



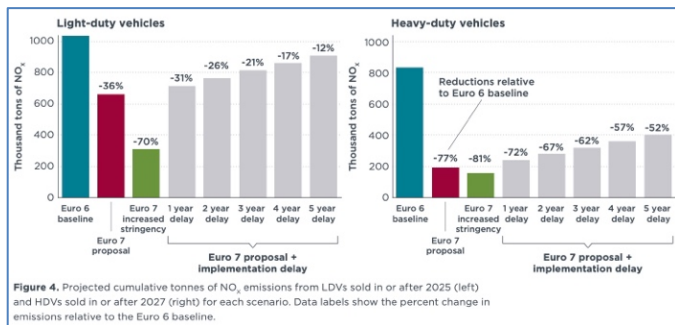
Further information can be found at cleanairblueskies.org/latest/featured-updates.

GENERAL

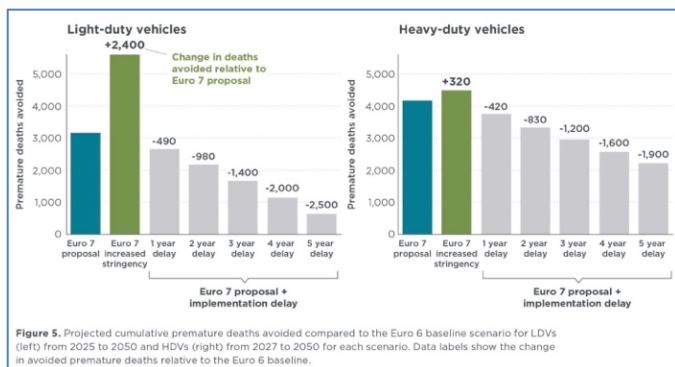
ICCT Briefing on Public Health Benefits from Timely Euro 7 Standards

On 11 September 2023, the International Council on Clean Transportation (ICCT) published a briefing modelling the emission reductions and health benefits from implementing Euro 7 as proposed, with increased stringency, and under a delayed implementation schedule.

The analysis finds that implementing the European Commission proposal for Euro 7 would avoid approximately 1 million tonnes of NO_x from light- and heavy-duty vehicles through 2050. These reductions would avoid 7 200 premature deaths until 2050, with 56% attributed to reductions in emissions from heavy-duty vehicles. The analysis also finds that each year of implementation delay would lead to approximately 900 additional premature deaths. A delay in line with the proposals from the Environment Committee in the European Parliament would lead to an additional 1,800 premature deaths.



Added stringency, in line with the upper ambition of the impact assessment that accompanied the original Euro 7 proposal, could avoid totals of 5 500 premature deaths from light-duty vehicle emissions and 4 400 premature deaths from heavy-duty vehicle emissions. The additional benefits from increased stringency for light-duty vehicles are larger since the current proposal is comparatively less stringent to the proposal for heavy-duty vehicles.



The full briefing document can be downloaded from theicct.org/publication/euro7-premature-deaths-sep23/.

ICCT Briefing on Relative Stringency of European Commission Euro 7 Proposal

On 25 September 2023, the International Council on Clean Transportation (ICCT) published a briefing paper presenting an international comparison of the stringency of the Euro 7 limits proposed for cars and vans with the rules applicable in the United States and China.

ICCT translated Euro 7, US Tier 3 final, and China 6b emission limit values into comparable units for light-duty vehicles. This shows that the combined NO_x+NMHC limit put forth by the European Commission for Euro 7 light-duty vehicles of 128 mg/km is 2.9 times weaker than the US Tier 3 final limit.

Unlike for Euro 7, the US standards do not require emission compliance demonstration in real-driving tests. Instead, it says more demanding laboratory tests are performed. China 6b is more than 1.8 times more stringent for cars and 1.2 times more stringent for large vans than the Euro 7 proposal, with both regulations requiring emissions compliance demonstration in the laboratory and during real driving.

Table 1. Emission limits for passenger cars and vans of the current Euro 6 regulation, proposed Euro 7 regulation, impact assessment policy options, U.S. Tier 3, and China 6b.

Emission species and limits in mg/km	Euro 7 impact assessment policy options		Euro 6 ^c	Euro 7 proposal	U.S. EPA Tier 3 final	China 6b ^f
	PO2a/PO3a	PO2b				
NO _x + NMHC	75 ^a	45 ^b	128-190 ^d	128	SFTP ^e : 44 ^{g,h}	70-105
Particulate matter (PM)	2	2	4.5	4.5	US06 ⁱ : 3.7	3
Particle number (PN10) ^h	1.0e11	1.0e11	6.0e11 ^h	6.0e11	N/A	6.0e11 ^h
Carbon monoxide (CO)	400	400	500-2,270	500	SFTP ^e : 2,610	500-740
Formaldehyde (HCHO)	5	5	N/A	N/A	2.5	N/A

Notes: Under U.S. Tier 3, the sum of NO_x and hydrocarbon emissions are limited. For comparison, the equivalent limits for EU and China are calculated from separate NO_x and hydrocarbon limits.

^a Unit of PN limit is #/km; ^b NO_x + Non-methane organic gases (NMOG); ^c Ranges indicate different limits for different engine technologies, fuel types, and applications (cars, large and small vans); ^d Euro 6 sets no NMHC limit for diesel engines. Therefore, only values for petrol vehicles are shown; ^e Includes only particles down to 23 nm (PN23); ^f Supplemental Federal Test Procedure; ^g Equivalent limit for internal combustion engine vehicles assuming a battery electric vehicle fleet share of 30%; ^h For the more demanding US06 emission test, more lenient emission limits apply than for the Federal Test Procedure test; ⁱ Ranges indicates different limits for cars, small and large vans.

The ICCT briefing concludes that the Euro 7 proposal does not tighten the emission limits to match those in the United States and China. It says the proposed Euro 7 regulation still includes important provisions that would lead to modest emission reductions, but for Euro 7 to successfully drive cost-effective technologies to the market, it is advisable to consider NO_x emission limits akin to those found in other jurisdictions and to preserve all elements included in the Euro 7 proposal.

The ICCT briefing can be found at theicct.org/publication/euro-7-comparison-cars-vans-united-states-china-sep-23/.

NGO Reactions to Council Position on Euro 7

On 25 September 2023, Transport & Environment (T&E) reacted to the European Council's general approach on Euro 7, calling it a 'disaster for air quality'.

T&E says that the severely weakened proposals agreed by ministers will do nothing to improve air quality and the health of European citizens. Instead, it claims it will allow the automotive industry to greenwash cars as 'clean Euro 7' while still running on 'highly polluting' Euro 6 technology.

The NGO adds that MEPs have the final opportunity to set a meaningful Euro 7 regulation and they 'should not squander it for the sake of everyone's health.'

The T&E press release is at transportenvironment.org/discover/te-reaction-ministers-position-on-euro-7-a-disaster-for-air-quality/.

POLIS and EUROCITIES published their response to the Council's position, stating why they think the Euro 7 standards are crucial to delivering cleaner air in cities.

After looking at the impact of air pollution on health, the policy context and the contribution of vehicle emissions to air pollution in cities, the NGOs present key arguments for a more ambitious Euro 7. The document says that Euro 7 is essential to allow public authorities to attain the future EU air quality standards, recently voted for by the European Parliament (see above). It also says that Euro 7 is a matter of public health, bringing an important opportunity to decrease the negative health, social and well-being effects of

transport-related air pollution. Discussing what it calls the ‘erroneous Euro 7/electromobility dichotomy’, POLIS and EURO CITIES say it is important to ensure that the emissions levels of vehicles in countries where the average age of fleets can be 14-16 years are as low as possible. They then explain that the exemption for vehicles running exclusively on e-fuels could offer a route for automakers to keep selling combustion engine vehicles after 2035, thus bringing even more need to a strong Euro 7.

The POLIS and EURO CITIES document is at polisnetwork.eu/wp-content/uploads/2023/09/EURO-7-Report-Final.pdf.

ICCT Blog on Contribution of Truck and Bus CO₂ Standards to EU Climate Goals

On 28 September 2023, the International Council on Clean Transportation (ICCT) published a blog on the proposed European CO₂ standards for trucks and buses, saying that they do not align with Europe’s climate goals.

ICCT explains that, by its analysis, Europe’s current CO₂ standards for trucks trim emissions from the heavy-duty sector by about 2% below 1990 levels. Its latest projections of the effect of proposed changes show a 69% reduction in heavy-duty sector emissions by 2050 relative to 1990. This compares to the 90% target.

The report goes on to consider the positions of the various groups in the European Parliament.

Political party	2025	2030	2035	2040
Current standards	15%	30%	30%	30%
EC proposal	15%	43%	64%	90%
Greens	15%	64%	95%	100%
The Left	15%	64%	95%	100%
S&D	15%	59%	79%	100%
Renew	15%	49%	70%	95%
EPP	15%	43%	64%	90%
ID	15%	30%	50%	70%
ECR	15%	30%	50%	70%

Table 1. CO₂ emission reduction targets for trucks and coaches in Europe by political party

After taking into account other proposals by each of the political parties, ICCT concluded that proposals by The Greens, The Left, and S&D would reduce emissions in the heavy-duty sector by nearly enough to approach the 90% mark. This is thanks to increased targets and to the extension

of standards to cover vocational vehicles (i.e., not-for-delivery vehicles, like construction and refuse collection vehicles). While vocational vehicles were excluded from the Commission’s original proposal, they are the only non-regulated vehicle type that already reports their emissions. According to ICCT, that means they are well positioned to be included in the standards.

Renew’s proposal roughly aligns with the most ambitious targets considered by the Impact Assessment accompanying the European Commission’s proposal, but ICCT says it would only reduce emissions by 77%, short of the 90% target. Renew also wants to include vocational vehicles, although with slightly lower targets than the other parties.

Proposals by ECR and ID would allow much more emissions than the Commission’s proposal; a proposed 69% reduction in 2050 drops to only 24%. Focusing on the biggest party in Parliament, the European People’s Party (EPP), ICCT states that the EPP does not look to change targets for trucks (although they do want to reduce the target for trailers). Instead, together with the ECR and ID parties, it seeks to include what ICCT describes as a contentious new flexibility called the Carbon Correction Factor (CCF). The CCF would reduce the emissions of every diesel and natural gas vehicle by the share of so-called CO₂ neutral diesel (e.g., biodiesel) or renewable methane, respectively, in the total European road sector.

The ICCT blog can be found at theicct.org/blog-proposed-co2-standards-for-hdvs-eu-parliament-climate-goals-sept23/.

State of Global Air Report on Health Costs of Air Pollution in South Asia

On 11 September 2023, the Health Effects Institute (HEI) published a State of Global Air (SOGA) report on the health and economic costs of air pollution in South Asia.

The report highlights nitrogen dioxide (NO₂) as a pollutant of concern in South Asia, with exposure increasing by 22% between 2000 and 2019, while global averages decreased by 5%. It says this increase is likely driven by a reliance on fossil fuels for energy production, expanded industrial activity, and increases in the numbers of passenger vehicles over the last decade.

HEI’s report adds that PM_{2.5} exposures in South Asian cities are among the highest in the world.

The document concludes by saying that targeted interventions are under way to address key sources, including tackling emissions from vehicles.

The SOGA snapshot can be found at stateofglobalair.org/sites/default/files/documents/2023-09/soga_reg_aq_snapshot_9-11-23_final.pdf.

RESEARCH SUMMARY

Effects of Emissions and Pollution

Relationships between morphology and optical properties of vehicle-emitted soot, Magín Lapuerta, et al.; *Journal of Aerosol Science* (November 2023), Vol. 174, 106261, [doi: 10.1016/j.jaerosci.2023.106261](https://doi.org/10.1016/j.jaerosci.2023.106261).

Chemical and oxidative properties of fine particulate matter from near-road traffic sources, Nagendra Raparathi, et al.; *Environmental Pollution* (November 2023), Vol. 337, 122514, [doi: 10.1016/j.envpol.2023.122514](https://doi.org/10.1016/j.envpol.2023.122514).

Emissions from modern engines induce distinct effects in human olfactory mucosa cells, depending on fuel and aftertreatment, Laura Mussalo, et al.; *Science of The Total Environment* (December 2023), Vol. 905, 167038, [doi: 10.1016/j.scitotenv.2023.167038](https://doi.org/10.1016/j.scitotenv.2023.167038).

Air Quality, Sources and Exposure

The spatial-temporal exposure to traffic-related Particulate Matter emissions, Asjad Naqvi, et al.; *Transportation Research Part D: Transport and Environment* (October 2023), Vol. 123, 103899, [doi: 10.1016/j.trd.2023.103899](https://doi.org/10.1016/j.trd.2023.103899).

FORTHCOMING CONFERENCES

Aachen Colloquium Sustainable Mobility

9-11 October 2023, Aachen, Germany
aachener-kolloquium.de/en/attend/speaker/call-for-papers.html

FEV Zero CO₂ Mobility Conference

7-8 November 2023, Berlin, Germany
fev-live.com/zero-co2-mobility

Heavy-Duty, On- and Off-Highway Engines

7-8 November 2023, Nuremberg, Germany
atlive.de/en/events/heavy-duty-on-and-off-highway-engines

European E-fuels Conference

8-9 November 2023, Dusseldorf, Germany
wplgroup.com/aci/efue4-mkt-agenda

POLIS Annual Conference

29-30 November 2023, Leuven, Belgium
polisnetwork.eu/2023-annual-polis-conference

IMEchE Powertrain Systems for a Sustainable Future conference 2023

29-30 November 2023, London, United Kingdom
events.imeche.org/ViewEvent?code=CON7568#msdyntrtid=P31DYp9_uO9BcgMpB1eDYE_yyLahi1N1sHvWz0Zd1JU

International Engine Congress

27-28 February 2024, Baden-Baden, Germany
atlive.de/en/events/international-engine-congress/information/information-for-speakers/call-for-papers/

45th International Vienna Motor Symposium

24-26 April 2024, Vienna, Austria
wiener-motorensymposium.at/en

SIA Powertrain International Conference

19-20 June 2024, Lille, France
event.fourwaves.com/79651605-96c9-454f-9129-fe5986450f40/pages

Deadline for abstracts 6 November 2023

Emissions Control, Catalysis, Filtration

Multi-objective optimization study of hydrothermal aging on NO_x-assisted soot catalytic combustion and secondary pollution emission in regeneration of CeO₂ catalytic diesel particulate filter, Zonglin Li, et al.; *Thermal Science and Engineering Progress* (October 2023), Vol. 45, 102101, [doi: 10.1016/j.tsep.2023.102101](https://doi.org/10.1016/j.tsep.2023.102101).

Transport, Climate Change & Emissions

Outlooks for zeolite catalysts in a low-carbon scenario, David Serrano, et al.; *Catalysis Today* (January 2024), Vol. 426, 114365, [doi: 10.1016/j.cattod.2023.114365](https://doi.org/10.1016/j.cattod.2023.114365).

A critical review of the current state of circular economy in the automotive sector, Georg Prochatzki, et al.; *Journal of Cleaner Production* (in press), [doi: 10.1016/j.jclepro.2023.138787](https://doi.org/10.1016/j.jclepro.2023.138787).

Life Cycle Assessment of a novel functionally integrated e-axle compared with powertrains for electric and conventional passenger cars, Michael Koroma, et al.; *Science of The Total Environment* (December 2023), Vol. 904, 166860, [doi: 10.1016/j.scitotenv.2023.166860](https://doi.org/10.1016/j.scitotenv.2023.166860).