L-vehicles Emissions and Noise mitigation Solutions

D2.11

List of scientific papers & presentations to international conferences/events

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Executive summary

This deliverable provides an overview of LENS' dissemination activities, documenting the publications produced and events attended throughout the project period. It catalogues peer-reviewed articles and conference papers that disseminate project findings to the research community, as well as scientific conferences, workshops and stakeholder meetings where LENS presented its work and engaged with relevant audiences. By tracking these activities, the deliverable demonstrates how the project has actively shared the knowledge created within LENS, ensuring that research outcomes reach and benefit the wider scientific communities, in line with the project's communication and dissemination objectives.

1 Aim of this deliverable

Throughout the project period, LENS undertook extensive dissemination activities. As a research project, particular emphasis was placed on scientific publications and participation in relevant events. This document provides an overview of all publications produced throughout the project lifecycle and highlights the main conferences, workshops, and forums where the project was promoted and stakeholders were engaged with.

Further dissemination and exploitation information can be found in supplementary project deliverables, which are also published simultaneously with this deliverable:

- D2.13, the Legacy Exploitation Plan, outlines strategies for knowledge utilisation and exploitation beyond the project's conclusion, following a summary of the main achievements
- D2.14, 'A LENS on Noise and Emissions of L-Category Vehicles', is the project's final brochure. It presents the main recommendations alongside a concise overview of the measurements and results for a broader audience.

All dissemination activities, including events and publications, have been systematically reported through the EU Funding and Tenders Portal, where communication key performance indicators are tracked and documented. The content and strategic approach presented in this deliverable build upon the frameworks established in D2.2, '*Draft Plan for Dissemination and Exploitation Including Communication*' and D2.7, '*Final Plan for Dissemination and Exploitation Including Communication*', which together guided the project's communication strategy from inception to completion.

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2 List of events

The following sections provide detailed descriptions of all the events at which LENS was represented throughout the project period. These include 22 international and European conferences, workshops and forums, as well as six national events. Each event is outlined in terms of its date and location, the specific contribution of LENS, and the audience reached.

2.1 Description of international events

Throughout the lifetime of the LENS project, the consortium attended 21 European and international events. This ensured that the knowledge generated within the project was disseminated to relevant scientific, industry, and policy audiences across multiple disciplines and geographical regions.

The project made its first public appearance at the 1st International "Motorcycle Noise Pollution" conference in Aachen, Germany, on 30 April 2023. Organised by residents' groups and municipalities from the Netherlands, Belgium, and Germany, this event addressed the growing concern of motorcycle noise pollution and advocated for harmonised European standards. LENS presented an overall overview of the project, its aims, and methodology to an audience of approximately 50 participants.

Between 20 and 22 June 2023, LENS participated in the ETH Nanoparticles Conference (NPC) in Zurich, Switzerland. This interdisciplinary platform brought together 400 representatives from research, industry, and legislation to discuss all aspects of nanoparticles, from emission sources to health and environmental impacts. The LENS presentation, "*Roadside detection of excess particle emitters: practical limits & potential for 'garage-grade' instruments"*, contributed to discussions on technical mitigation and particle legislation.

From 3 to 8 September 2023, the project was represented at the European Aerosol Conference in Malaga, Spain, where the presentation "*Practical limits and low-cost options of high emitter detection through roadside particle measurements*" reached an audience of 1,100 scientists, engineers, and researchers engaged in aerosol science and technology.

On 28 November 2023, LENS participated in the 2023 ERMES (European Research for Mobile Emission Sources) plenary online event. The presentation "*Measuring emissions and noise from motorcycles: the LENS project*" introduced the project to 30-50 experts working on mobile emissions and low-carbon mobility, fostering collaboration within this specialised research community.

The Small Powertrains and Energy Systems Technology (SETC), which took place from 31 October to 2 November 2023 in Minneapolis, United States, provided a global platform for the project. LENS delivered two presentations: "*A PN-Measurement System for Small Engine Applications*" and "*Exhaust*

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Aftertreatment Technologies for PN Reduction of Motorcycles," engaging with 250 OEMs, suppliers, and engineers focused on small engine performance and emissions reduction.

From 20 to 21 February 2024, the project contributed to the GAeF START 2024 Revival of Schwebstofftechnische Arbeitstagung in Vienna, Austria. This scientific exchange platform for the aerosol research community heard the LENS presentation *"An Approach for the Roadside Measurement of Particulate Emissions of Category-L Vehicles by Point Sampling"*, reaching approximately 50 attendees.

The Transport Research Arena (TRA) 2024 from 15 to 18 April in Dublin, Ireland, represented one of the project's largest outreach opportunities, with 4,000 participants. LENS presented "*Extent of L-vehicles tampering and impact on noise and emissions*" at Europe's largest transport research and innovation conference, facilitating exchange between research, industry, and policy stakeholders across all transport modes.

From 5 to 7 February 2024, LENS participated in Road Transport Research (RTR) 2024 in Brussels, Belgium, presenting "*Real world driving conditions & testing requirements*" to an audience of 700. This conference showcased accomplishments of EU-funded projects in road transport, demonstrating how European research advances sustainable and intelligent mobility.

The 13th Annual International Onboard Sensing, Analysis, and Reporting (OSAR) Conference in Riverside, California, attracted 1,000 participants on 14 March 2024. LENS contributed with the presentation "*Evaluation of a Miniaturised Exhaust Emission Measuring System for L-Category Vehicle Measurements in Real-World Driving Condition"*, addressing the conference theme of driving change for cleaner air through on-board sensing technologies.

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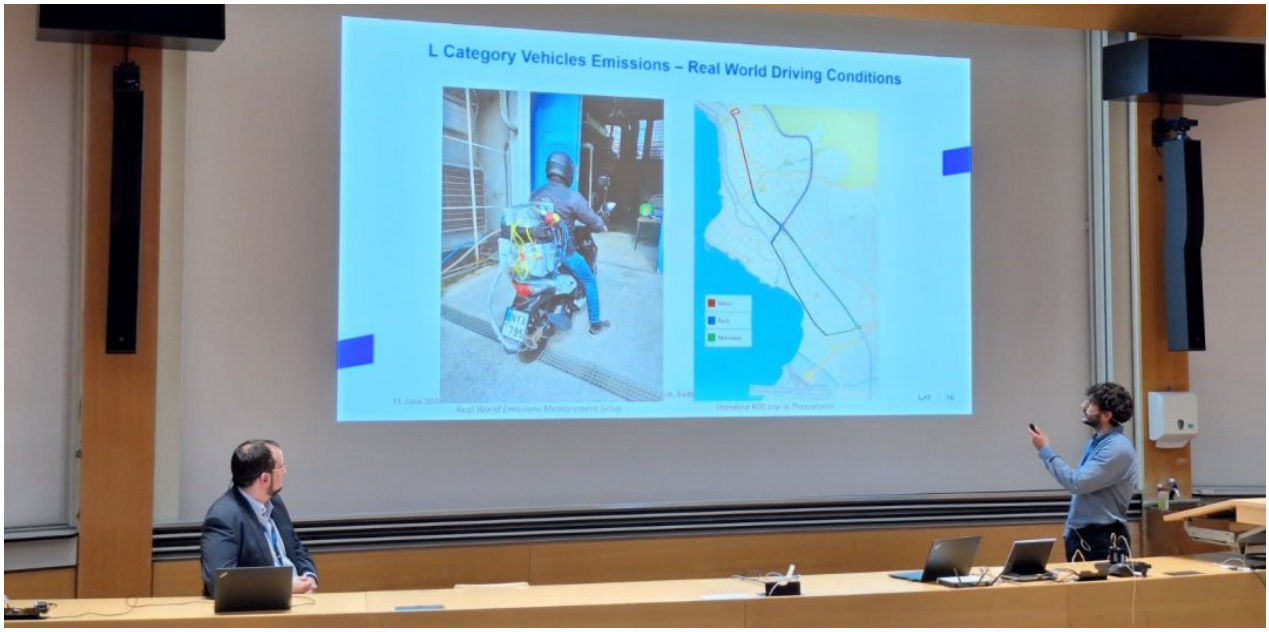
Between 25 and 29 August 2024, LENS presented "*Noise monitoring of loud vehicles in four Dutch cities*" at the Internoise Conference 2024 in Nantes, France. This leading international forum for acoustics and noise control, attended by 500 experts, provided an opportunity to share the project's work on sound management and quality of life enhancement.

The project returned to the ETH Nanoparticles Conference (NPC) in Zurich between 10 and 14 June 2024, presenting two papers: "*Evaluation of a miniaturised exhaust emission measuring system for L category Vehicles measurements in real world driving conditions*" and "*Assessment of pollutant emissions including ultrafine particles down to 10nm of high-performance motorcycles – lab and real-world evaluation using advanced PEMS technology*" to an audience of 400 participants.



At the European Aerosol Conference in Tampere, Finland, on 25 to 30 August 2024, LENS contributed three posters: "*Evaluation of Photoacoustic Sensors for Roadside Black Carbon Measurements and Comparison to an Aethalometer*", "*Cycle-Based and Real Driving Particle Number Emissions of Category-L Vehicles*", and "*Roadside Particle Measurement of Category-L Vehicles by Point Sampling*", engaging with the conference's broad aerosol research community.

The Small Powertrains and Energy Systems Technology (SETC) conference in Bangkok, Thailand, in 4 to 7 November 2024 featured two LENS presentations: "*RDE Methodology Development for Motorcycle Emissions Assessment*" and "*Statistical Modelling-Based Approach for Exhaust Mass Flow Calculation in Motorcycles*", reaching 300 participants from the global automotive engineering community.

Later that month, LENS presented "*Investigation of Noise-Intensive Driving Patterns under Real Driving Conditions*" at the Aachen Acoustics Colloquium between 25 and 27 November in Germany. This

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event brought together 200 experts to share knowledge on methods and technologies for improving vehicle acoustics and reducing vibrations.

The POLIS Conference happening at the same time in Karlsruhe, Germany, provided a platform to present "*Tackling noise- and air pollution through the LENS of light vehicles*" to around 80 attendees. As Europe's leading event on sustainable urban mobility, this conference enabled engagement with cities, regions, and decision-makers from the public and private sectors.

On 25 February 2025, LENS participated in the UNECE GRBP Task Force Vehicle Sound meeting in Geneva, Switzerland, presenting "*Loud vehicle monitoring in four Dutch cities and mitigation options*" to about 100 participants. This sub-group of the Working Party on Noise and Tyres is responsible for reviewing vehicle sound emissions and developing proposals to improve international noise regulations.

The EGU 2025 conference from 27 to 30 April in Vienna, Austria, attracted 18,000 geoscientists in April 2025. LENS presented "*Potential of on-board FTIR as a single instrument for simultaneous measurement of all gaseous pollutants of interest under real-driving conditions*", demonstrating the project's relevance to Earth and planetary sciences.

Once again, the project participated in the ETH Nanoparticles Conference (NPC) between 16 to 19 June 2025, LENS presented "*On-road PN and BC emission measurements of L-category vehicles*" to 400 participants, maintaining the project's presence in this key forum for nanoparticle research.

The COPERT Webinar between 30 to 31 October 2025 provided an online platform for LENS to present "*How innovative data and methodologies from LENS contribute to the continuous evolution of COPERT tools and environmental assessment*" to 100 participants. COPERT serves as the EU standard vehicle emissions calculator, making this presentation particularly relevant for policy implementation.

The Transport and Pollution Conference (TAP) in Paris, France, between 4 to 6 November 2025 featured the LENS presentation "*A comprehensive study on the on-road and chassis dyno emissions performance of motorcycles and other L-category vehicles*", reaching 800 international experts addressing air quality, noise, and pollution from an integrated sustainable mobility perspective.

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Finally, the Small Powertrains and Energy Systems Technology (SETC) conference in Florence, Italy, between 10 to 13 November 2025 showcased three LENS presentations following the project's conclusion: *"Overcoming Challenges in Motorcycle Exhaust Flow Measurement: A Study on Measurement Accuracy and Systematic Effects of an Annubar-Based Approach"*, *"Ultralightweight Emission Measurement Systems for Motorcycles: Accuracy and Practicality in RDE Testing"*, and *"Emission Performance of Motorcycles: Regulated and Non-Regulated Pollutants under Harmonized and Extended Testing Conditions"*. These presentations to 300 attendees demonstrated the project's continued impact beyond its formal end date.

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Beyond the formal conclusion of the LENS project, the consortium will continue to disseminate its findings at international events. Between 18 to 21 May 2026, LENS will be represented by project coordinator EMISIA at the Transport Research Arena (TRA) 2026 in Budapest, Hungary. As Europe's largest transport research and innovation conference, TRA brings together stakeholders from all modes of transport (road, rail, waterborne, and aviation) to strengthen collaboration between research, industry, and policy.

Additionally, the LENS consortium partners have identified potential events for 2026. Participation in these events will require further coordination between partners, additional application processes and potential collaboration with other projects or initiatives in order to secure funding beyond the project's end date. The potential events for 2026 include:

- Leuven Conference on Noise and Vibration Engineering
- EARPA FORM Forum in Brussels
- Flanders Make Symposium in Brussels
- Aachen Colloquium Sustainable Mobility
- Euronoise Conference 2026 in Graz

2.2 List of national events

In addition to its presence at European and international conferences, LENS actively engaged with national audiences by participating in regional events across Austria, the Netherlands and Germany. These events provided an opportunity to connect with local stakeholders, industry professionals and policymakers who are working on issues relating to mobility, noise and air quality at a national level.

The project's first national engagement took place at the Motion Expo 2023 exhibition in Graz, Austria, from 10 to 12 March 2023. As Austria's leading event focusing on the future of mobility, MotionExpo brought together 1,000 industry leaders, researchers and innovators. LENS showcased a motorcycle fitted with PEMS equipment and displayed project posters to demonstrate the practical application of emissions measurement technology. The exhibition covered topics ranging from new cars and e-bikes to smart urban mobility and classic vehicles, with live demonstrations taking place in a dedicated racing area.

On 14 November 2023, LENS participated in the GTL Congress in Hilversum, the Netherlands. The event attracted 300 attendees, to whom LENS presented "*Luide voertuigen in de G4 steden en het LENS-project*" (Loud vehicles in the G4 cities and the LENS project). Spanning two days, the GTL Congress is the leading Dutch event for professionals specialising in noise, vibration, and air quality, offering presentations, interactive discussion forums, and a trade fair showcasing the latest innovations and technologies.

The DAGA 2024 - 50. Jahrestagung für Akustik took place from 18 to 21 March 2024 in Hanover, Germany, attracting 1,400 participants. LENS presented "*Entwicklung einer Methodik zur Ermittlung*

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akustisch relevanter Fahrsituationen von Fahrzeugen der Klasse L" (Development of a methodology for determining acoustically relevant driving situations of L-vehicles), contributing to Germany's leading acoustics conference and its 50th anniversary edition.

Returning to the GTL Congress in Hilversum from 12 to 13 November 2024, LENS presented '*Haalbaarheid van de Geluidflitspaal in Nederland*' (Feasibility of the Noise Camera in the Netherlands) to an audience of 500 professionals. The presentation addressed the practical implementation of noise enforcement technology in the Dutch context, sparking discussion among national experts in noise and air quality management.

On 12 May 2025, LENS participated in the Motorlärmtag in Berlin, Germany, presenting "*Krafträder in der (urbanen) Mobilität- Herausforderungen & Trends*" (Motorcycles in (urban) mobility – challenges and trends). Organised by the Federal Association Against Motorcycle Noise, this event brought together approximately 110 participants both in Berlin and online to examine motorcycle noise from scientific, political, and social perspectives under the theme "*Motorcycle Noise at the Hotspot: Even More Annoying Than Aircraft Noise".*

Finally, from 11 to 12 November 2025, LENS was represented at the GTL Congress in Hilversum for the third consecutive year through an interactive slideshow presenting LENS findings. By continuing to be present at the Netherlands' leading event for noise, vibration and air quality professionals, which reached 500 attendees, the project demonstrated its ongoing commitment to engaging with national stakeholders and sharing its research outcomes within the Dutch professional community.

3 List of publications

A core component of LENS' dissemination strategy was the production of high-quality, peer-reviewed scientific publications, ensuring that the project's findings would contribute to the academic body of knowledge while remaining accessible to the wider research community. The project was committed to submitting open-access scientific publications to journals and magazines and to presenting at conferences and other relevant international, European, national and local events. The original target was to produce at least seven peer-reviewed publications during the project's lifetime. Although the project has exceeded this expected number, several contributions are still under review. Therefore, the consortium decided to categorise the list of papers to ensure full transparency.

In accordance with the grant agreement requirements for open science, all LENS beneficiaries ensured open access to peer-reviewed scientific publications relating to their results. This involved depositing a machine-readable electronic copy of either the published version or the final peer-reviewed manuscript in a trusted repository for scientific publications by the time of publication at the latest. These repositories provided immediate open access to all deposited publications under the Creative Commons Attribution International Public Licence (CC BY) or equivalent, ensuring that research outcomes were freely accessible to scientists, policymakers, industry professionals and the

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general public. Where appropriate, the repositories also provide information about any research outputs or tools needed to validate the scientific publications' conclusions.

The following list catalogues all peer-reviewed publications produced by the LENS consortium, demonstrating the project's commitment to transparent, reproducible and widely disseminated research that benefits the broader scientific community and supports evidence-based policy development in the field of L-category vehicle emissions and noise.

3.1 Peer-reviewed & open-access publications

Peer-reviewed and open-access:

Batsalia, N., Triantafyllopoulos, G., Dittrich, M., Tziovas, A., & Ntziachristos, L. (2025). Extent of L-vehicles tampering and impact on noise and emissions. In *Transport and Research Arena*. Springer. https://doi.org/10.1007/978-3-031-95284-5_10

Imtiaz, H. H., Schaffer, P., Hesse, P., Kupper, M., & Bergmann, A. (2025). Automatic Number Plate Detection and Recognition System for Small-Sized Number Plates of Category L-Vehicles for Remote Emission Sensing Applications. *MDPI Sensors*. MDPI. https://doi.org/10.3390/s25113499

Krasa, H., Fruhmann, V. M., Schurl, S., Kupper, M., & Bergmann, A. (2025). Condensation Diffusion Charging – Particle Number Measurement of High Concentrations Down to 3 nm. *Aerosol Research*. Copernicus Publications. https://doi.org/10.5194/ar-2025-20

Schurl, S., Schmidt, S., Bretterklieber, N., Kupper, M. et al. (2025). "Emission Performance of Motorcycles: Regulated and Non-Regulated Pollutants under Harmonized and Extended Testing Conditions," SAE Technical Paper 2025-32-0069. https://doi.org/10.4271/2025-32-0069.

Vojtisek, M., Pechout, M., Kotek, M., Vijayakumar, K., Fleischhans, M., & Fleischhans, L. (2024). Practical, low-cost integrity testing of diesel particle filters using remote sensing measurement at the campus entrance gate. *Science of the Total Environment*. Elsevier. https://doi.org/10.1016/j.scitotenv.2024.178067

Peer reviewed

Grigoriadou, A., Triantafyllopoulos, G., Lekaki, D., Karageorgiou, T., Steven, H., Hausberger, S., Schmidt, S., Dippold, M., Dittrich, M., Riemersma, I., van Mensch, P., Kermani, J., Garbí, A., & Ntziachristos, L. (2026). Policy options to reduce emissions of L-category vehicles in the European Union and expected effects. *Transport and Research Arena*.

Schurl, S., Hafenmayer, C., Lankau, M., Brenn, G. et al. (2025). Overcoming Challenges in Motorcycle Exhaust Flow Measurement: A Study on Measurement Accuracy and Systematic Effects of an

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Annubar-Based Approach. *SAE Technical Paper 2025-32-0016.* https://doi.org/10.4271/2025-32-0016

Schurl, S., Lienerth, P., Japs, L., Schroeder, M. et al. (2025). Ultralightweight Emission Measurement Systems for Motorcycles: Accuracy and Practicality in RDE Testing. *SAE Technical Paper 2025-32-0011.* https://doi.org/10.4271/2025-32-0011

Triantafyllopoulos, G., et al. (2025). On-road PN and BC emission measurements of L-category vehicles. *ETH Nanoparticle Conference*. [Presentation]

Triantafyllopoulos, G., Tziovas, A., Melachrous, D., Schmidt, S., Schurl, S., Hausberger, S., Dippold, M., Garbí López, A., García Vázquez, B., Savignac, P., Kermani, J., Vojtisek-Lom, M., Pechout, M., Vobr, V., Liska, V., Kotek, M., & Ntziachristos, L. (2025). A comprehensive study on the on-road and chassis dyno emissions performance of motorcycles and other L-category vehicles. *TAP Conference*.

Vojtisek, M., Pechout, M., Dittrich, L., Mejdr, F., Liska, V., Vobr, V., & Kotek, M. (2025). On-road measurement of all Euro 7 gaseous emissions from motorcycles using a rider-worn portable FTIR analyzer. *ETH Nanoparticle Conference*. [Poster]

3.2 Additional papers:

Sjödin, Å., Hallquist, Å. M., Cha, Y., Kupper, M., Imtiaz, H. H., Penz, M., Bergmann, A., Gryllias, K., & Denayer, H. (2025). Roadside Measurements of Pollutant Emissions and Noise from L-category Vehicles in Three European Cities. *TAP Conference*.

Kupper, M., Imtiaz, H., Penz, M., & Bergmann, A. (2024, February 20–21). An approach for the roadside measurement of particulate emissions of category-L vehicles by point sampling [Poster presentation]. *Schwebstofftechnische Arbeitstagung 2024*, TU Graz, Austria.

Raptis, I., Tziovas, T., Triantafyllopoulos, G., Kousias, N., Haedrich, L., Stahl, U., Ntziachristos, V., & Ntziachristos, L. (2024, June 10). Evaluation of a miniaturized exhaust emission measuring system for L category Vehicles measurements in real world driving conditions [Conference presentation]. ETH Nanoparticle Conference, Zurich, Switzerland. https://www.nanoparticles.ch/archive/2024_Raptis_PR.pdf

3.3 Documents with limited access

Whilst the project prioritised open access publishing to maximise the impact and accessibility of its research, LENS partners also disseminated findings through additional peer-reviewed publications in established scientific journals and conferences. Although some of these publications follow traditional

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subscription-based models, they nevertheless contribute to the scientific discourse and reach specialised audiences within their respective fields.

Imtiaz, H., Liu, Y., Schaffer, P., Kupper, M., & Bergmann, A. (2025, January 10). Reconstruction of density fields of category L-vehicles' exhaust plumes for optimising remote emission sensing and engine performance. *SAE International Journal of Engines.* https://doi.org/10.4271/03-18-06-0036

Schurl, S., Lienerth, P., Japs, L., Schroeder, M. et al. (2025). Ultralightweight Emission Measurement Systems for Motorcycles: Accuracy and Practicality in RDE Testing. *SAE Technical Paper 2025-32-001*. https://doi.org/10.4271/2025-32-0011

Schurl, S., & Schmidt, S. (2025). Overcoming Challenges in Motorcycle Exhaust Flow Measurement: A Study on Measurement Accuracy and Systematic Effects of an Annubar-Based Approach. *SAE SETC Conference 2025*. SAE.

4. Conclusion

The LENS project has demonstrated a strong commitment to disseminating its research findings and engaging with a variety of stakeholders from the scientific, policy and industry communities.

The project successfully participated in 21 European and international events and six national events, reaching a broad audience from various disciplines and geographical regions. These events provided valuable opportunities to share knowledge, collaborate and ensure that LENS research outcomes informed ongoing discussions on L-category vehicle emissions, noise pollution and sustainable mobility. In addition to its extensive participation in events, LENS has published 20 papers, of which five are peer-reviewed and open access by the time of writing.

This comprehensive dissemination positioned LENS research to inform future policy developments, industry practices and academic investigations into L-category vehicle emissions and noise reduction.

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