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CONFERENCE REPORT

for the 6th European Zero Emission Bus Conference

THE SIXTH EDITION OF THE ZERO EMISSION BUS CONFERENCE

The sixth edition of the European Zero Emission Bus Conference was organised by ERM - Environmental Resources Management and Busworld Foundation and took place on 7-9th October 2025 in Brussels alongside Busworld Europe 2025. This brought considerable benefits to attendees - what was discussed at the conference could then be seen in the exhibition, especially given the high concentration of zero-emission buses and related infrastructure and services on display at Busworld Europe 2025.

The Zero Emission Bus Conference (ZEB) is an event series created by ERM (previously Element Energy) and CTE (Center for Transportation and the Environment) to accelerate the transition to zero emission bus technologies. Since launching in 2016, eleven successful ZEB events have been held to date in Europe and America. Previous European editions of the conference took place in Brussels (2023), Paris (2021), online via a series of ZEBINARS (2020), in Cologne (2018) and in London (2016).

ZEB 2025 showcased the significant progress made over the last years; zero-emission buses have developed from being an emerging technology to a proven technology. The agenda was designed to give bus operators, public transport authorities, policy makers, and all sector stakeholders the opportunity to explore the newest developments and latest innovations driving the deployment of zero-emission fleets.

This edition focused on the remaining challenges and potential solutions for achieving zero tailpipe emissions across bus fleets, addressing technological, people-focused, and policy-related aspects. Insights and contributions came from more than 90 speakers, including representatives of European ministries, bus operators, transport authorities, leading associations, researchers, and industry pioneers.

Stay tuned for the latest update of the European Zero Emission Bus Conference by following our LinkedIn account:

European Zero Emission Bus Conference

This report summarises the key takeaways of the conference.

The organisers, ERM and Busworld Foundation, would like to thank all the sponsors, speakers, partners, and participants for making this edition a success.




KEY TAKEAWAYS OF THE ZEB CONFERENCE 2025

1. SMART ENERGY MANAGEMENT SYSTEMS & CHARGING STRATEGIES

- There is no universal approach to smart charging; strategies should be tailored to fleet size, infrastructure, and bus types, while standardisation and simplicity offer operational benefits. The example of a Transdev depot in Bogotá, where 400 buses use one bus type and one charger type, illustrated the advantages of standardisation and simplicity.
- Operators emphasised testing, interoperability, and trusted providers. "It's not smart charging, it's smart people who charge," – with this quote, the crucial role of skilled operators was illustrated. Ultimately, smart energy management for bus operations depends on interoperable systems and sector-wide cooperation to ensure efficiency and reliability.
- Cost savings through optimised and smart charging should never compromise service reliability. Charging management systems must prioritise dependable bus operations above all else.

2. DECARBONISING LONG HAUL & INTERURBAN ROUTES

- Decarbonising long-distance coach operations requires system-wide transformation. Key challenges include market readiness, charging infrastructure, and limited grid capacity.
- Achieving zero-emission long-haul transport will require a mix of technologies. While battery-electric and hydrogen solutions are advancing, alternative fuels like HVO and biogas will remain important due to range and infrastructure constraints. It is yet to be established which technology will take the upper hand in the zero-/low-emission bus market.
- Access to finance, supportive policies, and alignment among countries and industry actors are critical. Coordinated infrastructure development and policy consistency are needed to ensure an even transition.

3. MARKET TRENDS AND POLICY SUPPORT

- The European market for zero-emission buses continues to expand rapidly, with electric bus sales now surpassing those of diesel models (58% vs 32%, natural gas making up 10% of sales). 83% of zero-emission buses sold in the EU are manufactured in Europe, Chinese manufacturers remain the largest competitor at 17%.
- National examples from the German Ministry of Transport and the Austrian Ministry of Innovation, Mobility and Infrastructure illustrated strong policy and funding support driving market uptake. Germany's E-Bus Funding Guideline and Austria's EBIN/eMove programmes are enabling large-scale fleet conversions and charging infrastructure deployment, with the Austrian State planning to invest €127.5M in battery-electric buses in 2025 and 2026.
- Despite this progress, challenges remain in decarbonising longer or more complex routes, particularly interurban and rural services. Research presented showed that battery-electric buses may face technical and operational limits on certain routes due to range, energy density

and climatic factors, with solutions such as opportunity charging, HVO-assisted heating or hydrogen range extenders identified as potential options to ensure full network decarbonisation.

4. LEVERAGING DATA AND AI

- Integrating and standardising data across planning, operations, charging, and fleet management is essential for effective zero-emission bus operations, though this increases IT complexity and costs.
- The shift to electric and hydrogen buses introduces new variables, such as battery health, charging profiles, and energy pricing, which require operators to continuously adapt, analyse operational data, and utilise AI tools for recommendations, while ensuring human oversight remains central to decision-making.
- Universal access to high-quality, standardised operational data is critical; the EU Data Act and ongoing standardisation efforts are expected to empower operators, improve collaboration, and support better financial and operational outcomes. Moreover, it was noted that it is buyers, i.e. public transport authorities and operators, who have the power to demand full access vehicle data by including this as a requirement in tenders.

5. EVOLUTION OF CAPEX AND OPEX

- CAPEX prices are coming down, driven by suppliers outside Europe, falling battery prices, and more favourable warranties. Achieving cost parity requires early infrastructure planning (such as securing grid connections from day one), leveraging relationships with hydrogen suppliers, and considering full depot electrification.
- OPEX optimisation depends on holistic strategies: battery-electric buses are helping to reduce fuel cell bus costs through shared supply chains, but maintenance, insurance, fire risk management, and residual value uncertainties remain challenges. Avoiding vendor lock-in, scaling spare parts supply, and investing in workforce training are key, while operational differences between BEB and FCB fleets (logistics, safety, and cost per km) must be carefully managed.
- However, fuel cell bus costs remain a significant hurdle, and geographical differences in grid capacity and connection further impact deployment. While the global fuel cell bus market is still predominantly in China, the main challenge is not the bus technology itself but the development of a robust hydrogen ecosystem; sector coupling and ecosystem solutions are essential for managing both CAPEX and OPEX.

6. ORGANISATIONAL CHANGE AND REAL-WORLD PERFORMANCE

- Successful integration of ZEBs demands significant organisational adjustments, including staff upskilling, change management, and cross-sector collaboration. Fleet deployment strategies, route planning, and recharging or refuelling logistics must be redesigned. Real-world experience from Oslo and other cities underscores the importance of robust winter

operations, proactive coordination with road maintenance, and continuous learning to address technical challenges.

- European projects such as JIVE & JIVE 2, along with UITP's global network, reveal notable improvements in fuel efficiency and bus availability for both fuel cell and battery electric buses. However, performance remains sensitive to climate conditions, operational practices, and infrastructure maturity. Sharing operational data and best practices across operators accelerates system optimisation and supports evidence-based decision-making.
- Main challenges in scaling up ZEB fleets are technical (e.g., battery and charging issues, thermal comfort, range reduction in certain climatic/topographic conditions, parts shortages) and organisational (e.g., need for new training, change management, and cross-sector collaboration). Additionally, convincing the public to shift from private to public transport is critical, making reliability and service consistency essential for success.

7. DELIVERING RELIABLE HYDROGEN REFUELLING: A HANDBOOK FROM PLANNING TO OPERATION

- High standard hydrogen refuelling stations are now operational in Europe, but challenges remain, particularly the high price of hydrogen and the reliability of stations. Addressing these issues requires robust, well-sized stations, experienced providers, and a focus on system dependability to encourage wider adoption of hydrogen mobility.
- Improving HRS dependability involves aligning incentives so that both station operators and OEMs are rewarded for keeping stations operational, rather than penalised for downtime. Contracting and tendering processes should prioritise reliability, while knowledge management and the upskilling of local technicians are essential to ensure that learnings and solutions are consistently incorporated into station design and operation.
- The liquid hydrogen station in Crawley has a compact footprint of 485 square metres (22 by 22 metres) and delivers hydrogen with three times the density of the gaseous form at 300 bar, making them well suited for large fleets. Lessons from Cologne highlight the value of a central hub with satellite stations and the importance of system resilience through built-in redundancies. Potential OPEX funding support schemes were also discussed as means to help address the ongoing challenge of hydrogen pricing.

8. OPPORTUNITY AND FIXED CHARGING INFRASTRUCTURE FOR ELECTRIC BUSES

- The transition to battery-electric buses requires operators to fundamentally rethink their approach to refuelling/charging infrastructure. Unlike diesel buses, careful, early planning for grid connection is crucial, as geographical differences in grid access and costs can be significant - even within the same country. Each city or site faces unique challenges, so while learning from others is valuable, charging systems must ultimately be tailored to local conditions.
- The choice of charging technology has evolved: while pantographs were initially the primary choice to achieve high-power charging, plug-in solutions are now also effective. However, issues such as buses wearing down asphalt and alignment problems with pantographs highlight the need for robust foundations and ongoing adaptation of infrastructure.

Communication between chargers and buses, often via WiFi, can also be problematic in large fleets, adding further operational complexity.

- The Trondheim pilot in Norway demonstrated that inductive charging delivers consistent power and high efficiency, even in harsh winter conditions with snow and ice. This technology reduces wear on roads and simplifies bus alignment, making it a resilient option for electric bus fleets. The technology is used as a range extender, rather than for continuous charging.

9. NAVIGATING BATTERY DEGRADATION, SAFETY, AND END-OF-LIFE MANAGEMENT

- For operators, batteries are still largely a "black box" - they lack direct access to the data needed to fully understand battery health, performance, and status. This makes transparent, reliable data sharing and ongoing collaboration with OEMs essential. Operators increasingly require tools and systems that provide actionable insights into battery condition, enabling better monitoring, predictive maintenance, and informed decision-making throughout the battery's lifecycle.
- Safety remains the overriding concern in battery management, and operators see it as a higher priority than improvements in energy density. This is why operators are advocating for a uniform "State of Safety" for batteries. This focus has only intensified following past incidents, such as the bus fires in Paris (2022). Research is ongoing into alternative chemistries that could further enhance safety and reduce environmental impact, especially if lithium becomes less central to battery design.
- As the first generation of electric bus batteries reaches the end of its service life, second-life management is becoming increasingly important. Operators are beginning to repurpose batteries for stationary energy storage, supported by innovations such as battery passports, standardised labelling, and automated dismantling processes. These advances, highlighted in the BatteReverse project, enable safer, more efficient reverse logistics and facilitate both repurposing and recycling, helping to maximise the value and sustainability of battery systems beyond their initial use in vehicles.

10. SERVICING AND MAINTAINING ZERO EMISSION BUS ECOSYSTEMS

- Transitioning to zero-emission bus fleets requires significant investment in upgrading depots and workshops. This includes reinforcing lifting equipment to handle heavier vehicles and adapting facilities for new safety requirements (e.g. bus depot adaptation to hydrogen in Paris by RATP for 22 hydrogen buses included new H2 detectors, dissipative floor to prevent electrostatic discharges during maintenance operations, etc.). These upgrades are critical, and costs can be substantial (e.g. 300,000€ per workshop pit, a sunken maintenance trench allowing technicians to work under buses, in Stockholm to endure 16-ton axle load per electric bus).
- Speakers noted the need for robust technical solutions and best practices in workshops, such as strengthening all maintenance areas for higher axle loads, implementing specialised safety systems for hydrogen and electric buses, and ensuring clear operational procedures to prevent error (e.g. in bus depot adaptation to hydrogen in Paris in maintenance area for H2 and CNG buses are in a specific colour to prevent parking mistakes, 8 new emergency gas extractors,

etc.). The experience from Nordic countries shows that despite challenging weather, electrification can progress rapidly with careful planning and adaptation of infrastructure.

- Ensuring maintenance staff have the right skills is a top priority. The shift to zero-emission vehicles changes maintenance routines (e.g. less mechanical wear but more focus on high-voltage and hydrogen safety), and ongoing training is essential. Continuous upskilling prepare teams for new technologies and helps reduce repair times as experience grows.

11. FINANCING THE TRANSITION

- Accessing finance for zero emission bus projects remains challenging, especially for smaller cities, but is not out of reach. Building consortia and combining multiple smaller projects can help meet the thresholds set by institutions such as CINEA and the European Investment Bank. European, national, and local support, as well as public–private partnerships, are essential. CINEA, who mainly finance equipment, have observed that projects with secured offtake tend to perform better.
- The European Investment Bank typically works with larger sums and supports cities with clear strategies and targets, focusing on investment plans and broader ecosystems rather than individual components. Smaller cities can access funding via intermediary banks, and leasing from original equipment manufacturers is a viable entry point. Upfront investment remains high, and physical space for infrastructure can be a barrier.
- There is a trend away from supporting companies that continue to invest in fossil fuels. Public transport is recognised as an essential service with a low carbon footprint, driving social cohesion and inclusion. A coherent financial framework, blending grants, loans, and partnerships, is vital to make projects affordable and bankable. Tools like the Social Climate Fund and Public Procurement framework will be key to scaling up ZEB fleets.

12. THE FUTURE OF MANUFACTURING ZERO EMISSION BUSES IN EUROPE

- ACEA stated that meeting the EU's 2030 CO_2 reduction target of -43% will require approximately one-third of bus production to be zero-emission, but current infrastructure and total cost of ownership are still inadequate; achieving this goal depends on supportive policies, including minimum European content requirements in vehicle tenders. Projections show that between 2025 and 2030, around 48,000 electric urban buses and 20,000 electric intercity buses and coaches will enter the European market.
- The European manufacturing sector is under significant pressure, as emphasised by the announcement of an unbeatable price for a battery electric bus from a non-European OEM during Busworld. There are growing concerns about the competitiveness and future prospects of European manufacturers, with viewpoints ranging from pessimistic to optimistic across the sector. Industrial representatives called for clear policy measures and increased investment to boost confidence and maintain a strong manufacturing base in Europe.
- Despite these challenges, there was a positive note that public transport authorities can play a crucial role in shaping the future of European manufacturing. By supporting local industry through procurement choices and collaboration, PTAs have the potential to foster innovation and resilience within the European zero-emission bus sector.