

Workshop

ZEvRA Automotive Strategy & Innovation Forum: Setting the course for a growing Circular Materials Demand – Summary of outcomes

8 April 2025, REMATEC in Amsterdam



**Funded by
the European Union**

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101138034.

ZEvRA project abstract

ZEvRA's main objective is to improve the circularity of light-duty EVs throughout their entire value chain, from materials supply and manufacturing to end-of-life (EoL) processes, which aligns with the European Union's goal of achieving zero CO₂e emissions by 2035, particularly in the EV value chain. To do so, ZEvRA will develop a Design for Circularity (DfC) methodology and a holistic circularity assessment aimed at improving the production of electric vehicles (EVs) based on the 9Rs. This methodology will be validated by developing zero emission solutions for the most important automotive materials, covering > 84% material mix: steel, three versions of aluminium (wrought, casting, and foam), thermoplastics composites (long and continuous fibre-reinforced), unfilled/short fibre plastics, glass, tyres and Rare Earth Elements (REE). These solutions will be supported by a set of digital tools to support the manufacturing of the use cases, the assessment of circularity, traceability, and the virtual integration of components into a full replicable vehicle.

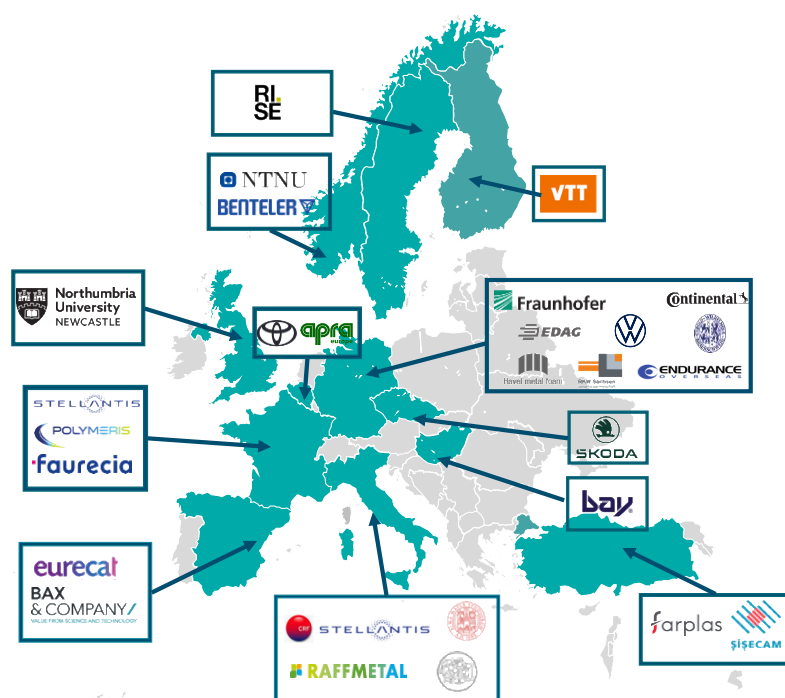


Figure 1: ZEvRA consortium

To maximise the outreach of our methodology and zero emission solutions, ZEvRA will develop a dedicated training & upskilling programme for the automotive workforce and academia, together with activities aimed at increasing awareness & acceptability of the proposed zero emission solutions. Lastly, circular business models targeting EoL and logistics aimed at improving the economic feasibility of circularity in EVs are advanced. ZEvRA's innovations aim to improve zero

emission approaches in the life cycle and value chain of at least 59% of European EVs by 2035 through the 5 OEMs and Tier 1's that are part of the consortium (Figure 1), which includes industry and academia covering the entire automotive value chain.

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Executive summary

Thank you for your participation in the first **ZEvRA Automotive Strategy & Innovation Forum: Setting the Course for a Growing Circular Materials Demand**, held on 8 April 2025 at REMATEC in Amsterdam and online. The forum brought together 30 experts from industry, research, and academia to identify and discuss the barriers and opportunities related to the increasing demand for recycled materials in the automotive sector. The discussion focused on the availability, sourcing, and integration of circular materials, with particular attention to the ZEvRA-related material groups steel, wrought and cast aluminum, foam aluminum, thermoplastics composite and mineral plastics.

The forum highlighted several key barriers that must be addressed as the project advances. Among the most significant are economic and cost-related challenges, particularly for materials like foam aluminum, thermoplastics composites, and mineral plastics, where recycled alternatives can be more expensive than virgin materials due to labor-intensive processes or extended production times. Equally critical are supply chain and availability constraints. Participants expressed concern about the limited and inconsistent availability of high-quality secondary materials, especially as demand increases across the sector. The current reliance on existing recycling streams is insufficient to meet future volumes, and while some confidence was expressed—particularly for foam aluminum and thermoplastics—the overall assessment revealed considerable uncertainty. Scores reflecting confidence in the market's ability to supply secondary materials were largely moderate, suggesting that without strategic action, the supply gap may persist or widen.

You can read the more detailed results below.

What barriers do you see to increasing demand?

The results of the voting session during the forum provided a clear indication of which categories of barriers are currently perceived as most critical across different material markets. The most prominent categories identified were cost and economic barriers, as well as supply chain and availability barriers.

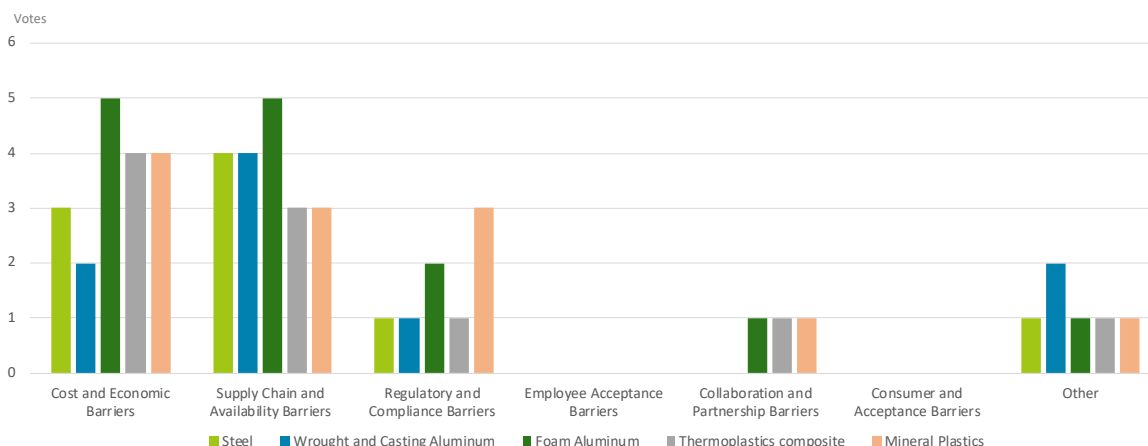


Figure 2: *Most critical barriers voted during the session*

Cost and Economic Barriers emerged as the most frequently cited challenge across all materials. Participants indicated that cost pressures, such as higher prices for recycled materials compared to virgin alternatives and additional processing costs, are a major constraint, particularly for foam aluminum, thermoplastics composites, and mineral plastics. These concerns were especially prominent in the case of foam aluminum, which received the highest number of votes in this category. The voting reflects a shared concern that without economic incentives or reductions in processing costs, scaling up the use of recycled materials may remain difficult.

Supply Chain and Availability Barriers were also strongly represented, particularly for foam aluminum, steel, and wrought and casting aluminum. Participants pointed to uncertainties in securing consistent, high-quality feedstock and the limited availability of secondary materials at the volumes needed for industrial-scale production. This underscores the importance of improving collection infrastructure, reverse logistics, and strategic sourcing, especially considering projected increases in circular material demand.

Regulatory and Compliance Barriers received fewer votes but were noted, especially in the context of mineral plastics. Concerns in this area included uncertainties around standards, approval procedures, and the integration of recycled content into existing regulatory frameworks.

Although not perceived as the primary obstacle, these barriers remain relevant, particularly for ensuring market access and legal conformity.

Collaboration and Partnership Barriers were occasionally mentioned, with a few votes highlighting the importance of cross-sector collaboration for developing recycling technologies and improving material flows. These responses suggest that while not a dominant concern, partnerships and knowledge-sharing could support progress in overcoming technical and logistical hurdles.

Other Barriers, such as design integration challenges or lack of data transparency, were noted sporadically across all material categories, indicating the presence of material-specific or context-dependent issues that require targeted attention.

How realistic do you think it is that the market will provide these quantities?

The participant ratings on the likelihood that the market will be able to supply increasing quantities of secondary materials reveal a cautious but varied outlook across material groups.

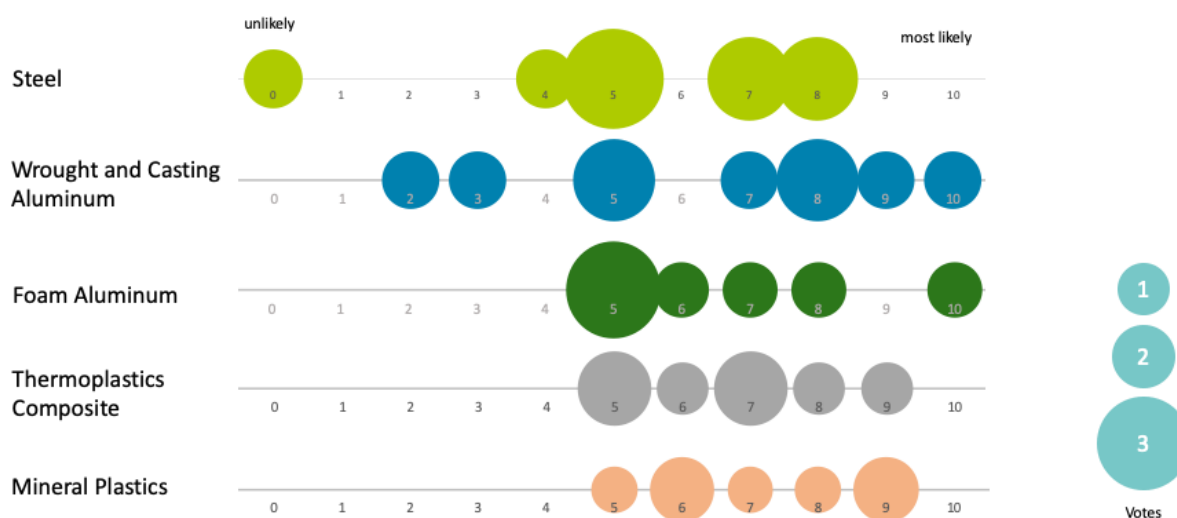


Figure 3: Likelihood of supply increasing quantities of secondary materials voted during the session

On a scale from 0 (unlikely) to 10 (most likely), **steel** received the most mixed assessment, with scores ranging widely from 0 to 8. While some participants expressed moderate confidence (particularly at the midpoint score of 5), the overall distribution indicates uncertainty about the scalability of steel recycling to meet future demand.

Wrought and casting aluminum showed a slightly more optimistic profile, with a spread of ratings concentrated in the mid-to-high range. Scores were more evenly distributed across 5 to 10, with a few participants expressing strong confidence. However, lower scores were also present, suggesting that concerns remain regarding sourcing stability and processing capacity, especially under rapidly growing demand.

Foam aluminum received a relatively concentrated set of scores, clustered mostly around the midrange. Ratings were generally neutral to moderately optimistic, with a majority falling between 5 and 8. This indicates a measured confidence that, while not without challenges, the foam aluminum market may be better positioned to expand its supply capacity if supported by targeted initiatives.

Ratings for **thermoplastics composites** and **mineral plastics** also fell predominantly within the moderate range, with no participants indicating strong pessimism (scores of 0–4). Most responses clustered between 5 and 9, reflecting cautious optimism that with improved collection, standardization, and industry coordination, these materials could meet increasing demand. However, the absence of higher confidence scores (e.g., 10) points to underlying concerns about infrastructure readiness and market maturity.

What are the current sources?

Participants provided a range of insights into current sources of secondary materials, reflecting diverse and partially mature supply streams across the material types discussed. For **steel**, key sources include internal sector recovery, scrap and secondary materials, restamping and laser cutting of used parts, and dismantling of end-of-life vehicles (ELVs), with Germany mentioned as a potential stronghold for sourcing. **Wrought and casting aluminum** are primarily sourced through recycling processes, with contributions from both European and Chinese suppliers, scrap melting, aluminum hydroxide, and established aluminum recyclers. In the case of **foam aluminum**, participants pointed to scrap aluminum and aluminum recyclers as the main supply channels. For **thermoplastics composites**, current sources include a combination of virgin raw materials, recycled plastics, post-industrial waste, and outputs from plastics recyclers. **Mineral plastics** are obtained from plastics recyclers, PCR hard plastics, packaging materials, textiles, and other parts, with additional input from chemical recycling processes and recovery from other industries. These responses highlight that while foundational sources are in place, further development and diversification will be essential to meet growing demand.

How can further sources be developed/ expanded?

Participants shared a range of suggestions for expanding future sources of secondary materials, tailored to the specific challenges and opportunities of each material group. For **steel**, increased recovery within the sector and scaling up the dismantling of end-of-life vehicles (ELVs) were seen as promising strategies to boost scrap availability. In the case of **wrought and casting aluminum**, participants suggested optimizing existing recycling streams and encouraging the establishment of new companies focused on secondary aluminum processing. For **foam aluminum**, similar emphasis was placed on founding new companies and promoting localized reuse and enhancement through techniques like cutting and material supplementation. Suggestions for **thermoplastics composites** included greater standardization of materials, improved collection systems, and the integration of recycling into manufacturing processes, along with in-house recycling and better use of local post-consumer waste supported by enhanced logistics. For **mineral plastics**, participants highlighted the importance of in-house recycling, recovery from other industries, and especially the need for clearer communication about material specifications and requirements across company networks. These suggestions point to a shared recognition that increasing future supply will require both systemic improvements and targeted, material-specific actions.

Closing Discussion

The closing discussion of the workshop brought together diverse perspectives on how to enhance circularity in the automotive sector and addressed both systemic and operational levers for change. Participants emphasized the importance of rethinking business models—such as leasing and product-as-a-service (PaaS)—where OEMs retain ownership and control over material flows. This shift, however, requires new financial models and the involvement of additional stakeholders, including banks and service providers. It was acknowledged that such transformations must be supported by a broader cultural change, which varies significantly across generations, regions, and between urban and rural contexts.

The discussion also highlighted the need to extend the use phase of vehicles through better design for repairability, modularity, and upgradeability, supporting sustainability without sacrificing functionality or performance. Questions were raised about consumer acceptance of vehicles built from used or remanufactured components and whether differing ownership models influence acceptance levels. Several participants noted the significant loss of materials through the export of end-of-life vehicles (EoLVs) to non-European markets, with approximately 3.5 million vehicles leaving the European system annually. Regulatory developments, such as the revised End-of-Life

Vehicles Directive and the Critical Raw Materials Act, were seen as essential instruments to retain valuable materials within the European economy and to boost the use of recycled plastics in new vehicles.

The discussion further stressed the strategic role of OEMs in driving circularity, particularly in early design phases. While external consultants and top management may be aligned with sustainability goals, middle management was identified as a critical group for awareness and acceptability. Positioned between strategic direction and operational execution, middle managers influence financial decisions, work closely with suppliers, and play a key role in translating sustainability goals into practice. Participants called for clear and long-term commitments from OEMs toward circularity, underlining that consumers can only choose from the products offered—making the OEM’s design decisions central to achieving meaningful change.

Conclusions

To foster circular economy and the ZEvRA innovations, participants called for OEMs to adopt a clearer and more long-term position on sustainability and circularity. OEMs were seen as central actors with the power to drive change through early design decisions, setting material standards, and shifting business models. There was a strong plea for OEMs to implement design for sustainability at the earliest development stages and to prioritize repairability, modularity, and upgradeability in future vehicle concepts. Moreover, the workshop stressed the importance of targeting middle management within OEMs, as this group holds substantial influence over operational decisions and supplier relationships and serves as a key link between strategy and execution.

From a policy perspective, the forum underscored the need for stronger and more harmonized regulatory frameworks to secure material flows within Europe. Participants welcomed developments such as the Critical Raw Materials Act and the upcoming End-of-Life Vehicles Directive, which mandate higher recycling quotas and aim to reduce the export of valuable end-of-life vehicles from the EU. However, there remains a clear demand for policies that not only set targets but also support systemic improvements in collection, reverse logistics, and material traceability. Politicians are encouraged to provide long-term regulatory certainty, financial incentives for recycling innovation, and mechanisms to prevent material leakage from the European economy.