German Environment Agency

11. November 2025

AutoRess Factsheet 7: Ecodesign: How electric vehicles can be used and repaired for longer without becoming obsolete

Results from the project 'Resource efficient and circular electric cars' (AutoRess) - FKZ 3722 57 101 0

Key findings

Extending the lifespan of vehicles can save raw materials and reduce emissions.
An extension of the current average vehicle lifespan from about 15.8 years to 19 years (+20%) can reduce the raw material demand for vehicle production in 2045 for certain materials by up to 12 percentage points.

Vehicle design constitutes the basis for durable and repairable vehicles.
Modularity and standardization of key components are especially important here. However, changes in design only translate into potential savings after a significant time lag.

New challenges due to the shift to e-mobility

The production phase becomes more significant
Extending vehicle lifespan becomes even more important in the context of the shift to electric cars, as the emissions-intensive lifecycle phase shifts from use to production.

The vehicle battery as a limiting factor
As long as the battery's lifespan is shorter than that of the rest of the vehicle, it remains the limiting factor—as long as it is not modular.

Dependence on software and special components
There are concerns about increasing dependence on software and proprietary special components. This could make repairs more difficult and lead to premature technical obsolescence.

Longevity must not hinder technological progress
Increasing longevity must not slow down the adoption of important technical innovations and efficiency improvements.

Savings potential of lifespan extension

Design changes typically take considerable time to have an impact, since vehicles remain in use for many years and the composition of the vehicle fleet evolves only gradually. This is also shown in the model calculation for a 20 % lifespan extension (see figure below).[1]. While there is hardly any effect at first, from 2045 onwards there is a clear reduction for some raw materials: total raw material demand can be reduced by up to 12 percentage points for certain materials compared to the reference scenario (baseline). The reduced demand for primary materials also

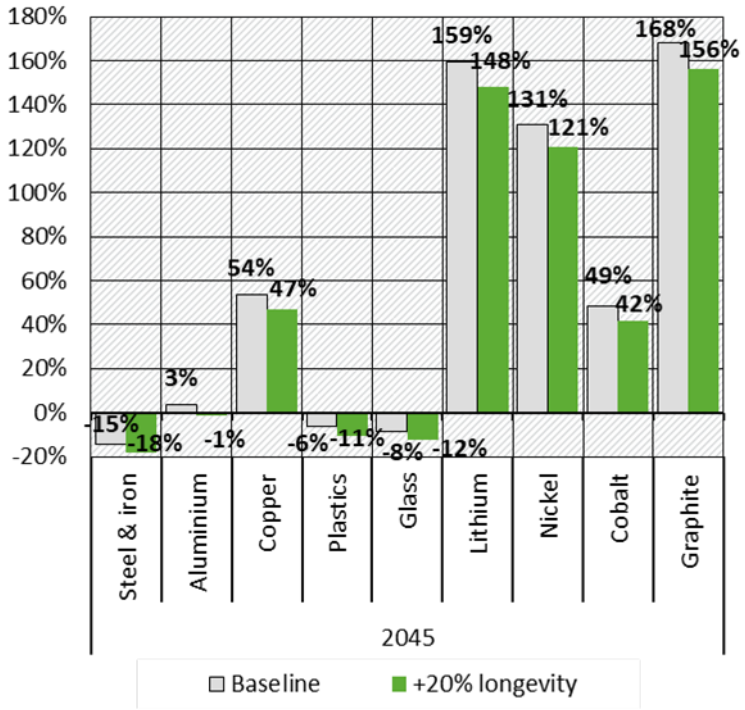
[1] For details on assumptions, modeling, and results, see the AutoRess final report.

results in a reduction of manufacturing-related GHG emissions by about one percentage point compared to the baseline. The effect on GHG emissions is therefore small. This is because the vehicles considered are mainly made of steel and aluminum, while materials with higher savings potential are only found in small amounts within the vehicles.

Ecodesign: Levers for longer vehicle use

Repairability and upgradability are important aspects that contribute to vehicle longevity. Fixed bonding techniques and a lack of modular construction can make replacing defective or outdated components uneconomical. The long-term effects of new manufacturing techniques, such as Gigacasting, on repairability are currently unclear. Modular vehicle design also increases disassembly capability and thus recyclability at the end of the vehicle's life. [2]

Changes in total raw material demand compared to 2025



Source: own illustration (ifeu)

The final report of this project therefore proposes a list of parts that should be replaceable with reasonable effort and standard tools. These include: the battery and its individual modules, the electric motor with control unit and wiring harnesses, as well as wear parts and fluid containers. Furthermore, model- and (ideally) manufacturer-spanning standardization of these components can help simplify repair or replacement, as fewer special tools are needed and spare parts can be provided more easily. In addition, economies of scale from standardization have a positive effect on both recycling and manufacturing.



Source: own illustration (AI-generated)

[2] Further information on the importance of repairability and disassemblability of vehicles, as well as policy measures that also address the use and disposal phases of the lifecycle, can be found in Factsheet 6

Improved modularity and standardization, leading to increased repairability and upgradability, can also help make the second-hand market for e-vehicles more attractive and thus increase vehicle usage duration. Other design-level approaches include reducing model variants or considering disassembly during the design process and optimizing the vehicle for better disassembly. OEMs could be required to provide detailed information and instructions for disassembling their vehicles.

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