BMW GROUP

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From end-of-life vehicles to new cars: Car2Car research project demonstrates feasibility of high-quality material loops on an industrial scale

+++ Research project highlights potential of high-quality material loops, particularly for steel, aluminium and copper +++ Car2Car rate increases from six to 51 percent under expanded processing and sorting conditions +++ Results provide important data basis for vehicle recycling +++

Munich. Through the Car2Car research project, the BMW Group and its consortium partners have demonstrated that high-quality material loops are technically feasible in the automotive industry. Under expanded processing and sorting conditions, it was possible to increase the "Car2Car rate" from six to 51 percent. The "Car2Car rate", as defined by the project, is the percentage of materials from an end-of-life vehicle that can, in principle, be recovered at high enough quality for reuse in new industrial applications. Particularly high recovery potentials were achieved for steel, aluminium and copper, whereas significant technological challenges remain for plastics and glass. At the same time, the project demonstrates which conditions, investments and regulatory frameworks will be necessary to further scale high-quality material loops in the future. The results are based on a research and demonstration approach under optimal processing and sorting conditions.

Sorting and processing unlock high-quality material loops

Various recovery scenarios were explored as part of the research project. The findings show that additional processing and sorting steps can significantly increase the potential of high-quality material loops. The steps include improved pre-sorting, modified shredding processes, classification, sensor-based sorting of material streams and more precise separation of aluminium alloys. Using methods currently standard in the market, the project achieved a "Car2Car rate" of six percent across all five focus material groups during a vehicle recycling trial with minimal compulsory dismantling. With the help of advanced process engineering and optimised processing routes, the rate climbed to 51 percent. Under these conditions, the "Car2Car rate" increased from one to 81 percent for steel, from 23 to 52 percent for aluminium and from 48 to 68 percent for copper.

The findings confirm the considerable potential for high-quality material loops, especially for metals. At the same time, the results clearly demonstrate that this potential cannot be applied equally across

all material groups. Specifically, further development is required for plastics and glass. To achieve large-scale industrial implementation, additional investments will be needed in disassembly, sorting and recycling infrastructure, as well as corresponding regulatory frameworks.

Steel shows potential of high-quality material loops

The project's key findings are illustrated by the example of steel. Up until now, copper-bearing impurities from cables, connectors and other components have hindered the recycling of end-of-life vehicle scrap into high-quality automotive steels. The Car2Car project has now demonstrated that an additional processing step can substantially improve scrap quality. Copper contamination was reduced in a targeted manner by sorting the steel scrap. This ensures high-quality steel scrap as the starting material for new flat steel that meets the requirements of modern automotive applications. A patent application has been filed for this process.

The so-called steel coils produced using this method were integrated into industrial production following successful material and quality testing. In a field test conducted at BMW Group Plant Leipzig, more than 100,000 series parts were produced for use in vehicles. The project thus demonstrates, along a real industrial value chain, that new vehicle components can be manufactured from end-of-life vehicles. However, for large-scale industrial implementation, scalable process chains, additional infrastructure and viable business models are still needed.

Huge potential for metals, further development needed for plastics and glass

At the same time, the project highlighted that progress towards a circular economy varies, depending on the material and the technology available. While recycling processes are already in place for metals such as steel, aluminium and copper, there is still a lack of solutions for plastics and glass that meet the automotive industry's high quality standards.

The wide variety of materials, complex composite material structures and stringent quality requirements make it difficult to produce high-quality recyclates for high-end automotive applications. For plastics, in particular, it has become evident that precisely tailored process chains comprising various sorting and processing technologies will be needed in the future to consistently achieve the material quality necessary for automotive material loops.

Insights for next-generation circular vehicle concepts

The findings from Car2Car will feed into further development of the BMW Group's circular economy, confirming its established Design for Circularity approaches. They will also help design vehicles even

more systematically for high-quality material loops. Cooperation with end-of-life vehicle recycling partners, such as PreZero, can also benefit from the experience gained through this project.

Beyond the BMW Group and the participating project partners, the Car2Car findings also provide an important data basis for further development of the entire automotive recycling landscape. In the context of future regulatory requirements, such as the European ELV Regulation, Car2Car illustrates which technological, economic and structural conditions must be created to enable higher material recovery rates and closed material loops. This includes innovation and investment in disassembly, sorting and recycling technologies, increased digitalisation and framework conditions that promote transparency, quality and the return of materials to European material loops.

Car2Car does not focus on what is already standard today but highlights the potential that high-quality material loops could offer in the future. Whether this potential will be realised depends not only on technical feasibility, but also on factors such as access to end-of-life vehicles, favourable market conditions, investment and viable business models throughout the entire recycling value chain.

Quotes

"The circular economy is an integral part of the BMW Group's corporate strategy. Car2Car shows that its full potential can be realised when the entire value chain is optimised. Together with our partners, we are using the project findings to develop new process and business models that combine environmental and economic benefits, and advance the transition towards a circular automotive industry."
Alexander Efthimiou, Senior Vice President Business Development, BMW Group

"With Car2Car, we wanted to understand under which conditions materials from end-of-life vehicles can be reused in new cars. The project has shown the potential in current material streams from end-of-life vehicles that have not yet been optimised for high-quality material loops. The most significant progress was seen with steel: We were able to demonstrate that high-quality flat steel for automotive applications can be produced from end-of-life vehicle scrap. In the field test at BMW Group Plant Leipzig, more than 100,000 series parts were produced using this steel and installed in vehicles – making the project's results tangible."
Hilke Schaer, Car2Car project manager, BMW Group

Broad consortium spanning the entire value chain

The Car2Car research project brings together partners from the automotive industry, materials manufacturing, the recycling industry and academia. The aim was to investigate the recovery of materials from end-of-life vehicles for use in new automotive applications along the entire value chain. A further objective was to identify suitable process routes for high-quality material loops.

The consortium included BMW AG, TU Bergakademie Freiberg (MVTAT, IEST and IGT institutes), the Helmholtz Institute Freiberg for Resource Technology (part of Helmholtz-Zentrum Dresden-Rossendorf (HZDR)), Technical University of Munich (Professorship of Circular Economy, Chair of Materials Handling, Material Flow and Logistics (fml) and the Institute for Machine Tools and Industrial Management (iwb)), Scholz Recycling, STEINERT UniSort, thyssenkrupp Steel Europe, Salzgitter Mannesmann Forschung, Aurubis, Novelis Germany, OETINGER Aluminium and Pilkington Automotive Germany.

The final report of the full Car2Car consortium is available for download here. The BMW Group-specific final report can be found here.

FAQ:

What is the Car2Car research project?

Car2Car is a research project focused on the recovery of materials from end-of-life vehicles for use in new automotive applications. It investigated under which conditions high-quality material loops are possible along the automotive value chain.

What was the project's key finding?

The key finding was that it was possible to increase the "Car2Car rate" from six to 51 percent under expanded processing and sorting conditions. Particularly high recovery potentials were achieved for steel, aluminium and copper. A key factor is that these results were achieved without dismantling end-of-life vehicles beyond the compulsory disassembly currently standard in the industry before recycling.

What does the "Car2Car rate" mean?

The "Car2Car rate" refers to the percentage of materials from an end-of-life vehicle that can, in principle, be recovered at high enough quality for reuse in new automotive applications. It is therefore more than just a conventional recycling rate. The decisive factor is not just whether a material can be recycled, but whether it can be returned to the automotive material loop with a comparable level of quality.

Which materials were the main focus?

The main focus of the project was on steel, aluminium and copper. Potential and limits for plastics and glass were also considered.

Why is steel particularly relevant?

In the case of steel, it was possible to demonstrate that just one additional processing step, in the form of sorting, can reduce copper-bearing impurities, resulting in high-quality steel scrap. This was then used to produce flat steel for modern automotive applications.

Have the results been tested on an industrial scale?

Yes. In the field test at BMW Group Plant Leipzig, more than 100,000 series parts were produced from recovered steel and then installed in vehicles. In this way, it was possible to demonstrate, along a real-world industrial value chain, that new vehicle components can be produced from end-of-life vehicles. However, this industrial field test does not yet mean that the relevant recycling and processing processes are widely available on the market.

How many end-of-life vehicles were examined in the field test?

The field test covered 433 vehicles from 60 different BMW Group models, including test vehicles that were less than five years old.

Where is further development needed?

Comparable progress has not been achieved with plastics and glass to the same extent as with steel, aluminium and copper. Further innovation is required in areas such as vehicle design, disassembly, sorting and recycling.

Table:

Overview of key findings

Material stream	"Car2Car rates" under research conditions
Steel	"Car2Car rate" increases from 1 to 81 percent.
Aluminium	"Car2Car rate" increases from 23 to 52 percent.
Copper	"Car2Car rate" increases from 48 to 68 percent.
Overall system	"Car2Car rate" increases from 6 to 51 percent.
Industrial application field test	Over 100,000 series parts from recovered Car2Car steel produced BMW Group Plant Leipzig and installed in vehicles.

If you have any questions, please contact:

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The BMW Group

With its four brands, BMW, MINI, Rolls-Royce and BMW Motorrad, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial services. The BMW Group production network comprises over 30 production sites worldwide; the company has a global sales network in more than 140 countries.
In 2025, the BMW Group sold 2.46 million passenger vehicles and more than 202,500 motorcycles worldwide. The profit before tax in the financial year 2025 was € 10.2 billion on revenues amounting to € 133.5 billion. As of 31 December 2025, the BMW Group had a workforce of 154,540 employees.

The economic success of the BMW Group has always been based on long-term thinking and responsible action. Sustainability is a key element of the BMW Group's corporate strategy and covers all products – from the supply chain through production to the end of their useful life.

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