German Environment Agency

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AutoRess Factsheet 10: Use of recycled steel in automotive manufacturing

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

Key findings

Use of secondary steel in automotive manufacturing

- A recycled content target of 30% for steel from closed-loop recycling in automotive manufacturing is feasible (total target for flat steel, long steel, and cast iron).
- Up to 50% secondary steel can be produced from open-loop recycling.
- This requires significant improvements in the processing of steel scrap, particularly for the separation of copper components.

Challenges for the use of recycled steel

Various steel and iron products are used in automobiles, from **flat steel** and **long steel** to **cast iron**. Of these, flat steel accounts for the largest share in a passenger car.

Steel scrap is typically contaminated **with other elements**, of which **copper** poses a problem in secondary steel production. Thin sheets in particular become brittle when the copper content is too high, leading to surface cracks during hot rolling and forming. For this reason, flat steel today comes almost exclusively from primary steel production, in which no post-consumer scrap is used.

In contrast, long steel and cast iron components can also be made from secondary steel.

The effective **removal of copper** from steel scrap is essential for high-quality recycled steel that can be used to produce flat steel products.

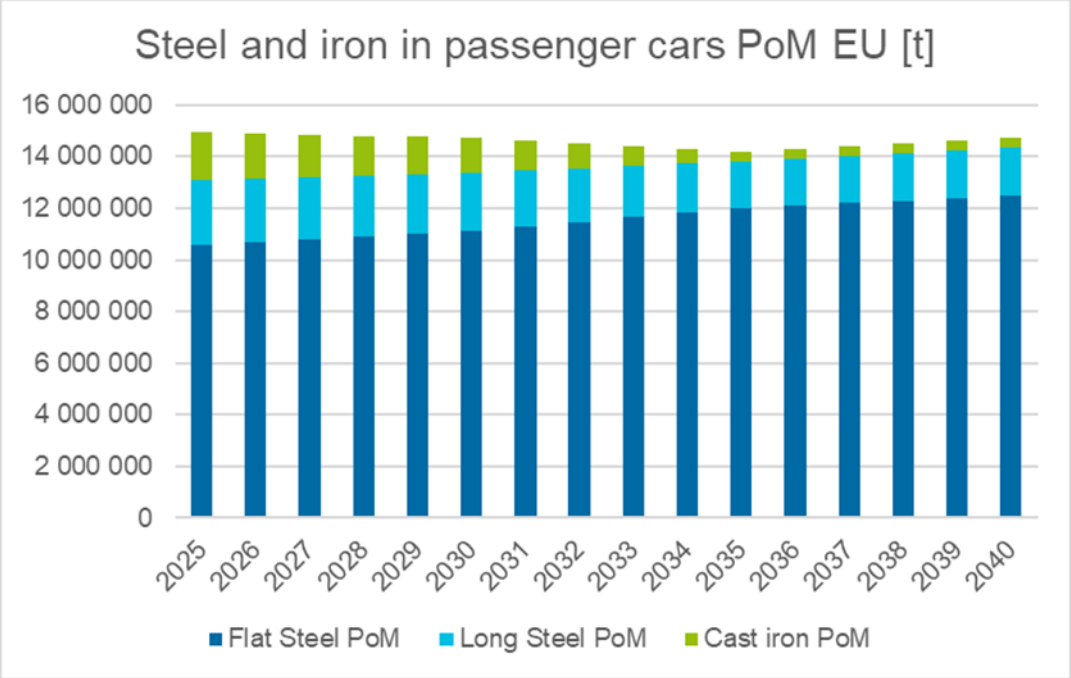
From steel scrap to high-quality flat steel products

Steel is traditionally produced in one of two ways: either via the blast furnace - basic oxygen furnace (BF-BOF) route, which uses iron ore, or via the electric arc furnace (EAF) route, which uses scrap.

The steel industry in the EU produced more than 126 million tons of steel in 2023. More than 28% of this was produced in Germany (around 35 million tons), making Germany the largest steel producer in Europe and the seventh largest crude steel producer in the world. The automotive sector is the second largest consumer of steel (19.1%) after the construction sector.[1] in Europe. The following figure shows the demand for iron and steel in new cars in the EU until 2040. Since electric cars contain less long steel and cast iron than combustion engine vehicles, the shift towards electromobility will reduce the demand for long steel and cast iron.

[1] https://www.eurofer.eu/assets/publications/brochures-booklets-and-factsheets/european-steel-in-figures-2024/EUROFER-2024-Version-June14.pdf

Figure 1: Amounts of steel and iron in new cars in the EU



Source: [Sutter et al. 2025[2]]

The highest demand for strip steel products (i.e., flat steel products) is in the automotive industry. It accounts for approximately 39.2% of total strip steel production in 2023 (48.8 million tons in the EU as a whole).

In contrast, post-consumer steel scrap is typically used in the construction sector to manufacture reinforcing bars. Most steel scrap contains other metals which, if not removed during the melting process in the electric arc furnace (EAF), are referred to as "alloying elements." These include metals such as copper (Cu), nickel (Ni), tin (Sn), arsenic (As), chromium (Cr), molybdenum (Mo), lead (Pb), and others. The most important accompanying elements in steel recycling are copper and tin, as both can cause hot short circuits – a phenomenon that leads to surface cracks during hot rolling and forming. In the case of copper, this occurs when its concentration exceeds 0.1 wt%, while tin can cause similar problems at concentrations as low as 0.04 wt% (Daehn et al., 2017a)[3] .

The nominal tolerance for copper concentration in steel determines the suitability of recycled steel for various applications. For flat products (e.g., drawn steel, sheets), the limit values are generally less than 0.06 wt% copper. The copper concentration in shredded end-of-life vehicle scrap can currently range between 0.23% and 0.7% (Sander et al. 2020[4] , Daehn et al., 2017b[5]).

[2] Sutter, J., Adjei, F., Baron, Y., Kosińska-Terrade, I. (2025): Boosting the use of recycled steel in the EU automotive industry under the ELV Regulation. Quantitative Impact Study for Transport & Environment. Oeko-Institut e.V., Darmstadt 2025. Available online at https://www.transportenvironment.org/uploads/files/2025_04_Report_Recycled_steel_EU_automotive_industry_final.pdf (19.11.2025)

[3] Daehn, K. E. Cabrere Serenho, A.; Allwood, J. M. (2017a): How Will Copper Contamination Constrain Future Global Steel Recycling? Environmental Science & Technology: 51, Pages 6599-6606.

[4] Sander, Knut; Rödig, Lisa; Wagner, Lukas; Jepsen, Dirk; Holzhauer, Ralf; Baberg, Lutz et al. (2020): Evaluation and updating of the methodology for determining end-of-life vehicle recycling rates through shredder tests under the EC End-of-Life Vehicles Directive 2000/53/EC. Published by the Federal Environment Agency (UBA). Ökopol. Dessau (UBA texts, 15/2020). Available online at https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2020-01-20_texte_15-2020_altfahrzeugemonitoring.pdf

[5] Daehn, K.E. Cabrere Serenho, A.; Allwood, J. M. (2017b): How will copper contamination constrain future steel recycling? - Supplementary Information.

Minimizing copper contamination in recycled steel is crucial to ensure that steel recovered from post-consumer scrap, especially from end-of-life vehicles, meets the quality standards required to increase closed loop recycling in vehicle production.

Two approaches are currently being pursued to reduce the copper content in steel scrap: First, copper-containing components are removed before shredding (in particular, dismantling of the main wiring harness). Research conducted for the "Car to Car Steel" study showed that more thorough copper removal prior to shredding results in a significantly lower residual copper concentration in steel shredder scrap (< 0.1%) and is also economically feasible due to the additional revenue generated by the separated copper.[6] One of the recommendations from this study is the introduction of a new scrap class "E40+" with a copper content of < 0.15%. On the other hand, new techniques for processing steel scrap after shredding are being developed. Modern processing plants are already capable of achieving a high purity of steel scrap (Cu < 0.08%), which is also suitable for primary steel production in blast furnaces and converters and can therefore also be used for the manufacture of high-quality flat steel.[7]

The quantities of steel scrap generated from end-of-life vehicles in the EU would, if processed appropriately, make it possible to achieve a recycled content for steel of around 30% in automobile manufacturing (Sutter et al. 2025)[8] . There are various possibilities for sources from which additional quantities of high-quality recycled steel could come. On the one hand, recycled steel that has previously been used in other applications, e.g., in the construction sector, could be used, and on the other hand, recycled steel that has previously been exported to non-EU countries could be used. A third option would be to import recycled steel. In all cases, the recycled steel is not currently processed to the quality required for use as flat steel in the automotive sector, so further processing is necessary regardless of its origin, in particular the separation of copper. The advantages of additional processing of steel scrap to increase the proportion of secondary steel in passenger cars lie in the additional recovery of copper and the fact that processed recycled steel will be significantly cheaper than primary steel from future green hydrogen direct reduction.

[6] Hannah Gross, Jean-Philippe Hermine: Potential of End-of-Life Vehicle deep-dismantling and use of copper depolluted steel scrap to decarbonize automotive flat steel production. March 2025; Available online at: https://circulareconomy.europa.eu/platform/sites/default/files/2025-03/IMT_Car-to-car_Steel_final.pdf (19.11.2025)

[7] https://arn.nl/wp-content/uploads/pdf_presentation-hks-arn-relatiedag-2-oktober-2024.pdf

[8] Sutter, J., Adjei, F., Baron, Y., Kosińska-Terrade, I. (2025): Boosting the use of recycled steel in the EU automotive industry under the ELV Regulation. Quantitative Impact Study for Transport & Environment. Oeko-Institut e.V., Darmstadt 2025. Available online at https://www.transportenvironment.org/uploads/files/2025_04_Report_Recycled_steel_EU_automotive_industry_final.pdf (19.11.2025)

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