Photo: Kirklai/Unsplash

Flat steel in the Free Allocation Regulation

Factsheet

sandbag
smarter climate policy

Context

The steel industry is a major source of carbon emissions in the EU. In 2021, steel was responsible for 27% of all direct emissions from sectors covered by the EU Emissions Trading Scheme (ETS).[1] Flat steel[2] was responsible for 97% of those.[3]

Steel made with scrap uses less resources and produces fewer emissions than steel made from virgin iron ore:

- Every tonne of recycled steel saves approximately 1.1 tonne of iron in ore, 0.6 tonnes of coal, 54 kg of limestone and 1.3 tonnes of solid waste generation.[4]
- Steel recycling is also much more energy efficient. Processing 1 tonne of ferrous scrap can save up to 7 times the energy required to make steel from raw materials, resulting in potential savings of up to 17 GJ per tonne of steel output.[5]
- Finally, recycling steel also results in 86% less air pollution, 76% less water pollution, 40% reduction in water use[6] and 96% lower direct CO_2 emissions.[7]

In the EU, long steel products are made of 100% scrap. By contrast, most flat steel products currently contain very little recycled content. Although part of this difference stems from additional technical constraints, recycling rates could still be increased dramatically. Instead, nearly 20 million tonnes of recycled steel are exported out of the EU every year.[8]

Why the current FAR proposal is problematic

Under the EU ETS steelmakers surrender allowances according to their carbon emissions, but they continue to receive most of them for free. The Free Allocation Regulation (FAR) establishes the methodology that calculates the number of free emission allowances for sectors covered by the EU ETS.

Following the revision of the ETS Directive in April 2023, the Commission was mandated to review the FAR. The revised ETS Directive, approved by the Parliament and the Council, stated that the allocation of free allowances should be "independent of the feedstock or the type of production process" for "the production of a product".[9] Yet the current draft of the FAR prepared by the Commission continues to give emission allowances to intermediate production stages, such as the transformation of virgin iron ores into ore-based metallics (OBMs) like pig iron ("hot metal") and sponge iron ("direct-reduced iron", or "DRI"), instead of allocating these allowances to final steel products.

This methodology **disincentivises the use of scrap** in the steel production process – since recycled steel is not covered by the free allowances – and instead encourages steel manufacturers to use higher proportions of OBMs. This leads to greater environmental risks associated with the extraction of iron ores, higher energy use and resource consumption, and higher overall carbon emissions.

1 Sandbag calculations based on EU ETS data and research on blast furnace waste gas emissions. "Direct" emissions exclude those in power plants from which electricity is consumed.

2 "Flat steel" refers to basic steel products such as plates and sheets used, for example, by the automotive and aviation industries, as opposed to "long steel" which refers to products like rails and bars mainly destined for construction projects.

3 Sandbag (2022) *"Starting from Scrap: the key role of circular steel in achieving climate goals"* (link)

4 Emery et al. (2002), as quoted by Söderholm and Ejdemo (2008), (link)

5 JRC (2022) *Technologies to decarbonise the EU steel industry,* (link)

6 Emery et al. (2002), as quoted by Söderholm and Ejdemo (2008), (link)

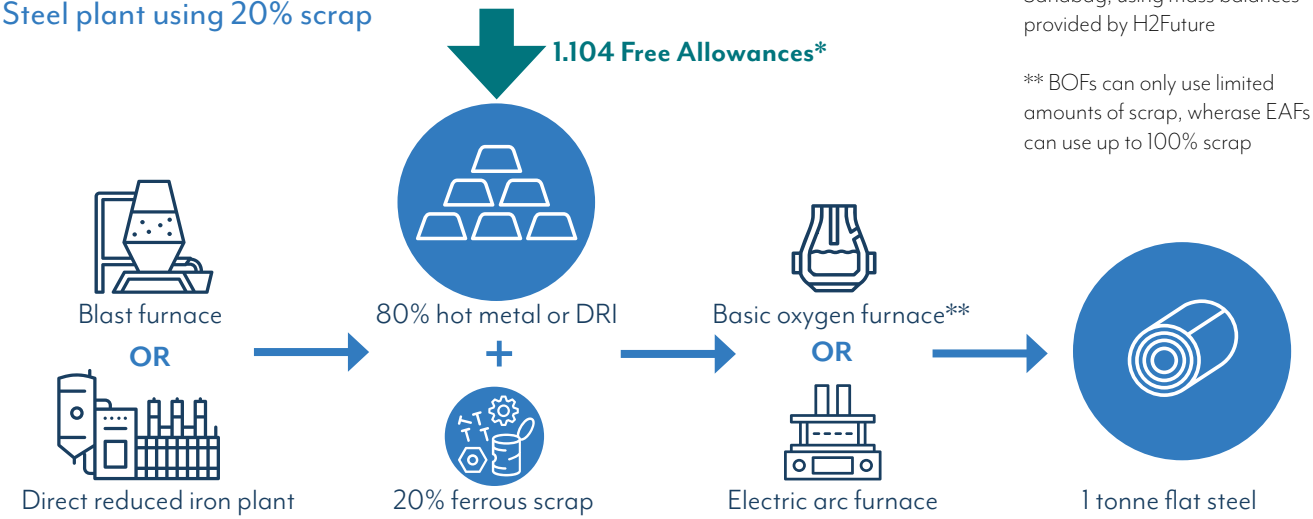
7 Based on Sandbag (2022), *"Starting from Scrap: the key role of circular steel in achieving climate goals"* (link)

8 Bureau of International Recycling (2023), *Facts & Figures,* (link)

9 Recital 10 in the EU ETS Directive. (link)

The two scenarios below show how, with the Commission's current proposal for the FAR review, the allocation of free allowances decreases when scrap content increases.

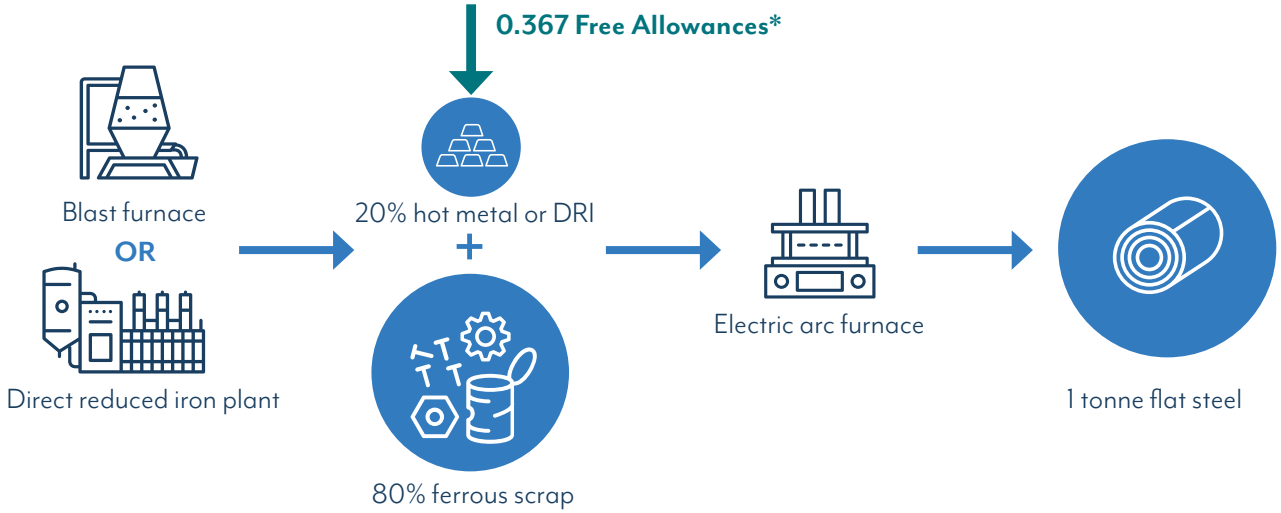
Commision's proposal – scenario 1
Steel plant using 20% scrap



* =1.288 x qty of hot metal used for 1t of steel. Estimate from Sandbag, using mass balances provided by H2Future

** BOFs can only use limited amounts of scrap, wherase EAFs can use up to 100% scrap

Commision's proposal – scenario 2
Steel plant using 80% scrap



Sandbag's proposal

Make free allocation proportional to flat steel output instead of hot metal/DRI in integrated steel plants

We propose that, for integrated steel plants (i.e. those that produce both OBMs and crude steel), free allowances should be granted per tonne of flat steel produced. The value of the proportionality coefficient would be the hot metal benchmark multiplied by the historical average hot metal / steel ratio, to keep the overall number of allowances constant for those plants compared to the Commission's method. This would create a level-playing field between scrap and OBMs and make recycling relatively more competitive than it currently is. The calculation of free allowances (FAs) for integrated steel plants would thus look like this:

FA (per tonne of steel) = hot metal benchmark x average historical quantity of hot metal used per tonne of flat steel produced by EU integrated plants = 1.104 FAs[10]

- **For existing integrated BF-BOF installations**, this change would, on average, not affect the number of free allowances received. However, it would award comparatively more allowances to plants that use more scrap (and less hot metal) than it currently does.
- **For standalone BFs and DRI plants**, our method would be identical to the Commission's proposal, with free allocation based on hot metal or DRI production. There are only two such commercial scale plants in the EU.
- **For standalone BOFs and EAFs,** our method would also be identical to the Commission's proposal, with no free allocation based on steel production.

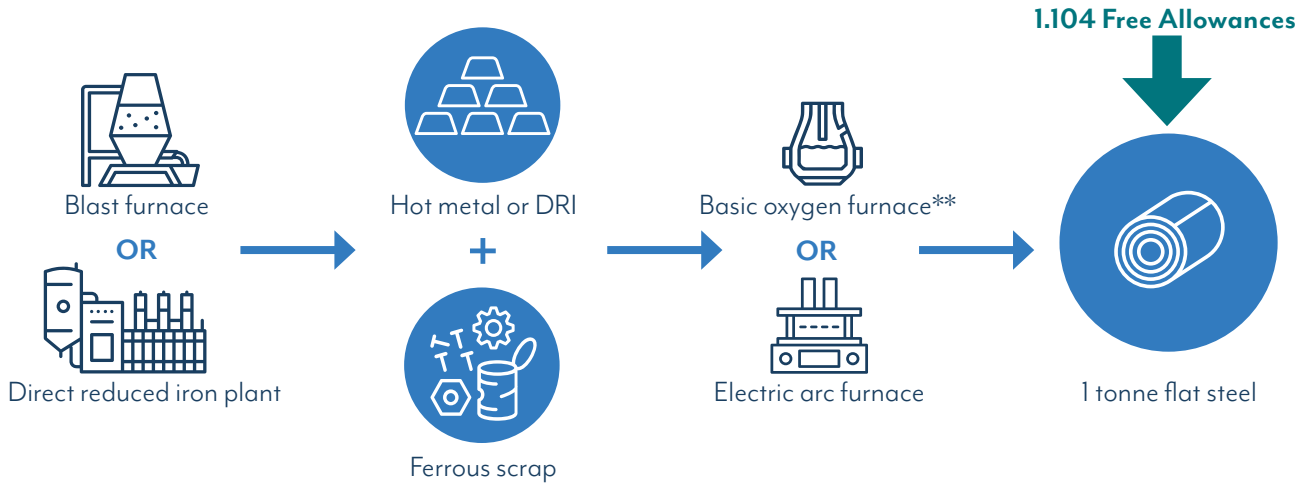
This method would be easy to put in place, as it requires minimal change to the FAR.[11] It addresses fair competition between feedstock and process, but only on the main source of emissions in steelmaking, which is the production of OBMs.

Circularity is an affordable means to achieve climate-neutral steelmaking and should not be overlooked. Furthermore, encouraging the recycling of steel scrap is also key to achieve greater strategic autonomy. European steelmakers using more scrap should not be penalised but encouraged to do so.

10 = 1.288 x 0.857. Estimate from Sandbag, using mass balances provided by H2Future (link)

11 In April 2023, Sandbag and recycling industries proposed to the European Commission a method (link) to ensure fair competition between feedstock and process along the broader value chain, which covered coking, sintering, lime production and hydrogen. Although it was more comprehensive, that method would require deeper changes in the FAR and has become less realistic today, given the remaining timeframe of the FAR review.

Sandbag's proposal (for integrated plants only)



Q&A

Would a "crude steel benchmark" have been preferable?

A "crude steel" benchmark may seem more desirable at first glance, since this would cover all steel products, irrespective of the "feedstock or the type of production process" involved. However, the vast majority of long steel products in the EU are already made from 100% scrap. Creating a crude steel benchmark would result in undue windfall profit (i.e. an unexpected gain) by increasing the number of allowances allocated to long steel producers. In addition, since the number of free allowances is fixed, these would have to be taken from others, which is not desirable.

Furthermore, no new benchmark can be created nor added to the FAR at this stage in the legislative process. Sandbag's proposal only consists in amending the proposed benchmark for hot metal and DRI, and to add a condition to it which only applies to integrated steel plants.

Would integrated steel plants receive less free allowances with Sandbag's proposal?

On average, no. We propose to distribute exactly the same number of allowances, on average, to integrated steel plants. What would change is the measure used to calculate the allocation of emission allowances, which would be based on flat steel output instead of ore-based metallics production (hot metal or direct-reduced iron), as currently proposed by the Commission. This would result in more allowances going to plants using more scrap (therefore less hot metal) than with the Commission's proposal.

Does Sandbag's proposal align with the requirement to distinguish between primary and secondary steel production?

Recital 10 of the revised EU ETS Directive states that *"the revised benchmarks for 2026 to 2030 should continue to distinguish between primary and secondary production of steel and aluminium".* This was included to prevent existing installations recycling scrap from receiving undue profits by selling allowances they did not previously receive or need.

Our proposal establishes a distinction between long steel products (made from 100% scrap) and flat steel products (made from ore-based metallics with varying proportions of scrap). In both cases, our proposal will grant the exact same number of allowances, on average, to each category, as the one currently proposed by the Commission.

What is the difference between "primary" and "secondary" steelmaking? What is so confusing about these terms?

The manufacturing of steel comprises many steps, and the industry often groups them together as follows: (1) "primary steelmaking" refers to the processes (BOFs and EAFs) involved to transform crude iron and steel scrap into crude steel, (2) "secondary steelmaking" refers to the subsequent refining processes and addition of elements such as alloys, and (3) "tertiary steelmaking" refers to the casting and rolling of crude steel into basic steel products. According to this classification method, crude steel made from scrap would thus still be referred to as "primary steel" - which may be counterintuitive.

However, the terms "primary" and "secondary" steelmaking are also sometimes used to distinguish different production processes and/or materials. Some consider that crude steel solely obtained from virgin iron ore is "primary steel", whereas steel made 100% scrap in an EAF constitutes "secondary steel". Others compare the BF-BOF route to "primary steelmaking" and the scrap/DRI-EAF route to "secondary steelmaking". Yet this distinction makes little sense, given that (i) the BF-BOF route often uses scrap and that (ii) EAFs may only use DRI and no scrap to produce crude steel.[12] The terminology that

12 Recycling Today (2022) US Steel talks metallics, but not scrap, (link)

distinguishes "primary" from "secondary" steelmaking is therefore confusing at best, and misleading at worst. Getting the wording of the Free Allocation Regulation right is key, and we recommend being as specific as possible to avoid any confusion.

How much scrap does the European steel industry collect and use?

Scrap often needs to be blended with ore-based metallics to obtain quality crude steel, so there is still a need for transformed virgin iron ores. However, this need could be dramatically reduced.

In 2022, the EU produced 136 million tonnes of steel in total. That same year, it recycled 79 million tonnes of ferrous scrap; however, another 18m tonnes (25%) was collected and exported outside of the EU.

See answer to "Will we have enough scrap to convert our flat steel industry to large-scale recycling?" (p6) for more on scrap availability.

Where do EU scrap exports go?

The EU is the world's largest exporter of ferrous scrap. In 2022, it exported 18 million tonnes of ferrous scrap. The vast majority of these exports went to Turkey, followed by Egypt and India. In most cases, the scrap sent to these countries is used to manufacture long steel products. Turkey, for instance, has become one of the world's largest exporters of long steel products.

However, the carbon footprint of these steel products, when exported, is considerably higher than it could have been, had the same products been directly manufactured in the EU using its recycled scrap.

Are steelmakers not already incentivised to use scrap?

Some argue that steelmakers are already incentivised to use scrap, because when they do so, they don't need to buy EU allowances. However, at the moment (due to current free allocation rules), it costs more to produce steel from scrap in the EU than from virgin iron ores – so there is no financial interest to do so.

Cost of producing crude steel in the EU using scrap vs. from hot metal.

Source: S&P Global Commodity Insights

Could steelmakers use more scrap to make flat steel products?

Flat products are usually made from higher shares of OBMs (relative to scrap) because their higher quality standards require more pure raw material. By contrast, scrap on its own is only used for long steel products, due to its generally lower level of purity. However, many flat steel products are over-specified and could be produced with slightly less pure steel than they currently are. Furthermore, by diluting scrap with an appropriate share of OBMs, the level of impurity can be reduced to levels that are in line with the specifications of most products, as is routinely done in the United States. Moreover, should the demand for scrap increase for flat steel production, the scrap market would likely adapt to meet the specific quality requirements sought after.

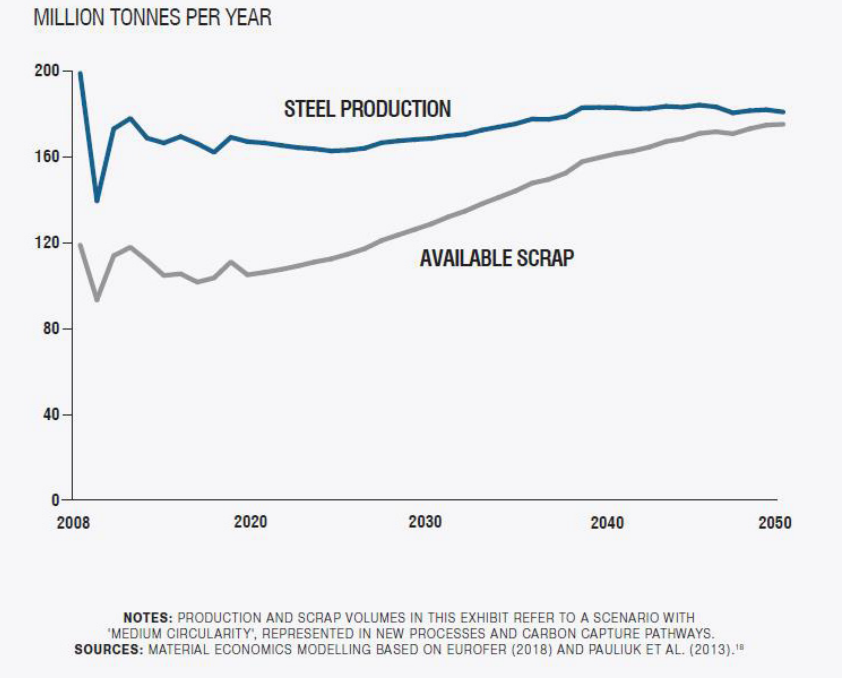
Electric arc furnaces are not limited in the amount of scrap they can mix with OBMs to produce flat steel. In contrast, basic oxygen furnaces (BOFs) – which produce most flat steel products in Europe – are limited by technical constraints. Scrap is often used in BOFs to control the temperature during the melting process and at present, only up to 20% of steel scrap are used in BOFs. Yet research shows that increasing the amount of steel scrap is feasible both in BOFs and in blast furnaces, suggesting further improvements can be made in this field, too.[13,14]

Will we have enough scrap to convert our flat steel industry to large-scale recycling?

Some stakeholders argue that the EU may become net importer of scrap in the future, thereby justifying to prioritise primary ore transformation. Scrap collection rates are partly correlated with scrap prices, and they would logically increase if scrap was more in demand. A better use of scrap in the EU would likely increase the market value of that key product, so more would be collected.[15]

In a Staff Working document,[16] the European Commission wrote that, according to some estimates, "By the 2050s, the amount of scrap available in the EU could be as large as total EU annual steel needs, raising the interesting prospect that recycling could satisfy a large part of the EU's steel needs, if the quality is good enough. Steel could become a nearly fully circular material."

Scrap availability and steel production



13 Association for Iron and Steel Technology (2022), *Potential for Increased Scrap Melting in a BOF,* (link)

14 Thyssenkrupp (2022) *Steel scrap becomes high-quality recycled raw material for use in blast furnace,* (link)

15 Sandbag (2022) *"Starting from Scrap: the key role of circular steel in achieving climate goals"* (link)

16 European Commission (2021) *Towards competitive and clean European steel*

According to a recent analysis[17], the view that scrap may be too scarce to help decarbonise is based on overstated assumptions on the lifespan of steel products. However, having calculated lower steel product lifespans, the report finds that there will be "enough scrap to enable a widescale industry transition to electric arc furnaces."

Why use scrap if we can make "green steel" using hydrogen?

Steel can be made without using fossil fuels by replacing them with hydrogen in the manufacturing of direct reduced iron (DRI).

Although this supposedly "green" steel tends to have a lower carbon footprint than "traditional" steel (made using coke in blast furnaces), it comes with an immense strain on scarce resources such as electricity and water (to produce hydrogen by electrolysis), and still requires other inputs such as iron ore and limestone whose extraction processes remain environmentally disruptive.

Furthermore, this "green" steel is only green as far as the electricity used to obtain hydrogen is carbon-free. Given that the production of renewable electricity is intermittent, electrolysers running around the clock have to use non-renewable electricity. Even according to the European Commission's definition, "green hydrogen" must have a carbon footprint 70% lower than "conventional hydrogen" made from steam methane reforming. Such a footprint is far from negligible, especially since the use of conventional hydrogen it compares with would be much more carbon intensive than current steelmaking processes.

If one considers hot metal as a product, is the Commission's proposal not meeting the mandate given in Recital 10 of the ETS Directive?

Indeed. But in integrated mills, hot metal (as well as DRI) is a liquid substance at 1500°C which cannot be transported, let alone traded or used in anything else than steelmaking. Furthermore, the hot metal benchmark covers emissions from the steelmaking chain down to casting operations, the output of which is crude steel and not hot metal. In this context, calling hot metal the *product* for this benchmark is incorrect and contradicts the intention to create decarbonisation incentives that motivated Recital 10 in the first place.

17 Steel Manufacturers Association (2023), *Ferrous Scrap's Role in Decarbonizing Steel: Assessing Steel Product Lifespans*, (link)

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