Decarbonising steel

OPTIONS FOR REFORMING THE EU'S EMISSIONS TRADING SYSTEM

Briefing, March 2022

Steelmaking is one of the most carbon-intensive industries in the European Union. The sector emits 221 megatonnes of carbon dioxide each year. To ensure the EU achieves climate neutrality well before 2050, it is necessary to drastically reduce emissions in the steel sector.

The EU's Emissions Trading System is the key instrument for incentivising emissions reduction in energy-intensive sectors, such as steel, but it is currently underperforming.

The ongoing revision of the system is an invaluable opportunity to strengthen the EU ETS and correct the flaws that have resulted in flatlining emissions and huge windfall profits in the steel sector over the past 10 years.

This will require updating the current benchmarks to ensure they encourage the uptake of cleaner technologies and the circular use of materials and implementing the proposed Carbon Border Adjustment Mechanism in such a way that triggers more investments in emissions reductions. It will also require raising and recycling more revenues to fund innovation to support industry in the green transition.

The scale of the problem

Steelmaking is one of the most carbon-intensive industrial processes in the world.

The EU steel industry currently accounts for 221 megatonnes of greenhouse gas emissions annually (including both direct and indirect emissions). This is 5.7% of total EU emissions, comparable to the annual emissions of France.

The five largest industrial emitters under the EU ETS all belong to the iron and steel sector. Some of the most polluting steel plants emit more than 5 megatonnes of CO_2 a year each, which is equal to the pollution produced by some 2.8 million cars.

Table 1 - Top 10 most polluting steel plants in the EU

Steel Company	Plant Name	Verified Emissions 2019	Free Allowances Allocated 2019	Verified Emissions 2020	Free Allowances Allocated 2020	Country
voestalpine Stahl GmbH	Voestalpine Stahl Linz	8,812,969	6,097,614	8,550,481	5,967,119	Austria
ThyssenKrupp Steel Europe AG	Integriertes Hüttenwerk Duisburg	7,810,779	15,174,658	6,835,470	14,861,357	Germany
Tata Steel IJmuiden B.V.	Tata Steel IJmuiden bv BKG 1	6,272,201	9,531,634	5,711,530	9,335,083	Netherlands
Acciaierie d'Italia S.p.A.	Stabilimento di Taranto	5,898,625	11,906,846	4,834,123	6,963,655	Italy
ArcelorMittal ESPAÑA, S.A.	ArcelorMittal ESPAÑA, S.A., Aviles - Asturias	5,097,167	6,337,954	3,911,930	6,207,261	Spain
Hüttenwerke Krupp Mannesmann GmbH	Glock Duisburg	5,108,311	6,173,557	3,952,291	6,046,112	Germany
ROGESA Roheisengesellschaft Saar mbH	Roheisenerzeugung Dillingen	4,207,263	5,557,480	3,600,915	5,442,880	Germany
ArcelorMittal Belgium	ArcelorMittal Gent 1	4,329,659	4,059,840	3,462,111	3,976,123	Belgium
Salzgitter Flachstahl GmbH	Glocke Salzgitter	4,115,736	5,174,551	3,735,647	5,067,847	Germany
SC Liberty Galati SA	SC Liberty Galati SA	4,193,464	5,643,926	3,895,152	5,527,525	Romania

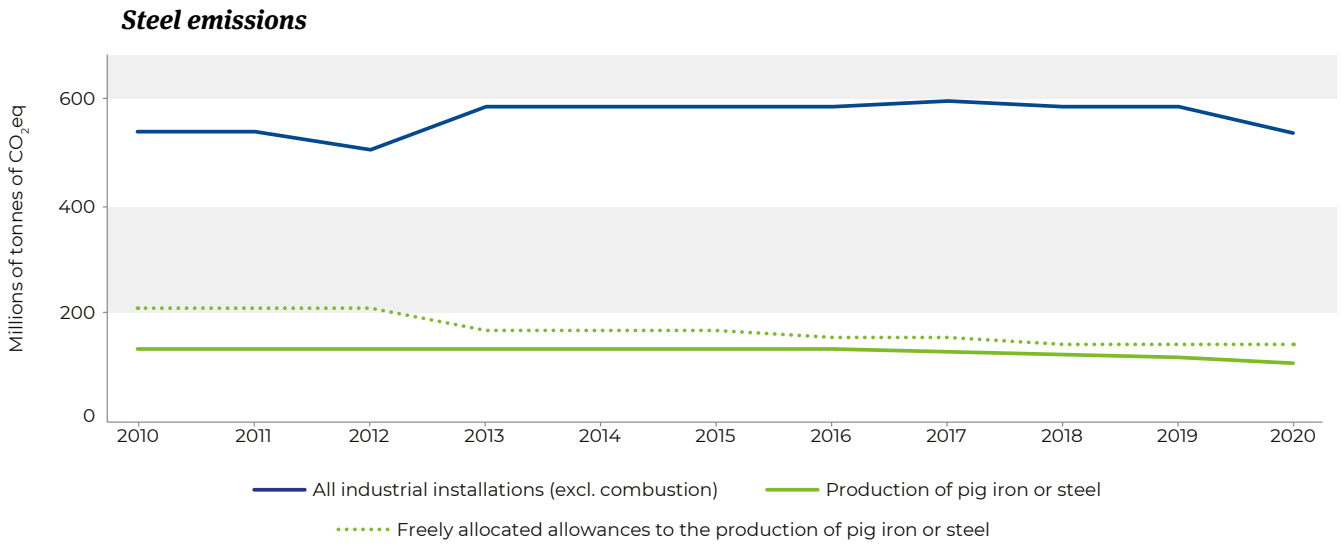
Globally, producing a tonne of steel releases, on average, two tonnes of CO_2 (1.4 tonnes of direct CO_2 emissions and 0.6 tonnes of indirect emissions). European producers have an efficiency comparable to some of the largest steel-producing countries, but they still release around 1.9 tonnes of CO_2 per tonne of steel, with wide local variations. For example, Polish and German steel plants emit up to three times more CO_2 per tonne of crude steel produced compared with Italian or Spanish plants.

Greenhouse gas emissions in the steel sector are regulated by the EU's Emissions Trading System. The EU ETS utilises the 'cap and trade' principle, with a ceiling set on the total amount of allowable GHG emissions. This cap is divided into millions of tradeable individual emissions allowances, many of which are granted to installations for free. Installations must hand over enough allowances to cover their emissions. If an installation reduces its emissions, it can make use of its spare allowances to cover its future needs or sell them to another installation that needs them. Between 2008 and 2019, the EU steel sector received 95% of all the emission allowances it needed for free.

Policy mettle

Despite its objectives of reducing the emissions of heavy industry, the EU ETS has been unsuccessful in the steel sector, especially over the last decade.

Steel emissions have stagnated since 2012 and will need to seriously pick up pace in order to reach climate neutrality before 2050.



The main reasons for this are the numerous flaws and loopholes in the EU ETS legislation. The current revision of the Emissions Trading System represents a golden opportunity to correct these flaws and close the loopholes.

1. Too many freebies

The steel sector has been receiving free pollution permits since the beginning of the EU ETS. Between 2008 and 2019, about 2.3 billion emission allowances were issued to the steel sector for free.

This is meant to counteract the risk of carbon leakage, which is the hypothetical situation in which European companies competing at international level would shift their production and/or investments (and pollution) to countries with less stringent or no climate policies.

By granting industries free allowances, legislators hope to keep them operating in the EU until they switch to clean production methods.

However, this practice has shielded industries from having to pay for their pollution, undermining the effectiveness of carbon pricing in creating financial incentives to reduce emissions. Evidence from the European Court of Auditors report (2020) has shown that these free pollution permits tend to slow down industrial decarbonisation.

This means the problem of pollution remains unaddressed and the EU steel industry has, on the whole, failed to shift to cleaner technologies and production processes. Moreover, those steelmakers that have invested in low or zero-carbon techniques are being undermined by a system that continues to subsidise large polluting installations.

By receiving free allowances, heavy polluters are receiving an unfair competitive advantage over their cleaner competitors

2. Paying the polluter

Carbon intensity benchmarks are used to determine the level of free allocation that each installation receives under the EU ETS. They are expressed as the greenhouse gases emitted per tonne of product produced and represent the average performance of the 10% best installations covered by the EU ETS.

If a sector is considered at risk of carbon leakage, individual installations receive 100% free allocations based on the relative benchmark. According to the EU ETS Directive, steel is considered at risk of carbon leakage. Therefore, every installation in the sector receives free allocation up to the benchmark level.[1] Those steelmaking plants that are less emissions intensive than the benchmark receive more allowances than they need, while those emitting more receive free allowances to cover their emissions up to the benchmark and must purchase additional allowances to cover the rest.

The ETS benchmarks are not static. They are designed to decrease over time to take into account technological developments, investments and best practices that reduce the emission intensity of the products.

However, the pace at which benchmarks improve is extremely slow and does not reflect the actual efficiency gains and improvements that happen in reality.

The minimum improvement rate of benchmarks is 0.2% a year and the maximum is 1.6%.

This system provides little incentive for industrial sectors to reduce their emissions.

Table 2 - Overview of benchmarks related to steel production

Benchmark	*BM Value (2013 - 2020) tCO_2e/t*	*Annual improvement rate*	*Total improvement rate (over 15 years)*	*BM value for 2021-2025 tCO_2e/t*	*(Attributed) GHG emissions covered by benchmark in 2016/2017*	*N. of installations using the the benchmark for free allocation*
Coke	*0.286*	*1.6%*	*24%*	*0.217*	*10,162,295*	*33*
Sintered Ore	*0.171*	*0.53%*	*7.9%*	*0.157*	*23,154,801*	*24*
Hot Metal	*1.328*	*0.2%*	*3%*	*1.288*	*128,889,587*	*28*
EAF carbon steel	*0.283*	*1.6%*	*24%*	*0.215*	*9,804,572*	*76*
EAF high alloy steel	*0.352*	*1.6%*	*24%*	*0.268*	*8,681,596*	*82*

These extremely slow improvement rates have allowed steel producers to keep receiving large amounts of free allowances for the past 15 years.

1 *In Phase 3 this was multiplied for their 'historic activity level' which is their historical production. If you decreased production your free allocation didn't go down leading to some perverse incentives to reduce production. In Phase 4 this will be partially corrected by bringing free allocation closer in line to real production levels.*

3. Hot metal exceptionalism

Hot metal is the primary input for the production of steel. As shown in the table above, the hot metal benchmark includes the most polluting aspect of steel production, covering more than 70% of all steel sector greenhouse gas emissions under the EU ETS. Even the 10% best and most efficient production generates more than 1.3 tonnes of CO_2e per tonne of hot metal produced.
In the fourth phase of the EU ETS, which started in 2021 and will end in 2030, an implementing regulation was agreed to tighten the benchmarks and ensure that they were determined on the basis of verified data on the greenhouse gas efficiency of individual installations. Moreover, two revisions of the benchmarks were envisaged. One was carried out in 2019 to determine the allocation of free allowances for the period 2021-2025. A second one is set to begin in 2023 to review the values and determine the allocation of free allowances for the 2026-2030 period.

The revision procedure follows specific and predetermined steps and all data is verified, checked and corrected by the European Commission. In every review, benchmarks are revised and can be updated, including on their annual improvement rate.

In spite of this, hot metal is the only product in the steelmaking value chain that benefits from the lowest benchmark improvement rate of 0.2%. This exemption for the hot metal benchmark "protects" it from any fact-based assessment and revision.

Moreover, any previous improvements in the carbon intensity of hot metal production beyond 0.2% per year will not count towards the reduction of free allowances as would be the case for all other industrial sectors.[2] In addition, the average GHG emissions intensity of the 10% most efficient installations producing hot metal in 2016/2017 was higher than benchmark value for phase 3. No other product covered by the ETS benchmarks shows such a lack of improvement on its carbon intensity.

All else being equal, this exception means that free allowances to hot metal production would decrease by a mere 20% over the coming century. Clearly, this is in no way compatible with the EU's goals and the urgency of the climate crisis.

This caveat has allowed the most emission-intensive steel production process to continue to pollute with impunity while receiving generous subsidies to do so.

Policy solutions: Steeling for change

Reform the EU ETS benchmarks

The European Commission's proposal for the revision of the EU ETS includes a higher maximum annual reduction rate of the benchmarks, from 1.6% to 2.5%. However, the proposal keeps the minimum annual reduction rate at 0.2%, and the specific exemption for the hot metal benchmark (as described above).

In this scenario, the most polluting phase of the steelmaking process would continue benefiting from an improvement rate that is much too slow to incentivise the decarbonisation of the sector. Moreover, as shown in the impact assessment accompanying the ETS proposal, the potential for emissions reductions in the steel sector is much higher than 0.2% a year.[3]

Iron and steel production is, in fact, estimated to have a potential for a minimum yearly improvement rate of 1% without considering a shift from primary to secondary steel production. A 1% annual improvement rate is also in line with the potential identified if highly emitting plants were to improve to a level between the median in the sector and the benchmarks applicable from 2021 to 2025, based on national implementation measures (NIMs) data.[4] The minimum annual reduction rate of the benchmarks should,

2 *Included in the Benchmarking Decision https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011D0278*

3 *https://ec.europa.eu/info/sites/default/files/revision-eu-ets_with-annex_en_0.pdf (page 87, Annex IV)*

4 *https://ec.europa.eu/info/sites/default/files/revision-eu-ets_with-annex_en_0.pdf (page 87, Annex IV)*

therefore, be set at 1%. The specific provision exempting the hot metal benchmark from a fact-based assessment of technological progress in the steel sector should be abandoned.[5]

In addition, a more thorough revision and update of the benchmarks is urgently needed. This should incentivise the uptake of cleaner technologies and account for the full potential of product substitution and the circular use of materials. Such a revision should include the definitions and system boundaries of product benchmarks to take these features into account.

This revision should at least make sure that, if free allocation continues being granted, it supports new zero carbon technologies and that it is independent of the type of production process used, i.e. truly product-based benchmarks are introduced. If new zero and low carbon technologies are included in the free allocation this would contribute to making investments bankable, mobilising private capital and thereby accelerating the green transition.

Cast iron court case?

LKAB is a Swedish mining company that produces sintered iron ore pellets. This product is used in the steelmaking process and it is more efficient than the comparable alternative: sinter iron ore.

For years, the company has asked the European Commission to include the sintered iron ore pellets in the sinter ore benchmark. This would result in a lowering of the benchmark value because the pellets are much less carbon intensive than the common sinter ore and a reduction of free emission allowances for all players covered by the same benchmark.

Unsurprisingly, this inclusion has been strongly opposed by steel manufacturers and other mining companies, and it has been rejected by the European Commission as well.

In 2021, LKAB, who had already challenged the Commission over this issue, appealed the Benchmarking Decision to the European General Court. LKAB argues that its treatment has mainly been based on claims from the steel industry's trade association EUROFER, without independent technical assessment of EUROFER's claims by the European Commission.

The verdict is still pending but the issue clearly shows how the current benchmarks can and should be better defined and promote cleaner production processes.

Carbon Border Adjustment Mechanism: The next frontier

The implementation of a Carbon Border Adjustment Mechanism (CBAM) as an alternative to the measures that address the risk of carbon leakage (free allowances) in the EU's Emissions Trading System would push the steel sector to invest in cleaner production processes while ensuring that trade partners competing in the EU single market are subject to the same carbon costs borne by EU steelmakers.

This would contribute to creating a market for decarbonised steel in the EU and encourage steel companies inside and outside the EU to clean up their production processes. The CBAM will achieve this aim only if it fully replaces current carbon leakage protection measures.

Tempering innovation

The EU steel industry has reduced emissions by 26% since 1990, mostly thanks to energy efficiency improvements and higher recycling rates. Achieving the EU's climate goals, however, requires much more fundamental improvements to the way steel is produced.

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5 *Specifically the provision in ETS Directive Art 10a(2) last paragraph: "the benchmark value for hot metal [...] shall be updated with an annual reduction rate of 0,2 % "*

Increased circularity through the electric arc furnace[6] route and a shift to fully decarbonised electricity are imperative. However, fully new zero-carbon processes, such as hydrogen direct reduction will also be needed to reach the EU's climate goals.

Injecting enough funding to develop these technologies and innovations is crucial to fully decarbonise such an energy and carbon-intensive sector. Through private and public investments, EU steel has the potential to become one of the first carbon-neutral basic materials in the world.

The ETS Innovation Fund has already started funding low-carbon innovative technologies, including in the steel sector. But much more money is needed to help the industry fully decarbonise.

Currently, the Innovation Fund allocates the derivatives of auctioning 450 million ETS allowances. At an ETS price of €25 per tonne, for the first call for projects, the fund was able to disburse €1 billion. However, the demand and variety of low-carbon projects that applied was more than 20 times what the fund made available in the call. Several projects that applied were steel and hydrogen generation projects.

In the first call of the Innovation Fund, only 1 project on steel received funding. According to data released by the European Commission, 48 projects out of the 70 selected in the first stage of the call met all the requirements but were beyond the available budget threshold. At least three of these projects were in the steel sector.

It is clear that the Innovation Fund can play a crucial role in helping the steel industry decarbonise but does not have enough resources. The ongoing revision of the EU ETS represents a crucial opportunity to increase the resources of the fund.

The European Commission's proposal of July 2021 included an increase of the Innovation Fund's budget. This is set to receive 50 million additional allowances from the auctioning share compared to the current legislation. Moreover, allowances resulting from the reduction of free allowances for sectors covered by the Carbon Border Adjustment Mechanism (CBAM) would also be injected into the fund.
These changes could potentially increase the Innovation Fund's resources substantially but it largely depends on how many allowances are auctioned in the future instead of being allocated for free following the introduction of a CBAM.

Table 3 - CBAM implementation and implications for the Innovation Fund

EC proposal	*Additional revenues for Innovation Fund*	*Share of revenues coming from steel auctioned allowances*
CBAM fully phased-in in 2035	*€7 billion a year*	*€3.5 billion a year*
CBAM fully implemented in 2026	*€13.4 billion a year*	*€6 billion a year*

According to the Commission's impact assessment for CBAM, phasing in CBAM over a 10 year period would generate €7 billion a year of additional revenues for the Innovation Fund by 2030, half of which would be generated from auctioning allowances in the steel sector.

However, in the current trading phase, the Commission proposal would allocate around 5 billion allowances to industry for free. At a carbon price of €60 a tonne, this amounts to €300 billion. This means that the value of free allowances would be 10 times the value of the ETS Innovation Fund. This shows that there is plenty of room to enlarge the Innovation Fund by speeding up the elimination of free pollution permits.

Moving to full auctioning in the CBAM sectors as of 2026 would already generate more than €13 billion a year that could be channelled to the Innovation Fund, more than €6 billion of which would be generated by the steel sector.

With that kind of firepower, the Innovation Fund could help the steel sector break the mould and become a world leader in climate-friendly production.

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6 40% of steel is made through the recycling route, where scrap steel is reprocessed in an electric arc furnace (EAF)

Innovation Fund: HYBRIT project selected for funding

The Hydrogen Breakthrough Ironmaking Technology (HYBRIT) is a project developed in Sweden by steelmaking company SSAB, mining company LKAB and the power company Vattenfal.

The objective of this project is to replace coal-based blast furnaces with direct hydrogen-based reduction technology in the steelmaking process. This way, it aims to reduce greenhouse gas emissions from steel production by 14.3 megatonnes in the first 10 years of operation. The production would account for 1.2 megatonnes of crude steel and would replace 25% of Swedish steel which is currently produced with conventional and polluting processes.

HYBRIT sets out to demonstrate a complete industrial value chain for hydrogen-based iron and steelmaking. According to the description, the project will include a new facility for hydrogen-based direct reduction of iron ore, with 500 MW fossil-free electrolysis in Gällivare, as well as an electric furnace in Oxelösund, that will replace two blast furnaces.

This project started as a research endeavour in 2016. The aim was to develop a process to produce steel almost entirely free of emissions throughout the whole value chain. Once the research phase was completed, the HYBRIT project applied for funding from the Innovation Fund in the first call for large-scale projects in 2020. It is the only steel-related project that was selected for funding.

Conclusions and recommendations

One of the most polluting sectors in the EU, steelmaking needs to radically reduce its emissions to ensure the EU achieves climate neutrality well before 2050.

The ongoing revision of the Emissions Trading System represents a crucial opportunity to strengthen the scheme and turn it into an instrument for incentivising emissions reduction in energy-intensive sectors such as steel. To do so, the reform needs more than anything to correct the flaws that have resulted in flatlining emissions and huge windfall profits in the steel sector over the past 10 years.

In this context, Carbon Market Watch recommends that the upcoming revision of the carbon market rules:

- Ends free allocation of pollution permits for steel as soon as possible to incentivise climate action in this sector
- For the period while free allowances are still allocated, updates the current benchmarks to ensure they encourage the uptake of cleaner technologies and the circular use of steel
- Implements the proposed Carbon Border Adjustment Mechanism as an alternative to free allowances to trigger more investments in emissions reductions
- Ensures more revenues are raised and channelled to fund innovation to support the steel industry in the green transition

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