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European Commission

SCIENCE FOR POLICY BRIEF

JRC Raw Materials Information System 2025

Analysis of the EU Steel supply chain:
Current trends and circularity opportunities

HIGHLIGHTS

- → Despite a 20% decrease in steel production between 2018 and 2024, the EU remains a major player with substantial production capacities and strong industrial capabilities.
- → The EU steel supply chain is import-dependent, with around 75% of its iron ore and coking coal supplies coming from extra-EU sources, highlighting the need to improve supply security
- → Enhancing access to high-quality ferrous scrap is also crucial to advance circularity, reduce resource leakage and strengthen resilience while contributing to the sector's necessary decarbonisation.

'Our European Union was built on a community of coal and steel. But European steelmakers are at a crossroads, facing the challenges of necessary decarbonisation and partly unfair global competition. We join forces to make a strong business case for steel made in Europe.'
(President Ursula von der Leyen, 04.03.25)

CONTEXT

Steel strategical importance

The European steel industry is a cornerstone of the European economy, providing critical inputs to many sectors, including automotive, construction, and defence. However, the steel industry currently faces significant challenges with a declining competitiveness as pointed out by the Draghi report[1]. EU production costs have increased due to high energy prices. At the same time prices have dropped since their 2021 peak due to a plateauing demand and non-market overcapacity at global scale.[2]

Decarbonisation potential

Steel production is **highly CO_2-intensive**, accounting for around 7% of global greenhouse gas (GHG) emissions and 5-6% of the EU total, making it one of the largest contributors among energy-intensive industrial sectors. Hence, the **decarbonisation** of steel is one of the major challenges to be tackled in achieving the European Green Deal's objective of climate neutrality by 2050, as well as REPowerEU plan [1]. Under the IEA's Sustainable Development Scenario [2], total direct emissions from the iron and steel sector should fall by more than 50% by 2050 relative to 2019. This **transition** should be made possible through a combination of efficiency of material use, circularity, fostering scrap-based steel production *via* Electric Arc Furnaces (EAF), and the deployment of

[1] Draghi, M., The future of European competitiveness – A competitiveness strategy for Europe, 2024. link

[2] COM(2025) 30 final, Competitiveness Compass: *non-market overcapacity* refers to a situation where production capacity exceeds demand, driven by systematic, state-induced over-investments and subsidies concentrated along supply chain.

innovative low-carbon production routes, such as hydrogen-based Direct Reduced Iron (H2-DRI), complemented by Carbon Capture, Utilization, and Storage (CCUS) technologies.

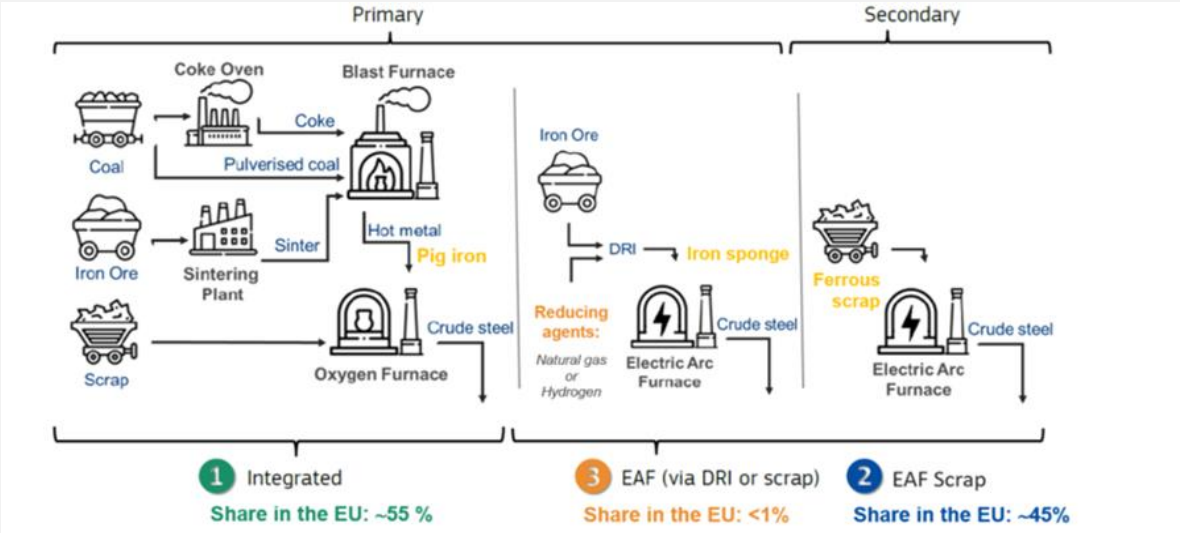
Policy landscape

The EU policy landscape for steel is evolving to tackle both competitiveness and sustainability challenges. The **Clean Industrial Deal**, released in February 2025, sets out a roadmap to accelerate the green transition of energy-intensive industries, starting with steel. Building on this, the European Commission (EC) launched a **Strategic Dialogue** on steel to strengthen collaboration within the sector. In this context, a **Steel and Metals Action Plan** has been launched in March 2025 compiling concrete measures to enhance the sector's competitiveness.

The **Industrial Decarbonisation Accelerator Act** is expected to introduce resilience and sustainability criteria to promote clean, European-made energy-intensive production, particularly steel, mobilizing public and private procurement to create 'lead markets'. Meanwhile, the **Ecodesign for Sustainable Product Regulation** (**ESPR) preparatory study on intermediate steel** is assessing eco-design and circularity requirements to improve sustainability across the steel value chain. Going further, the **Circular Economy Act** planned in 2026 is likely to incentivise the use of secondary steel material to foster a more circular EU steel sector.

Finally, regarding trade aspects, the **Carbon Border Adjustment Mechanism** (CBAM) will take effect in 2026 to prevent carbon leakage, particularly in the steel sector, whose emissions are included in the **EU Emissions Trading Scheme** (ETS). Rising protectionism and threats of global steel tariffs increase the risk of diverting overcapacities to the EU. To counter unfair trade practices, the EC can apply **Trade Defence Instruments**, including anti-dumping and anti-subsidy duties, and responds to steel tariffs with swift, proportionate countermeasures.

Box 1: EU Steel value chain & crude steel production shares by process



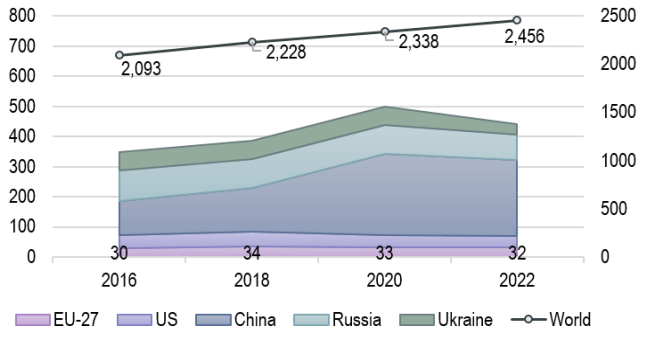
Source: adapted from previous JRC report [3]

TRENDS OVER THE PAST DECADE

Production & consumption volumes

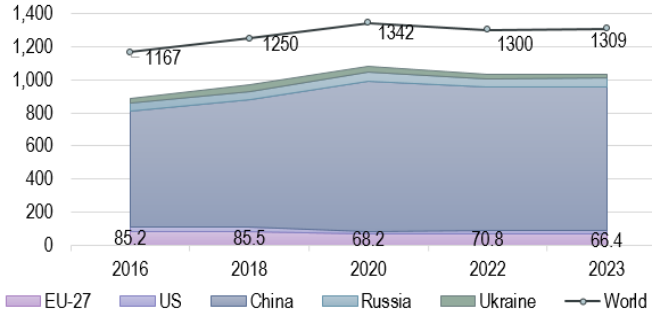
The trends over the past decade related to **production volumes** of precursors and crude steel are compiled in Figures 1, 2, 3 and 4a) highlighting **regional contributions.** In contrast, **apparent steel consumption** volume per region is shown in Figure 4 b).

Figure 1 – Iron ore production (Mt). Regional contribution (left axis) & global production (right axis).



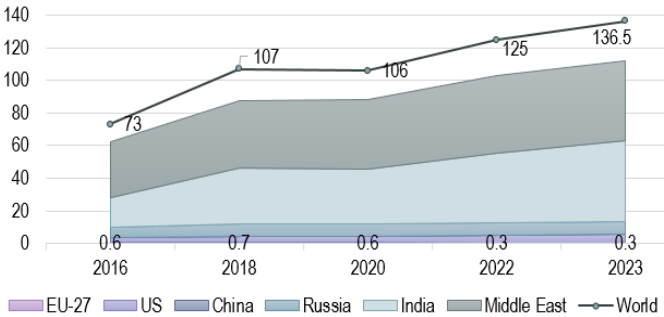
Source: JRC-RMIS [4] based on Worldsteel statistics [5]

Figure 2 – Pig iron production (Mt)



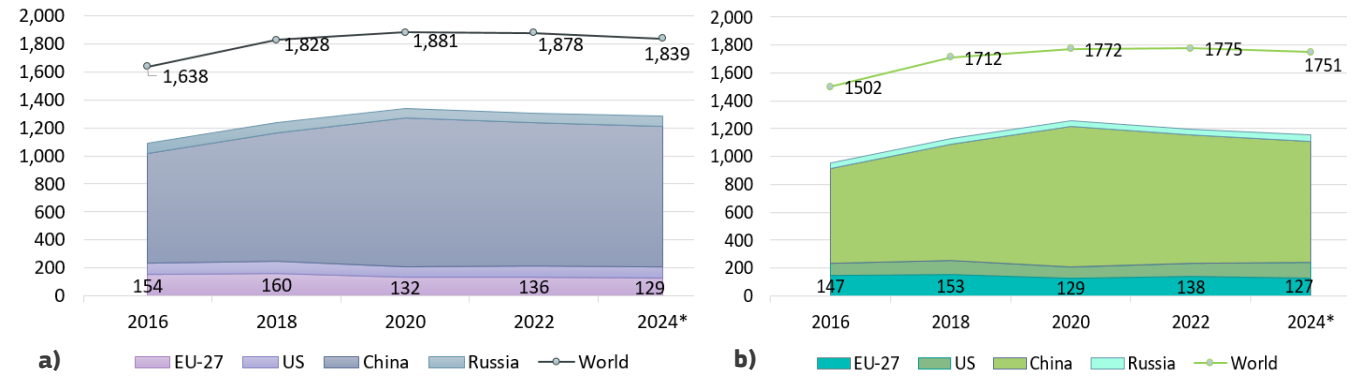
Source: JRC-RMIS based on Worldsteel statistics [5]

Figure 3 – Direct reduced iron (DRI) production (Mt)



Source: JRC-RMIS based on Worldsteel statistics [5]

Figure 4 – **a)** Crude steel production and **b)** apparent crude steel consumption (Mt)



Source: JRC-RMIS [4] based on Worldsteel [5] & Eurofer [6]. Note: The 2024 figures are non-consolidated and may be subject to revision.

Overview of supply & demand

Global **iron ore** extraction has increased over the past decade (see Figure 6 for key supplier countries to Europe), driven by the dominance of the primary steel production route worldwide (68%). In parallel, after a pre-COVID rise, the global **pig iron and crude steel production have stagnated in recent years**, with China accounting for approximately two-thirds and 55% of global production, respectively**. DRI** represents at the moment only a limited share of iron-based production (less than 10% of the total pig iron plus DRI) and is mainly concentrated in Middle East and India (with around 50 Mt each of DRI in 2023).

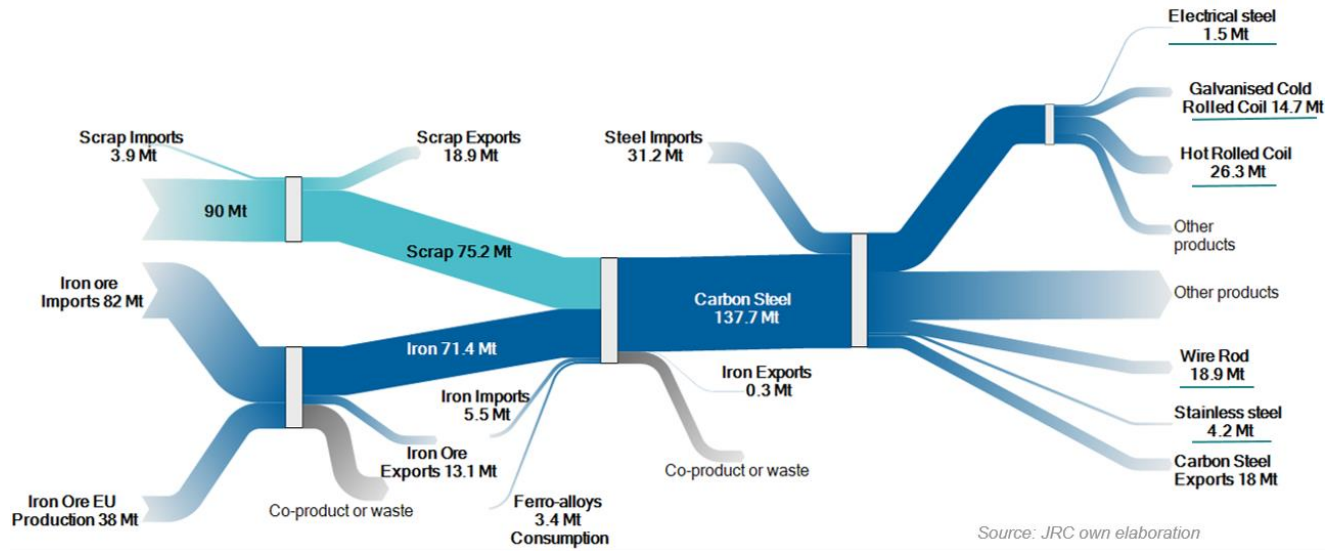
The United States' **crude steel production** has remained stable over the past decade, contributing around 4.5% of global output, while its apparent steel consumption has recently increased from 100 Mt to 115 Mt between 2018 and 2024 driven by growth in various sectors such as infrastructure, energy or defence. Conversely, while EU remains a strong player in the field being the third producing region worldwide, its crude steel production has steadily declined since 2018 from 160 Mt to 129 Mt in 2024 (-20%), correlating well with the observed 17% contraction in demand [5].

In China, amid slowing economic growth and a downturn in the construction sector, **steel demand has fallen by approx. 14%**: from 1,008 Mt in 2020 to an estimated 869 Mt in 2024. However, over the same period Chinese production levels have remained relatively stable, decreasing by only 5%, raising concerns about **overcapacity** and associated export volumes.

EU SUPPLY CHAIN ASSESSMENT

At the EU level, **steel production capacities** are divided between the Blast furnace-basic oxygen furnace (BF-BOF) route (58%) and the scrap-based electric arc furnace (EAF) route (41%). In 2023, actual production by process was 55% BOF and 45% EAF as highlighted in Box 1. EU Material inputs include, among others, **iron ore** and **coking coal** for the BF-BOF route, while EAFs are primarily fed with **ferrous scrap** and, marginally today, **sponge iron** (direct reduced iron - DRI). Figure 5 provides a quantitative overview of the EU steel sector, presenting along the supply chain, imports, exports and EU production of iron and steel **precursors, carbon steel** and specific **steel finished products**.

Figure 5 – Mass flows of the EU steel sector in 2022 with focus on the production of five finished products (underlined)



Source: JRC own elaboration

Steel precursors

At upstream level, the EU faces a supply bottleneck due to its reliance on imported iron ore, ferro-alloys, and coking coal,[3] the latest being used as reducing agent in the conventional BOF production.

Figure 6 – EU supply mix of primary raw materials used in steel production, averages between 2016-2020 and 2024

	Coking coal (2016-2020)	Coking coal (2024)	Iron Ore (2016-2020)	Iron Ore (2024)
USA	21%	33%	0%	3%
Australia	25%	32%	0%	0%
Poland	26%	26%	0%	0%
Canada	9%	4%	13%	26%
Ukraine	0%	1%	13%	14%
Brazil	0%	0%	33%	17%
Sweden	0%	0%	21%	19%
Russia	9%	0%	5%	0%
others	10%	4%	14%	20%
Total EU consumption (Mt)	42.8	39.7	125.0	97.0

	Molybdenum (2024)	Ferro-molybdenum (2024)	Vanadium and Niobium (2024)	Ferro-vanadium (2024)	Ferro-niobium (2024)
USA	48%	0%	18%	0%	0%
Chile	18%	4%	0%	0%	0%
Peru	10%	0%	0%	0%	0%
Brazil	0%	0%	0%	0%	86%
Canada	2%	0%	19%	0%	14%
South Korea	0%	31%	0%	8%	0%
Austria	0%	10%	0%	36%	0%
Belgium	0%	24%	0%	0%	0%
United Kingdom	0%	25%	0%	0%	0%
Czechia	0%	0%	0%	30%	0%
Senegal	0%	0%	60%	0%	0%
South Africa	0%	0%	0%	11%	0%
others	22%	6%	3%	15%	0%
Total EU Consumption (kt)	492.2*	30.7	5.4	19.6	20.2

*kt of Mo. In trade statistics, Vanadium, Niobium and Tantalum are reported with the same CN code, which leads to a lack of granularity in the analyses.

Source: JRC-RMIS based on Eurostat and EC CRMs study [7].

Figure 6 shows **the EU supply mix** for iron ore and coking coal over two time periods: average [2016-2020][4] and 2024.

This comparison highlights the impact of mitigation measures and sanctions implemented following Russia's invasion of Ukraine. Regarding **iron ore**, even with **19-21% of the supply coming from Sweden** the EU is facing an import reliance[5] of 77%. For coking coal, the EU production has decreased over the last years due to the closure of mines in Germany and Czechia. Coking coal is domestically produced in Poland (94%), and Czechia (6%) according to JRC estimates for 2024, **with Poland supplying 26% of coking coal** consumed in the EU. The EU **import reliance for coking coal** increased in recent years from 66% to 72% in 2024. Just before Russia's invasion of Ukraine, more than 18% of the iron ore was supplied by these countries, while Russia accounted with 9% of the coking coal supply. Figure 6 shows this situation has changed, with Russia no longer supplying these materials (as results of sanctions). A shift occurred, with an **increase of coking coal imports from the US and Australia**, making these regions the EU's primary suppliers. For iron ore, supply from Canada has grown, while imports from Brazil have declined.

Alloying elements such as **Vanadium** (V) and **Niobium** (Nb) are identified as **Critical Raw Materials** (CRM) for the EU economy. They are mainly used in the steel industry, this sector represents 90% of the domestic demand for V and 83% for Nb [7]. Despite the fact that **Molybdenum**

[3] Various ferro-alloys (e.g. V, Nb) and coking coal are identified as Critical Raw Materials for the EU (Regulation (EU) 2023/1233).

[4] [2016-2020] are 'reference years' of the 2023 CRM assessment which is based on a four-year average.

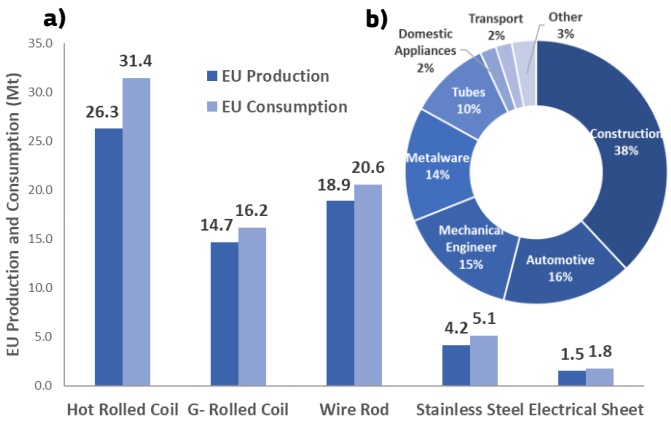
[5] **Import Reliance** = Net imports / Apparent consumption

(Mo) is not formally considered as a CRM, it remains **a key alloying element** in speciality steels, with 71% Mo consumed in the EU used by the steel industry. Figure 6 details the EU supply mix for these elements and associated ferro-alloys. While EU produces a certain amount of its domestic demand for ferro-Mo (34%) and ferro-V (66%), it remains highly dependent on imports for the base metals Mo, V and Nb as well as for Ferro-niobium. When dealing with supply dependencies, it is also worth mentioning the EC is investigating potential unfair competition in alloy imports, focusing on ferro-silicon and similar materials crucial e.g. for electrical steel production.[6]

Finished steel products

The EU manufactures a wide range of finished steel products. As presented in Figure 7, the construction sector is the largest consumer of finished steel products, primarily long products, accounting for 38% of total consumption in the EU. It is followed by the automotive sector (16%), which utilizes a significant share of flat products. To streamline the downstream supply chain assessment, **five specific finished steel products** have been selected: *hot-rolled coil, galvanized cold-rolled coil, wire rods, stainless steel,* and *electrical steel.* These are the five "representative products" selected in the context of the ESPR steel preparatory study[7] for which EU production and consumption (2022) are reported in Figure 7 a).

Figure 7 – **a)** EU production/consumption selected intermediate products, **b)** end-use sectors (2022)



Source JRC based on ESPR preparatory study on steel

Hot rolled coil, Galvanised cold rolled coil and *wire rods* together represent around 45% of both total EU consumption and production. Including *stainless steel* is crucial due to its higher CO_2-intensive production and an import reliance (approximately 18%) that is twice the average for EU steel in general (9% in 2022). Finally, despite currently low consumption volumes, the strategic importance of *electrical steel sheet* for end-use sectors such as clean technologies and its potential supply dependencies make it relevant to consider.

While **EU production** is sufficient to meet between **60-87% of the demand** for the five selected steel products, import reliance of the selected products still ranges from 8% for wire rod to 18% for stainless steel. Figure 8 displays **the top EU trade partners for imports and exports** of the five selected products, with the EU importing 17.5 Mt and exporting 7.3 Mt of these products in 2022. Türkiye, Japan, and Taiwan are the primary suppliers of *hot rolled coil*. *Galvanized cold rolled coil* is predominantly imported from **Türkiye**, **Vietnam**, and **South Korea**. The EU's main sources for *wire rods* are the UK, Malaysia, and Türkiye. For *stainless steel*, China, Taiwan, and India are the leading suppliers. Lastly, the EU imported in 2022 electrical steel primarily from China, Russia, and South Korea, but in 2024 the import from Russia stopped. On the **export side**, the EU's main trade partners are Türkiye, United Kingdom and the USA[8], except for electrical steel that is mainly exported to India.

STEEL PRODUCTION MIX

Installed capacities

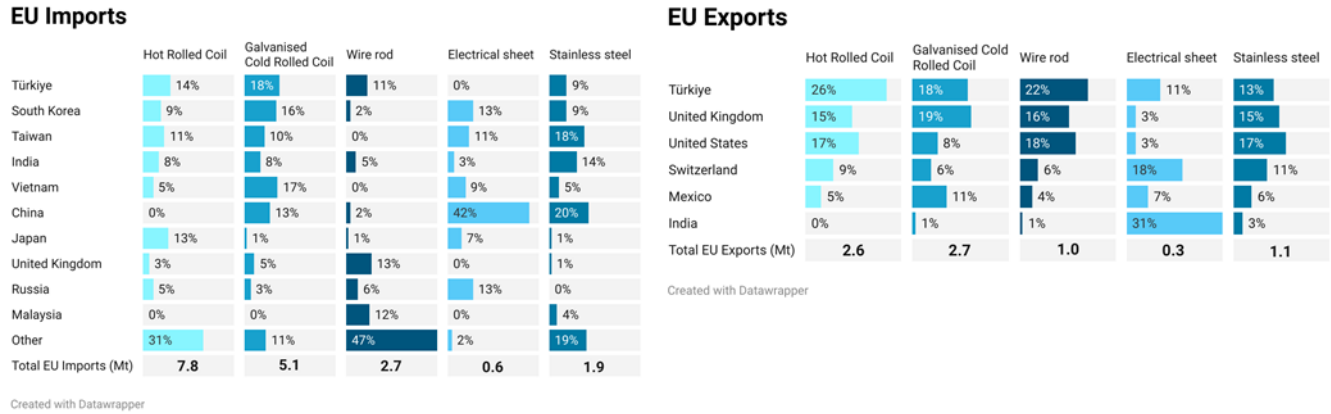
Figure 9 illustrates the current structure of steel **production capacity** by world region. The global average steel production is more dominated by BF-BOF (68%) than in the EU (58%). **The secondary route is more developed in the USA** than in the EU with EAF accounting for more than 64 % of the total installed steel production capacity, one important driver for this difference is the average price of electricity in the EU, which is over the double of that in the USA. Unlike the USA, more than 85% of the steel production capacity in China comes from the primary route, and EAF remains at 14% despite national objectives to increase secondary production. South Korea and India follow the global trend with BF-BOF accounting with 63% and 66% of the installed capacity, respectively. Important also to highlight the Indian capacity in DRI, which is superior to any other region showed in Figure 9.

[6] EC notice of initiation of a safeguard investigation concerning imports of manganese and silicon-based alloying elements (C/2024/9248): OJ link

[7] ESPR steel preparatory study on-going in March 2024

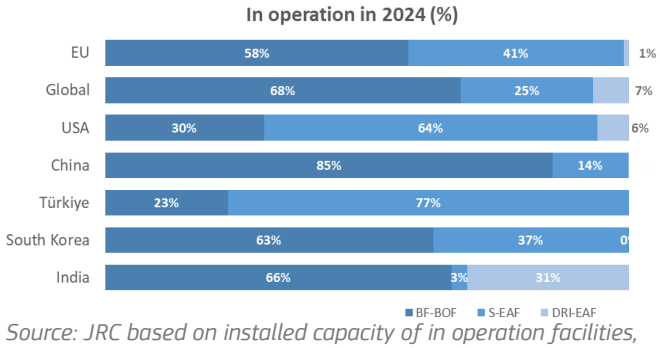
[8] In the context of steel tariffs, we note the USA accounted for around 1Mt of exports for these 5 products, out of a total of 2.3 Mt of steel exports to the US in 2022 (over 75% of which consisted of flat products) according to Eurofer [6].

Figure 8 –EU imports and exports mix for five selected representative products by trade partner, in 2022



Source: JRC based on Eurostat (COMEXT database), data compiled in the ESPR preparatory study on steel

Figure 9 – Comparison of steel technological mix capacities of different regions



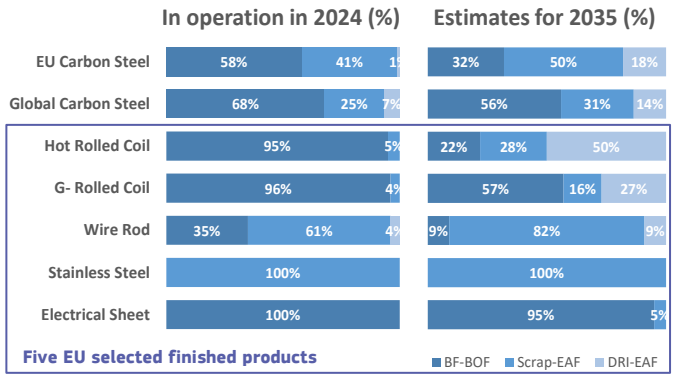
Source: JRC based on installed capacity of in operation facilities, data from the Global Energy Monitor, s.d. [8]

Forecasted production routes by products

Figure 10 depicts the current and 2035 estimates for EU steel production split between the primary route BF-BOF, DRI-EAF and the scrap-based EAF. The figure illustrates **an expected increase in the use of EAF and DRI-EAF technologies**. This increase is more prominent in the EU where new DRI-EAF facilities are expected to become operational until 2035 [8]. DRI-EAF is projected to significantly expand its role in EU steelmaking, reaching 18% of the capacity in 2035. Additionally, stand-alone **EAF capacity** is also predicted to grow substantially, with its production **share rising from 41% to 50%.** At the same time, the BF-BOF capacity may decrease since a substantial share of BF-BOF facilities in the EU were constructed during the 1950s and 1960s and will require replacement or retrofitting within the next decade [9, 10]. It is estimated **74% of BF-BOF furnace capacity in the EU will need to be upgraded** with high investments associated to ensure their economic viability. This could lead to facility closures, while already announced EAF installations and DRI-EAF projects facing lower carbon pricing should materialise in the coming decade[9].

Regarding the five selected products, within ESPR their production is mainly done through the BF-BOF, except for wire rod with 61% of its production coming from EAF and for stainless steel which is produced through re-melting of scrap in EAF facilities in combination with ferroalloys to produce different stainless-steel grades. For 2035 significant changes are expected in the production of hot rolled coil and galvanized cold rolled coil, due to the increased EAF and DRI announced capacities[10].

Figure 10 – Global and EU technological mix capacities for steel and EU production mix for the five selected finished products



Source: JRC based on "in operation", "announced" and "under construction" data from the Global Energy Monitor, s.d. [8], 2035 estimates were done considering also the closure of facilities with more than 50 years in the production countries.

[9] The EAF route requires less than half the capital investment of the primary conventional production route, while comparatively lower-CO_2 steel produced via the DRI-based process is estimated to be 50–70% more expensive than conventional BF-BOF steel. However, this cost difference could be offset by ETS CO_2 pricing [9].

[10] This refers to estimates with inherent uncertainties regarding future total capacity, as they do not account for global ferrous scrap dynamics by 2035.

CIRCULARITY OPPORTUNITIES

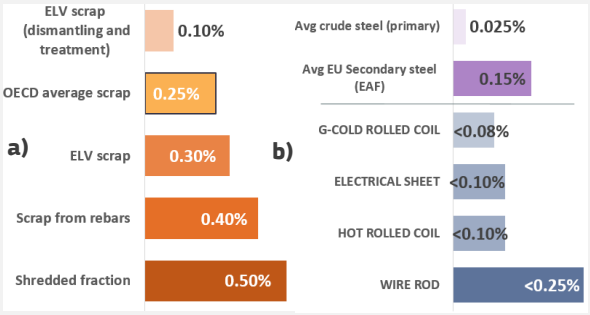
Worldwide, steel is one of the most recycled materials, with approximately 85% of end-of-life steel collected for recycling, while scrap currently accounts for around 32% of ferrous material inputs in steel production [2]. However, scrap use varies significantly across regions (see EAF shares in Figure 9). Fast-developing economies, such as India and China, face limited availability of post-consumer ferrous scrap[11], unlike more mature economies like the EU, US, and Japan. By 2050, EU scrap-based steel making route is expected to increase significantly (from +30% to +78%) according to scenarios depicted in JRC previous briefing[12].

Box 2: The importance of quality of steel scrap

If a relatively high amount of end-of-life scrap is available in developed countries, stringent applications require the use of the best quality scrap.

Steel contaminants, known as "**tramp elements**" (mainly Cu, Ni, Cr, Mo, Sn) limit recycled content in high quality steel products. Several sources investigated the composition of steel scrap [11-13] with a focus on copper-contamination: while the **average copper content** for scrap in OECD countries is estimated to **0.25%**, the concentration reaches 0.15% for product manufactured via the EAF route (Figure 11).

Figure 11 – a) current copper-content on various type of scrap and b) maximum copper tolerance for finished steel products *(ELV: End of Life Vehicles)*



Source: JRC based on references listed in Box 2

This is achieved by **"diluting" the copper content**. In the short term, contamination can be partially managed through global scrap trading for use in **tolerant applications**, as well as by **blending** it with primary iron sources.

However, in the longer term this strategy will become increasingly unfeasible due to the **accumulation of tramp elements** [14]. Therefore, better end-of-life treatment reducing tramp elements is absolutely needed to mitigate this growing concern.

Recent market trends for EU ferrous scrap

In the EU, scrap use[13] is estimated to be around 55% [15], though significant disparities exist across Member States. A potential "*scrap shortage*" in the EU is widely debated, but Eurofer's 2024 statistics [6] show no short-term shortage, with **scrap consumption** falling to a decade-low of **75.1 Mt in 2023.**

Meanwhile, EU extra-regional **scrap exports increased** by 50% over a decade, rising from 12 Mt in 2014 to 19 Mt in 2023 and 17 Mt in 2024 [6]. The **EU is currently the world's largest exporter of scrap**, accounting for 32% of extra-regional scrap exports [5]. The high export volume is driven by a weak domestic demand in recent years. **EU has reached a scrap surplus**, while other regions with rapid economic growth and lower scrap outflow remain in deficit. This imbalance creates a trade gradient that favours exports toward marginal producers. Unless scrap quality is adjusted to better align with EU demand, this trend is likely to persist.

Forecasted EU scrap supply/demand balance

Figure 12 shows the historical and projected volumes and origins of scrap used in steel production. In 2024, **scrap use reached approximately 77 Mt**, with a projected increase to 92 Mt by 2035, based on the estimated EU's mix (Figure 10) and assuming relatively stable steel production levels. Despite a moderate **increase in available scrap** (from the current 100 Mt to 112 Mt in 2035), its potential use will remain lower than domestic availability. This represents a moderate annual growth rate of 1% over the 2018-2035 period aligned with [11, 16].

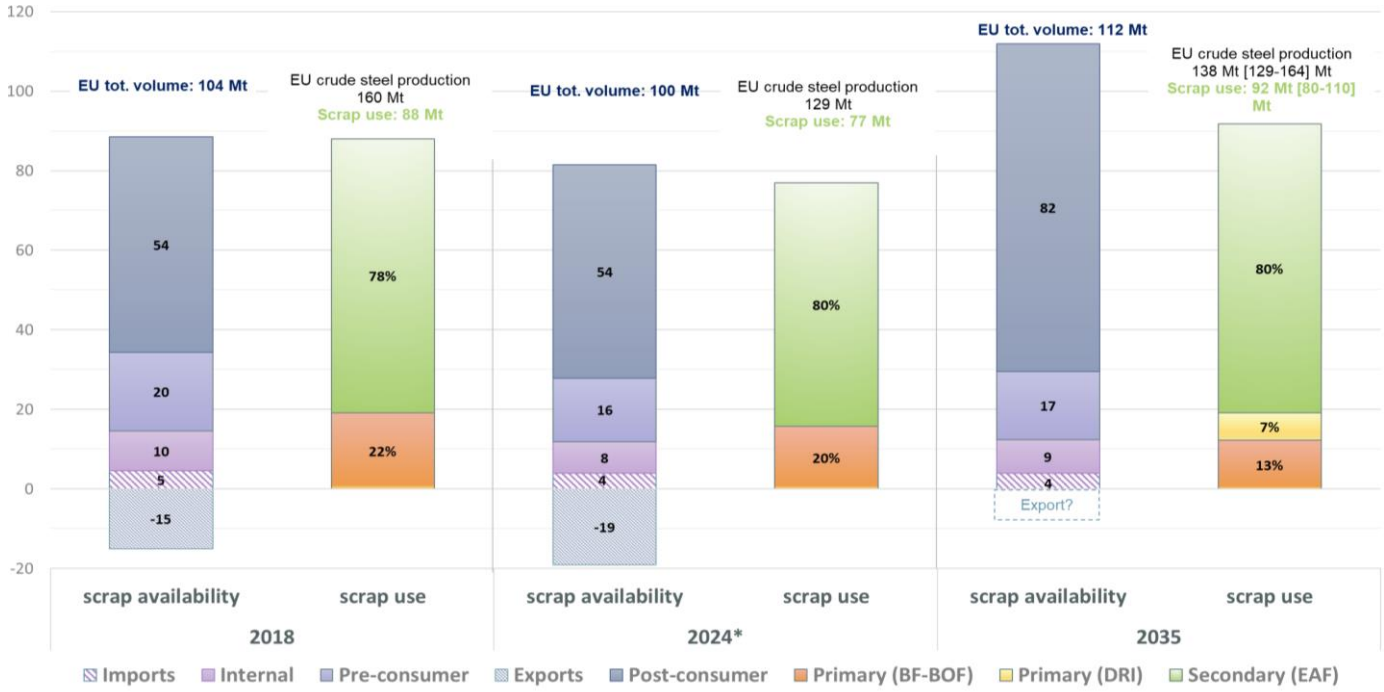
The absence of forecasted scrap shortage is confirmed by several sources [12-16], estimating the EU post-consumer scrap available should reach 80-90 Mt in 2035. Still, after 2035, Worldsteel association [17] estimated that the scrap availability in advanced economy should remain stable while significantly growing in countries such as India or China.

[11] Distinction pre-consumer/post-consumer scrap: (i) pre-consumer scrap is scrap generated during the manufacturing of steel, before reaching the market; (ii) post-consumer scrap is scrap generated at the product's end of life that has been already used by end consumers.

[12] JRC, Somers, J. Moya, J. 'Decarbonisation of industrial heat: The iron and steel sector'. European Union, 2020. Link

[13] Scrap use = scrap inputs divided by total steel production

Figure 12 – Scrap availability in the EU and associated use (Mt).



Source: JRC own elaboration based on [6, 11-13, 16] and targeted stakeholders' consultations. Note: The 2024 figures are non-consolidated and may be subject to revision, while 2035 are projected values.

POLICY PERSPECTIVES

» Strengthen supply chain resilience [access to raw materials] by:

Establishing mechanisms to monitor and mitigate both **risks of supply disruption and supply overcapacity** on critical steel products and associated precursors. Implementing **early-warning** systems for key products such as electrical steel to prevent supply bottlenecks.

» Improve Circularity of EU Scrap [access to high quality scrap supply] by:

Addressing inefficiencies in the **EU scrap cycle,** strengthening market transparency by defining a **quality-based scrap classification** while ensuring sufficient domestic **scrap demand**.

» Enhance EU steel sustainability through demand-side incentives [access to market] by:

Stimulating demand for **EU-domestically sourced scrap** for **recycled content** by integrating circularity requirements into public procurement, and sector-specific legislations.

Promoting **scrap content disclosure** (potentially associated with CO_2 savings) to drive EU market differentiation and sustainability.

HOW TO CITE THIS DOCUMENT

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REFERENCES

[1] Joint research Center, J. Somers, Technologies to decarbonise the EU steel industry, Publications Office of the European Union, 2022. Link
[2] IEA, Iron and Steel Technology Roadmap, 2020. Link
[3] Joint Research Centre, Koolen, D. and Vidovic D., 'Greenhouse Gas Intensities of the EU Steel Industry and Its Trading Partners', Publications Office of the European Union, 2022. Link
[4] RMIS - Raw Materials Profiles - Iron & Steel. Link
[5] World Steel Association, *World Steel in Figures*, 2024. Link
[6] EUROFER, 'European Steel in Figures 2024', Link
[7] European Commission, *Study on the Critical Raw Materials for the EU 2023: Final Report*, Publications Office of the European Union, 2023.
[8] Global Energy Monitor, Global Steel Plant Tracker, April 2024 (v1) release
[9] Agora Industry, Wuppertal Institute and Lund University: Low-carbon technologies for the global steel transformation. 2024. Link
[10] Su R. and Assous, A. 'Starting from scrap - The key role of circular steel, 2022. Sandbag. Link
[11] Hundt, C. and Pothen, F. *'European post-consumer steel scrap in 2050: A review of estimates and modeling'*, 2024. Link
[12] Dworak, S. and Fellner, J. 'Steel scrap generation in the EU-28 since 1946 – Sources and composition', 2021. Link
[13] Material economics, 'The Circular economy, a powerful force for climate mitigation', 2018. Link
[14] Daehn, K.E. Cabrera, A. Allwood, J.M. 'How Will Copper Contamination Constrain Future Global Steel Recycling?', 2017. Link
[15] EURIC, Boosting steel scrap recycling in the EU 2023. Link
[16] EUROFER, Low carbon roadmap, 2019. Link
[17] World Steel Association, 'Factsheet on scrap'. 2021. Link

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