

Briefing Paper

The export of ferrous scrap & the Waste Shipment Regulation

CO2 emission associated with the exports and possible criteria for establishing the burden of proof on the exports

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Introduction

The EU Green Deal and the New Circular Economy Action plan highlighted how much the domestic processing of the EU generated waste can contribute to various objectives of the Union, including reducing environmental and climate impacts. Accordingly, the EU export of waste should occur only when it makes sense from a sustainable point of view. The treatment and recycling of the EU waste should occur in EU when there is the technology for doing it and when exporting it to third countries would result in harmful impacts on environment and human health. The ongoing revision of the Waste Shipment Regulation comes timely and is a unique opportunity to address these very important aspects.

The Ferrous Scrap

The export of EU waste streams containing valuable materials¹ has dramatically increased from 2004 to 2019 passing from 21,700,000 t to 36,100,000 t (+66%). The major part of this export is constituted by ferrous scrap. The volume of exported scrap passed over the same period from around 12,000,000 t to 21,500,000 t (+79%) – see Figure 1. The ferrous scrap is a key input material for the production of steel. It allows partially or even completely replacing the use of virgin resources (iron ores) according to the expected characteristics of the final steel. Moreover, it has embedded a very high CO₂ reduction potential: the recycling of ferrous scrap generates new steel with only a third of the CO₂ emissions compared to the virgin production.

¹ https://ec.europa.eu/eurostat/databrowser/view/cei_srm020/default/table?lang=en; Circular Economy monitoring framework on recyclable raw materials' based on the waste streams containing: plastic; paper and cardboard; precious metal; iron and steel; copper, aluminium and nickel.

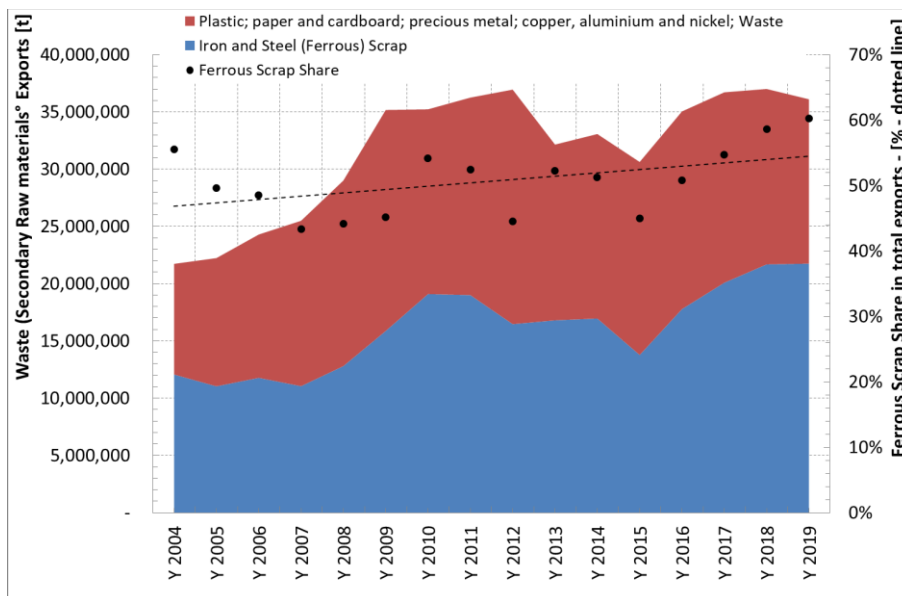


Figure 1. Total exports of valuable waste containing secondary raw materials as calculated by EUROSTAT in the Circular Economy indicators

It is an essential input material for the EU steel sector in order to continue and accelerate its de-carbonisation process. The availability of the ferrous scrap is a vital component of the EUROFER Masterplan for a Low-Carbon, Competitive European Steel Value Chain. The European Steel sector will commit large amount of resources for its de-carbonisation. A large number of R&D activities and industrial pilot projects already started and other will start from today till 2030 and beyond. Many of these will be also co-funded using EU and National Research funds. However, the availability of the ferrous scrap otherwise the de-carbonisation process will be at stake.

CO2 emissions associated to ferrous scrap export

The export of ferrous scrap for its recycling in third countries instead of recycling in EU, does imply substantial additional CO₂ emissions. Such export can also result in EU imports of steel products with high additional value of embedded CO₂ substituting EU production with much lower CO₂ footprint.

The average annual exports of the ferrous scrap, leaving the EU territory over the period 2017-2019, were at around 21,000,000 t. These exports are directed to several destinations; the most relevant ones are: Turkey, Egypt, Pakistan, India, US, Morocco, Indonesia, Vietnam, China, Kuwait, South Korea and Taiwan. Moreover, some of these countries represent major exporters of steel products to the EU market; thus, it is reasonable to suppose that part of this steel exported to the EU was produced using the ferrous scrap imported from the EU. Such interconnections might create additional CO₂ emission that would not occur if the ferrous scrap would have been processed in EU. In order to explain further this concept, the CO₂ emissions

associated to ferrous scrap export and processing abroad have been calculated². In particular the focus has been on the production of crude steel from EAF process using 100% of scrap input.

According to the calculations, the ferrous scrap exported to third countries and processed there into new steel generates additional carbon emission of 4,000,000 t, due to the transport and to the higher CO₂ intensity of their grid mix. Moreover, it might happen that some countries re-export back to the EU steel products produced using the ferrous scrap imported from the EU. In such event, the additional CO₂ intensity of imported steel product might vary between 200 kg_{CO2}/t_{steel} and 900 kg_{CO2}/t_{steel} with an estimation of the average intensity of 552 kg_{CO2}/t_{steel}.³

This shows that processing abroad the ferrous scrap that could have been processed in the EU under higher environmental standards and with lower CO₂ emissions is not a sustainable option, if only considering the aspect of the involved additional CO₂ emissions. The same conclusions could be derived concerning environmental legislations (i.e. covering emissions other than CO₂, waste management ...) and standards

The Revision of the Waste Shipment Regulation

Concerning the export of waste, the revision of the regulation should substantially improve the methodology and criteria for checking the Regulatory and Standards situation at destination. In the past, this concept, which is a basic principle of the Basel Convention as well, has not been effectively applied. It is essential to strengthen Article 49 of the WSR in order to impose a burden of proof on the exporters so that they have to demonstrate the environmental and human health conditions at destination are equivalent to the EU ones. This cannot be achieved just by checking whether the legislation at destination are in theory similar to that of the EU but whether in reality the destination facility comply with standards equivalent to those applicable in the EU. A practical proposal to implement this approach could be as follows:

² Tables containing the data and reference used are reported in the Annex I.

The total amount of additional CO₂ emissions associated with the ferrous scrap recycling has been calculated for each of the major importers of EU ferrous scrap. The total is calculated summing up the following two parts:

- (1) the average emissions of each vessel type (Annex I-A) have been multiplied by the distance between origin and destination ports (Annex I-B) and by the tonnage of transported scrap (Annex I-D);
- (2) the tonnages of the exported ferrous scrap to the different destinations (Annex I-D) have been multiplied by the additional CO₂ intensity of their respective electricity grid mixes (Annex-I C) and by the energy requirements of scrap smelting and scrap yield, these last two assumed the same in EU and all third countries.

³ The additional CO₂ intensity of imported steel product has been simply estimated summing up to the additional CO₂ load of producing one tonne of crude steel in the third country (transport plus scrap smelting) also the CO₂ load of the journey back from the ports in third countries to EU; (Annex I-B) multiplied by (Annex I-A) and by 1 tonne of steel.

- Step 1. **EXISTENCE OF RELEVANT LEGISLATION** – The exporter of EU waste would need to verify whether the destination country has relevant National Laws and Standards covering the following aspects:
- i. Climate Change (e.g. reduction targets; transition toward green electricity; investment plans for cur...
 - ii. Waste management and treatment
 - iii. Industrial Emissions (other than CO₂ like NO_x, SO_x...)
 - iv. Social and Labour Standards

For the sake of clarity, and as proposed by Eurofer in its reply to the Commission's ~~con~~ **SR should define explicitly a list of EU** vised legislations and standards (eg. BREFs), whose equivalence at destination country shall be mandatory for exports of waste to be allowed (such legislation and standards constituting the “ Relevant Environmental

If national laws or standards of the destination country do not cover the relevant scope of the Relevant Environmental EU Acquis, the export of waste to that destination country cannot be considered a sustainable or environmental acceptable option.

- Step 2. **AMBITION** - The exporter of EU waste would need to verify that the relevant national Laws and Standards at destination countries have scopes and objectives that are aligned with those of the Relevant Environmental EU Acquis (such as reduction of GHGs emissions, waste hierarchy and management options, emission limits). ~~The Laws and Standards can be different~~ **id a ...** in their methods but their overall aims and ambition (e.g. emission levels) should be equivalent to those of the Relevant Environmental EU Acquis. If the goals of the Laws and Standard cannot be considered equivalent to the EU ones, the export should not be allowed.

- Step 3. **ENFORCEMENT** – Finally, exporters of EU waste would have to establish whether the relevant Laws and Standards are effectively enforced and applied on the whole territory of the destination. If this can be confirmed, together with Steps 1 and 2, then the waste shipment can be cleared. If not, the exporter would have to provide evidence, through appropriate audits carried out in accordance with relevant EU and international standards by independent auditors of international standing, that each of the destination facilities receiving EU exported waste is operated in full compliance with the Relevant Environmental EU Acquis. Otherwise, the waste shipment would not be authorised.

As a measure of administrative simplification, and in order to ensure consistency of approach, we would recommend that:

- checks of sufficiency of national legislations (Steps 1 and 2) and of their effective implementation and enforcement by destination countries (Step 3) be carried out by the European Commission or under its direct supervision.
- When confirmation of effective implementation and enforcement by a destination country cannot be provided at country level, the proof that the receiving facilities comply with the Relevant Environmental EU Acquis shall be brought by the exporter through adequate audit reports carried out as proposed above.

ANNEX I – Data used for the calculations

A - CO₂ information for transport services

Description depending on the nature and capacity of the vessel	CO ₂ emission rate per unit transported and per km	Type of Ferrous Scrap Shipment	Average Emissions Rate per type of scrap shipment
Vraquier Handysize - De moins de 40 250 tonnes de port en lourd	11,0 g CO ₂ / t.km	Bulk	6.425 g CO₂ / (t.km)
Vraquier Handymax- De 40 250 à 63 499 tonnes de port en lourd	5,75 g CO ₂ / t.km	Bulk	
Vraquier Panamax - De 63 500 à 127 500 tonnes de port en lourd	5,36 g CO ₂ / t.km	Bulk	
Vraquier Capesize - De plus de 127 500 tonnes de port en lourd	3,59 g CO ₂ / t.km	Bulk	
Pétrolier Petit product tanker - De moins de 26 500 tonnes de port en lourd	24,9 g CO ₂ / t.km		
Pétrolier Handy product - De 26 500 à 68 499 tonnes de port en lourd	18,4 g CO ₂ / t.km		
Pétrolier Aframax - De 68 500 à 200 000 tonnes de port en lourd	5,33 g CO ₂ / t.km		
Pétrolier VLCC - De plus de 200 000 tonnes de port en lourd	3,31 g CO ₂ / t.km		
Gazier petit GPL	53,7 g CO ₂ / t.km		
Gazier VLGC	14,4 g CO ₂ / t.km		
Petit vraquier/navire fluvio-maritime	18,3 g CO ₂ / t.km		
Porte-conteneurs - De moins de 1 200 EVP	32,5 g CO ₂ / t.km	Container	19.54 g CO₂ / (t.km)
Porte-conteneurs - De 1 200 à 1 899 EVP	21,6 g CO ₂ / t.km	Container	
Porte-conteneurs - De 1 900 à 3 849 EVP	20,1 g CO ₂ / t.km	Container	
Porte-conteneurs - De 3 850 à 7 499 EVP	13,4 g CO ₂ / t.km	Container	
Porte-conteneurs - De plus de 7 500 EVP	10,1 g CO ₂ / t.km	Container	
Ferry de nuit	86,3 g CO ₂ / t.km		
Ferry de jour	57,9 g CO ₂ / t.km		
Ro-Pax	66,6 g CO ₂ / t.km		
Ro-Ro	101 g CO ₂ / t.km		

Table taken from the publication of the French ministry of the Ecology, the Sustainable Development and of the Energy, “Information Climat des transports”; Guide méthodologique

B - Ports Oceanic Distances

Ferrous Scrap destinations	European Origin port - Rotterdam	Destination port	Nautical Miles	km	Type of preferred shipment
Turkey	Rotterdam	Izmir	3,002	5,560	Bulk
Egypt	Rotterdam	El Dekheila	3,159	5,850	Bulk
Pakistan	Rotterdam	Karachi	6,133	11,358	Container
India	Rotterdam	Mumbai	6,320	11,705	Container
United States	Rotterdam	Ports of New York & New Jersey	3,390	6,278	Bulk
Bangladesh	Rotterdam	Chittagong	8,013	14,840	Container
Morocco	Rotterdam	Port of Tangier	1,342	2,485	Bulk
Indonesia	Rotterdam	Port of Jakarta	8,548	15,831	Container
Vietnam	Rotterdam	Saigon Port	8,934	16,546	Bulk
China, P. Republic	Rotterdam	Qingdao	10,751	19,911	Container
Kuwait	Rotterdam	Port of Shuaiba	6,560	12,149	Container
South Korea	Rotterdam	Port of Busan	10,791	19,985	Bulk
Taiwan	Rotterdam	Kaohsiung Port	9,909	18,351	Container

The oceanic distance between the reference ports have been calculated using the following sources: <https://sea-distances.org/>; www.metalbulletin.com. Moreover, the shortest route has been always chosen.

C - Grid factors for the different countries and regions

The CO₂ equivalent intensity associated to the electricity grids of the countries importing the EU ferrous scrap has been found from various sources, such:

- <https://www.iea.org/data-and-statistics/charts/carbon-intensity-of-electricity-generation-in-selected-regions-in-the-sustainable-development-scenario-2000-2040>
- European Standard EN 19694-2: Stationary source emissions — Determination of greenhouse gas (GHG) emissions in energy-intensive industries
- Carbon Footprint; Country Specific Electricity Grid Greenhous Gas Emission Factors, Last Updated June 2019; www.carbonfootprint.com

When the data related to a specific country were missing or too old, the most updated average of its world region has been used. For this exercise the following values have been adopted:

	g CO ₂ /kWh		g CO ₂ /kWh	Δ (country-EU) gCO ₂ /kWh
Turkey	543.40	European Union	269.01	274.39
Egypt	447.07	European Union	269.01	178.06
Pakistan	570.71	European Union	269.01	301.70
India	708.78	European Union	269.01	439.77
United States	405.47	European Union	269.01	136.46
Bangladesh	406.47	European Union	269.01	137.46
Morocco	781.64	European Union	269.01	512.63
Indonesia	755.10	European Union	269.01	486.09
Vietnam	612.57	European Union	269.01	343.56
China, P. Republic	612.57	European Union	269.01	343.56
Kuwait	717.60	European Union	269.01	448.59
South Korea	517.00	European Union	269.01	247.99
Taiwan	491.60	European Union	269.01	222.59

D - Volumes of exported scrap & hypothesis about EAF processes

The volumes of the exported ferrous scrap, annual average over the period 2017-2019, have been extracted from EUROSTAT COMEXT. In particular, the tonnages have been divided in two groups in accordance with the average energy demand for their smelting in the Electric Arc Furnaces. According to the practice, carbon scrap has lower energy requirements than stainless

steel scrap; with reference to most recent scientific literature⁴, the energy requirement for smelting carbon steel scrap have been fixed at 375 kWh/t_{scrap}; concerning the stainless and high alloy steel scrap the energy requirement increments till 500 kWh/t_{scrap} due to the presence of more alloying elements.

Metric tonnes	Ferrous scrap	Metric tonnes	Stainless & High Alloy Scrap	Metric tonnes	Carbon Steel Scrap
Bangladesh	703,856	Bangladesh	201,081	Bangladesh	502,775
China, P. Republic	180,664	China, P. Republic	48,584	China, P. Republic	132,080
Egypt	1,677,016	Egypt	9,493	Egypt	1,667,523
India	1,446,268	India	511,183	India	935,085
Indonesia	365,205	Indonesia	148,474	Indonesia	216,731
Kuwait	129,695	Kuwait	23,479	Kuwait	106,217
Morocco	399,828	Morocco	32,002	Morocco	367,825
Pakistan	1,543,350	Pakistan	408,085	Pakistan	1,135,265
South Korea	77,521	South Korea	5,943	South Korea	71,578
Taiwan	67,804	Taiwan	63,770	Taiwan	4,034
Turkey	12,240,575	Turkey	357,699	Turkey	11,882,875
United States	755,291	United States	15,911	United States	739,380
Vietnam	199,047	Vietnam	19,775	Vietnam	179,273

It has been assumed that the countries importing ferrous scrap utilise the same technologies and procedures and practices used in the EU. Therefore, the energy requirements associated with most efficient technologies are assumed - 375 kWh/t_{scrap} and 500 kWh/t_{scrap} – as the same yielding factor of the ferrous scrap in the EAF process fixed at 1.07 t_{scrap}/t_{EAFcrudesteel}.

⁴ Pasquale Cavaliere, *Clean Ironmaking and Steelmaking Processes Efficient Technologies for Greenhouse Emissions Abatement*, Springer Nature Switzerland AG 2019