



**Dillinger heavy plates with reduced product carbon
footprint rolled with material from
Saarschmiede Freiformschmiede GmbH
Determination of the route-related PCF value**

Commissioned by SHS – Stahl-Holding-Saar | AG der Dillinger Hüttenwerke & Saarstahl AG

Short Statement - December of 2023

1.0 Process

SHS group and its subsidiaries

SHS - Stahl-Holding-Saar GmbH & Co. KGaA (SHS Group) is the management holding company of the two large Saarland-based steel companies, Aktien-Gesellschaft der Dillinger Hüttenwerke (Dillinger) and Saarstahl AG (Saarstahl). Dillinger is a worldwide leader in the production of heavy steel plates among others for steel construction, mechanical engineering, offshore-windpower or the linepipe sector. Saarstahl is a globally leading manufacturer of rod and bar steel for the automotive industry, the construction industry and general machinery. Under the common roof of the SHS Group Dillinger and Saarstahl employ around 14,000 people. The primary hot metal pig iron is produced in blast furnaces (BF) at the 50% Saarstahl and 50% Dillinger owned subsidiary ROGESA. Included is a coke oven plant ZKS for the production of coke. Overall the SHS Group, which is reporting as a holding company with its two big subsidiaries and numerous further processing subsidiaries (e.g. Steelwind Nordenham, Dillinger France, Jebens, Ancofer Waldram, Ancofer Stahlhandel, Saar-Blankstahl, Schweißdraht Luisenthal, Drahtwerke St. Ingbert, Drahtwerke Köln, Conflandey Industries, Saarschmiede Freiformschmiede, Saar-Bandstahl, Saar-Stahlbau, Saarstahl Rail and Saarstahl Ascoval) includes two blast furnace plants, an electric arc furnace, a coke oven production site, two blast oxygen plants and a total of 6 hot rolling mills.

SHS continuously works on innovative and tailor-made steel solutions together with our customers. With our comprehensive knowledge of steel making and specialized rolling techniques our products are manufactured at the highest level to achieve both quality and consistency, ensured by the latest testing technology installed.

Study target

Since the customer demand for products with lower carbon emission intensity is rising, we develop new products that can achieve these qualities. Beside the big project PureSteel+, where the whole steel production route will be transformed towards a CO₂ reduced steel production beginning 2027, Dillinger has partnered with the Saarschmiede Freiformschmiede GmbH (SSF) on a short-term basis to produce heavy plates with reduced Carbon footprint. For this purpose, steel melted and casted into ingots in Völklingen at the SSF Electric Arc Furnace (EAF) plant. Further rolling is done at the Dillinger rolling heavy plate mill with the high-quality standards, Dillinger is known for. The study will show the clearly reduced CO₂ emission level of this alternative route.

The study has been conducted according to the requirements of ISO 14067. The analysis and interpretation of the results focusses, in correspondence with the goal of the study, exclusively on the Product Carbon Footprint development of heavy plate products originate from SSF production. All other impact categories are excluded from the scope of this study. The scope of the study covers the production of the considered products, excluding all other life cycle phases, and therefore represents a cradle-to-gate assessment.

Process description

Selected steel scrap is loaded in a basket and transported into the EAF at the SSF site in Völklingen. Between three graphite electrodes and the steel vessel, the scrap is molten by electric arcs. To support the process of heating and melting, additional energy is generated by burning natural gas and carbon in the furnace.

After tapping the steel into a ladle, the liquid steel is controlled heated in a ladle furnace for final processing in a vacuum degassing treatment, to reduce gaseous elements in the steel (nitrogen, hydrogen) and final adjusting the chemical composition.

After the metallurgical process, the molten steel is poured into ingots in various sizes up to 60 to weight. Chemical composition and weight of the ingots are ordered by the Dillinger rolling mill for further processing. Due to technical reasons, grades produced via this route are from the heat treatment condition Normalised (N) or Quenched and Tempered (Q+T).

2.0 Scope

2.1 Product System(s)

This study refers to heavy plate products in higher thicknesses and weights in the heat treatment conditions N and Q+T in the production chain of the Electric Arc Furnace at Saarschmiede SSF (Völklingen) and the hot rolling mill of Dillinger Hütte DH (Dillingen).

Typical applications for these heavy plates are for example within the construction or machinery sector or for the use in offshore oil and gas or offshore wind.

2.2 Product Function(s) and Functional Unit

The following functional units are considered within this study:

- 1 kg of heavy plate (Grobblech), produced on the production line steelmaking in the EAF at Saarschmiede-Völklingen and hot rolling at Dillinger including the final heat treatment (as average).

The selected functional units correspond with the goal of the study to calculate the Product Carbon Footprint (PCF) of the product systems and are shown as a mean value for different steel grades produced.

2.3 System Boundary

The study considers the production of the steel products slab and heavy plate at the sites Saarschmiede (Völklingen) and Dillinger Hütte (Dillingen) as described in Figure 1.

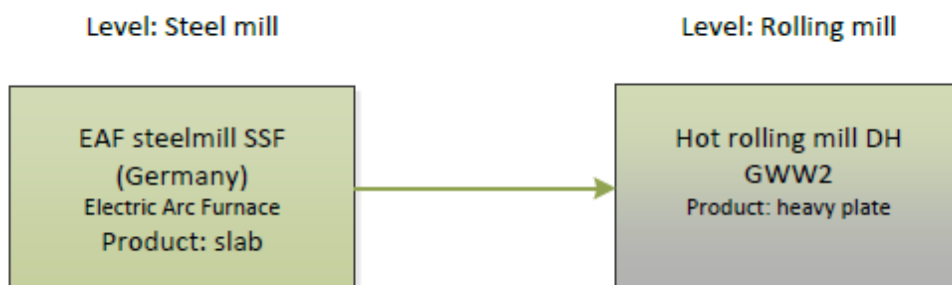


Figure 1:- Production Route ex. SSF and DH

The product carbon footprints represent a cradle-to-gate approach and is considering the EAF plant with its input streams, the transportation between steel mill and rolling mill as well as the rolling mill itself with all relevant consumptions.

- average data for all background processes. Whenever such data were not available (e.g., no industry-average data available for a certain country), best-available proxy data were employed.

2.4 Verification

The Verification Statement for the calculation method has been provided by proTerra Umweltschutz- und Managementberatung GmbH.

3.0 Product Carbon Footprint (PCF) for Plate produced via the Production Route Steelmaking at Saarschmiede SF and Rolling at Dillinger DH

The results for the impact category carbon emissions as PCF for the product systems under study are as follows:

Mean PCF for heavy plate grades from ingots ex SSF:

PCF: 1.135 kg CO₂ equivalents / 1.000 kg finished plate

The PCF results of the products under study have been calculated considering the consumption grid mix of Germany (Source: UBA/EcoInvent) where the production sites are located.

Limitations

The study represents a cradle-to-gate assessment with focus on climate change (Product Carbon Footprint).

The study does not allow any interpretation in the context of the full life cycle of the steel products under study or regarding other impact categories than carbon emissions from the processes under study.