Declaration Owner

ArcelorMittal Europe – Long Products
ArcelorMittal Commercial Sections
66, rue de Luxembourg
L-4221 Esch-sur-Alzette (Luxembourg)
https://sections.arcelormittal.com/
sections.northamerica@arcelormittal.com

Product:

Hot-rolled structural shapes

Functional Unit

The declared unit is one (1) metric ton

EPD Number and Period of Validity

SCS-EPD-09966

EPD Valid February 29, 2024 through February 28, 2029

Version Date: March 27, 2024

Product Category Rule

UL Product Category Rule (PCR) Guidance for Building-Related Products and Service, Part A: Life Cycle Assessment Calculation Rule and Report Requirements. Version 4.0 March 2022.

UL Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Designated Steel Construction Product EPD Requirements. Version 2.0. August 26, 2020.

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

Declaration owner:	ArcelorMittal Europe – Long Products
Address:	Arcelor Mittal Commercial Sections 66, rue de Luxembourg, L-4221 Esch-sur-Alzette, Luxembourg
Declaration Number:	SCS-EPD-09966
Date of Issue:	March 27, 2024
Declaration Validity Period:	EPD Valid February 29, 2024 through February 28, 2029
Program Operator:	SCS Global Services, 2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
General Program Instructions:	SCS Type III Environmental Declaration Program: Program Operator Manual. V11.0
Product(s):	Hot-rolled structural shapes
Declared Unit or Functional Unit:	One metric ton of structural shapes
Product's Intended Application and Use:	Structural Steel (Hot rolled sections)
Product RSL (if applicable):	n/a
Markets of Applicability:	Global
EPD Type:	Product specific / Manufacturer specific
Dataset Variability:	n/a
EPD Scope:	Cradle to gate with options: production (A1-A3), C1-C4 and D
Year(s) of Reported Manufacturer Primary Data:	2021
LCA Software & Version Number:	LCA Sphera for Experts software, version 10.7.1.28
LCI Database(s) & Version Number:	MLC database & 2023.2
LCA Practitioner:	Leonardo Guimarães Ribeiro
Reference PCR:	ISO 21930:2017 serves as core PCR and UL Part A Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Designated Steel Construction Product EPD Requirements. Version 2.0. August 26, 2020.
Sub-category PCR review:	Tom Gloria, Industrial Ecology Associates; Brandie Sebastian, JBE Consultants; James Littlefield, Independent Consultant
Independent critical review of the LCA and data, according to ISO 14044 and the PCR:	☐ internal ☒ external
LCA Reviewer:	Tess Garvey, Ph.D., SCS Global Services
Independent verification of the declaration and data, according to ISO 14025 and the PCR:	☐ internal ☒ external
EPD Verifier:	Tess Garvey, Ph.D., SCS Global Services

Declaration Contents:

Disclaimers: *An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication.*

Conformity: *This EPD conforms to ISO 14025:2006, and ISO 21930:2017.*

Ownership: *The EPD owner has the sole ownership, liability, and responsibility of the EPD.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability:

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of environmental performance of steel construction products using EPD information shall be based on the product's use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under this PCR. Full conformance with the PCR for designated steel products allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category Part B PCR, and use equivalent scenarios with respect to construction works. However, variation and deviations are possible.

1. ArcelorMittal Europe – Long Products

ArcelorMittal's strategy aims to maintain a long-term position as the world's leading steel and mining business, meet the world's rising demand for steel in a sustainable way while supporting the broader transition to a more circular, increasingly decarbonized economy, and deliver value to all stakeholders – including shareholders – throughout the cycle. As such, five strategic priorities are key to achieving these goals and driving sustainable value creation: Improve safety, strategic growth, decarbonization and sustainability leadership, cost advantage, and consistent return.
ArcelorMittal Europe – Long Products operates 27 production sites in ten countries and is a leader in the manufacturing of sections, sheet piles, rails, quality wire rod, rebars, and bars.

Our journey towards becoming carbon neutral by 2050 is well underway. In line with the Paris Climate Goals and the European Green Deal, ArcelorMittal has also committed to reduce CO2 emissions in our European operations by 35% by 2030 and by 25% worldwide.

2. Product

2.1 PRODUCT DESCRIPTION / SPECIFICATION

Structural steel shapes are hot rolled steel sections and merchants bars used in various construction applications (UN CPC code 412 - Products of iron or steel). These products are rolled shapes such as parallel flange sections, angles, channels.

More specifically at ArcelorMittal, when produced with 100% scrap input in an electric arc furnace, and when combined with GoOs (Guarantees of Origin) from renewable sources that provide 100% coverage for the electricity used to generate the product, the product is referred to as XCarb® recycled and renewably produced structural products, also commonly called sections and merchant bars.

Hot-rolled structural shapes can be produced in a wide range of height, width, and length according to the application and specifications. The declaration covers the whole range of structural shapes produced in:

- ArcelorMittal Luxembourg → Esch-Belval, Differdange, Rodange;
- ArcelorMittal Spain → Olaberria, Olaberria-Bergara.

Specific information on dimension tolerances, constructional data, as well as mechanical and chemical properties can be found in the relevant literature and/or the following standards:

- Design standards: ANSI/AISC 360 and EN 1993, EN 1994 apply to the design of steel structures and composite steel and concrete structures. They include the requirements regarding serviceability, bearing capacity, durability and fire resistance of steel structures and composite steel and concrete structures.
- Product standards: ASTM A913, ASTM A6, ASTM A709, ASTM A36, ASTM A572, ASTM A588, ASTM A709, ASTM A992, and EN 10025.
- Fabrication standards: AISC 360, AISC 341, AISC 303, AWS D1.1, and EN 1090-2.

Additional information on structural steel and constructing with steel can be obtained from ArcelorMittal Sales Program Sections & Merchant Bars available at http://sections.arcelormittal.com.

The main part of this EPD refers to LCIA results for structural sections and merchant bars produced with EAF route and standard electricity grid, whereas the LCIA results for XCarb production (EAF route with renewable electricity grid) can be found in Annex. The descriptive text generally refers to XCarb® recycled and renewably produced structural steel sections and merchant bars.

2.2 FLOW DIAGRAM

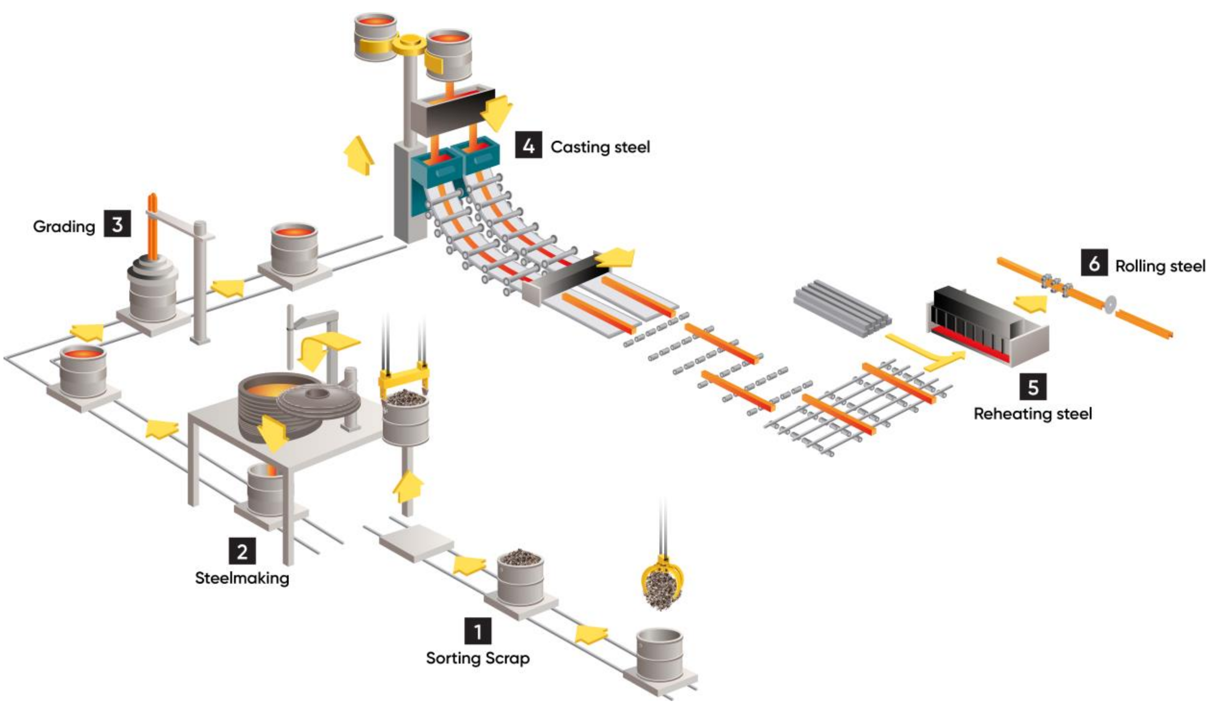

Figure 1: *Production process of structural steel.*

2.3 PRODUCT AVERAGE

This is a product specific EPD, from a specific manufacturer, produced at different sites. A weighted average based on 2021 production was used to obtain the results.

2.5 APPLICATION

Structural steel products, such as sections and merchant bars are intended for bolted, welded or otherwise connected constructions of buildings, bridges and other structures, as well as in composite steel and concrete structures such as:

- Single-story buildings (industrial and storage halls, etc.)
- Multi-story buildings (offices, residential, shops, car parks, high rise, etc.)
- Bridges (railway, road, pedestrian, etc.)
- Other structures (pylons, power plants, stadiums, convention centers, airports, stations, etc.)

2.6 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The hot rolled structural products are produced into a final shape by ArcelorMittal prior to shipment to a job site and further fabrication. The product does not require packaging.

3. Methodological Framework

3.1 DECLARED UNIT

The declared unit used in this study is defined as one (1) metric ton of structural shapes ready to be transported from ArcelorMittal to its clients.

3.2 SYSTEM BOUNDARY

Table 1. *Scope of the study*

Product			Construction		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x

X = Module Included | MND = Module Not Declared

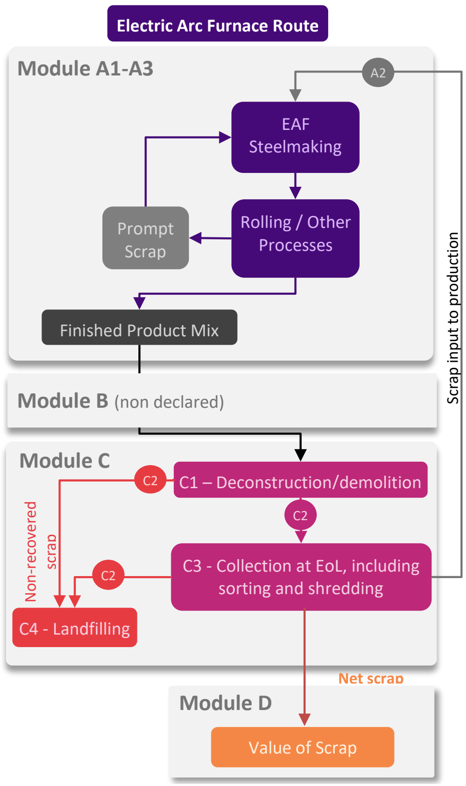

Figure 2: *System Diagram*

3.3 MODULE D

Module D is used for transparently reporting the additional benefits which result from the recycling or energy recovery at the end of life of the building product. For closed loop material recycling, as is mostly the case with metals, module D avoids any double crediting or counting because the substitution method calculations are based upon the net material flow only, i.e. the secondary material exiting the system boundary at the end of life, minus the secondary material already considered at the production stage. In the current model, external scrap that enters the product system is assumed to reach end of waste state after it has gone through a sorting and shredding process that takes place at demolition sites or waste processing facilities. Scrap emerging sorting and shredding meets the end of waste criteria, as it is a valuable commodity with a well-established existing market. After the collection and sorting stage, the demand for scrap input to the production is met by the amount of steel recycled (already sorted and shredded) at end-of-life. The steel scrap that is generated during production is reused directly in a cycle “loop”. This internally recycled process scrap is not used to calculate the potential environmental benefit or burden that is reported in Module D.

Depending on the product under study the corresponding LCA system boundaries might present a net surplus or deficit. Potential environmental benefits and burdens are given for the net scrap that is produced at the end of a final product’s life. This net scrap is determined as follows: Net scrap = Amount of steel recycled at end-of-life – Scrap input from previous product life cycles.

Interpreting the results in Module D: The values in Module D include a recognition of the benefits or impacts related to steel recycling which occur at the end of the product’s service life. The rate of steel recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits, or impacts, but are based on a methodology that uses current industry-average data reflecting current processes.

3.4 ALLOCATION

For the current product route, allocation was applied only in the Electric Arc Furnace process using the method developed by the Worldsteel association and EUROFER, which is compliant with ISO 21930:2017 and EN 15804 standards.

The methodology is based on physical allocation and considers the manner in which changes in inputs and outputs affect the production of co-products and material flows that carry specific inherent properties. The method is deemed to provide the most representative partitioning of the processes involved.

For all background data used in the model, the standard allocation assumptions of the used datasets were maintained.

3.5 CUT-OFF RULES

The environmental impact of the product studied has been assessed by considering all significant processes, materials, and emissions contributing to more than 1% to the total impact categories included in the EPD. The production of capital equipment, facilities, and infrastructure required for manufacture has not been considered.

There are no known flows or process deliberately excluded.

3.6 DATA SOURCES

Data quality is compliant with ISO 14025:2006. All primary data were collected from ArcelorMittal production facilities. The sources of secondary data are the MLC database (Sphera) and are representative for the years 2018-2023.

Table 2. *Data sources utilized in the LCA.*

Flow	Dataset	Data Source	Publication Date
Raw Materials and Consumables			
Nickel	Nickel mix; ore mining and processing, roasting, reduction, magnetic separation; production mix, at plant; 99.9%	MLC 2023.2	2023
Aluminium Ingot	Aluminium ingot mix; primary production; consumption mix, to consumer; aluminium ingot product	MLC 2023.2	2023
Cooper	Copper mix (99,999% from electrolysis); from electrolysis; consumption mix, to consumer; 99,999% Cu	MLC 2023.2	2023
Ferro chrome	Ferro chrome high carbon, consumption mix; primary production; consumption mix, to consumer; 60 % chrome, high carbon	MLC 2023.2	2023
Ferro-manganese	Ferro-manganese, high-carbon (HC FeMn), 74 to 82 wt. % Mn, up to 7.5 wt % carbon; primary production; production mix, at plant; 74 to 82 wt. % Mn, up to 7.5 wt % carbon	MLC 2023.2	2023
Ferro Niobium	Ferro Niobium; pyrchlore ore mining and refining, carbothermic reduction and aluminothermic reduction; single route, at plant; 55% Ni2O5 share	MLC 2023.2	2023
Ferro-vanadium	Ferro-Vanadium; Primary production, ore mining and processing; production mix, at plant; 80% vanadium content	MLC 2023.2	2023
Ferro-silicon	Ferro silicon mix (90% Si); primary production, smelting furnace; production mix, at plant; 90%, silicon	MLC 2023.2	2023
Oxygen	Oxygen (gaseous); via cryogenic air separation; production mix, at plant; 1.429 kg/m3, 16.0 g/mol	MLC 2023.2	2023
Nitrogen	Nitrogen (gaseous); via cryogenic air separation; production mix, at plant; 1.250 kg/m3, 14.0 g/mol	MLC 2023.2	2023
Argon	Argon (gaseous); Linde process, cryogenic air fractionation; production mix, at plant; 40 g/mol	MLC 2023.2	2023
Metallurgical coke	Metallurgical coke; coke oven process, from hard coal; production mix, at plant; 29 MJ/kg net calorific value	MLC 2023.2	2023
Hard coal mix	Hard coal mix; technology mix; consumption mix, to consumer; 69% carbon content, 27 MJ/kg net calorific value	MLC 2023.2	2023
Petroleum coke	Petroleum coke at refinery; from crude oil; production mix, at refinery; 31 MJ/kg net calorific value	MLC 2023.2	2023

Flow	Dataset	Data Source	Publication Date
Lime	Lime (CaO; quicklime lumpy) (EN15804 A1-A3); technology mix; production mix, at plant; 3.37 g/cm3, 56.08 g/mol	MLC 2023.2	2023
Dolomite	Dolomite (ground); dolomite mining and milling; single route, at plant; 2.90 g/cm3	MLC 2023.2	2023
Natural gas	Natural gas mix; technology mix; consumption mix, to consumer; medium pressure level (< 1 bar)	MLC 2023.2	2023
Process water	Process water from surface water; ion exchange, from surface water; single route, at plant; 1000 kg/m3, 18 g/mol	MLC 2023.2	2023
Inert matter landfill	Inert matter (Steel) on landfill; landfill including leachate treatment and without collection, transport and pre-treatment; production mix (region specific sites), at landfill site; landfill for steel	MLC 2023.2	2023
Electrode	Electrode; baking petrol coke, pitch and hard coal tar; production mix, at plant; >99% carbon	MLC 2023.2	2023
Heavy fuel	Heavy fuel oil at refinery (1.0wt.% S); from crude oil; production mix, at refinery; 1 wt.% sulphur	MLC 2023.2	2023
Diesel mix	Diesel mix at refinery; from crude oil and bio components; production mix, at refinery; 10 ppm sulphur, 7.86 wt.% bio components; 5.90 wt.% biogenic Carbon; 6.91 wt.% Share bio C to C-Total; for use in Transport Process share_CO2_bio: 0.0691	MLC 2023.2	2023
Electricity			
Electricity	Electricity grid mix; AC, technology mix; consumption mix, to consumer; <1kV	MLC 2023.2	2023
Transportation			
Container ship	Container ship, 5.000 to 200.000 dwt payload capacity, deep sea; heavy fuel oil driven, cargo; consumption mix, to consumer; global average 52.134 dwt payload capacity, deep sea	MLC 2023.2	2023
Motor ship	Motor ship, 1,100t payload capacity / canal; technology mix, diesel driven, cargo; consumption mix, to consumer; 1,100t payload capacity / canal	MLC 2023.2	2023
Rail transport	Rail transport cargo - Diesel, average train, gross tonne weight 1,000t / 726t payload capacity; diesel driven, cargo; consumption mix, to consumer; average train, gross tonne weight 1,000t / 726t payload capacity	MLC 2023.2	2023
Rail transport	Rail transport cargo - Electric, average train, gross tonne weight 1,000t / 726t payload capacity; electricity driven, cargo; consumption mix, to consumer; gross tonne weight 1,000t / 726t payload capacity	MLC 2023.2	2023
Truck	Truck, Euro 4, more than 32t gross weight / 24.7t payload capacity; diesel driven, Euro 4, cargo; consumption mix, to consumer; more than 32t gross weight, 24.7t payload capacity	MLC 2023.2	2023

3.7. DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 3. *Data quality assessment for XCarb® and standard structural steel sections and merchant bars product system*.

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	All primary data are collected for the year 2021. All secondary data come from the MLC (GaBi) 2023 databases and are representative of the years 2017-2023 (< 10 years). As the study intended to compare the product systems for the reference year 2021, temporal representativeness is good.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	All primary and secondary data are collected specific to the countries/regions under study. Where country / region specific data are unavailable, proxy data are used. Geographical representativeness is considered very good.
Technology Coverage: Specific technology or technology mix	Data are representative of current technologies
Precision: Measure of the variability of the data values for each data expressed	Precisions of results are not quantified. Data collected are based on yearly averages. Cross-checks concerning the plausibility of mass and energy flows are carried out on the data received to reduce variability. Internal checks based on previous years data and on similar processes and sites occur on a feedback loop which corrects potential mistakes.
Completeness: Percentage of flow that is measured or estimated	All relevant process steps are considered and modelled to represent the specific situations. The process chain is considered sufficiently complete regarding the goal and scope of this study. No known processes or activities contributing to more than 1% of the total in each environmental indicator are excluded
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	The representativeness is good overall. See time-related, geography, technology and completeness coverages parameters.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	To ensure consistency, all primary data are collected with the same level of detail, while all background data are primarily sourced from the Managed LCA Content databases. Allocation and other methodological choices are made consistently throughout the model.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Results of the current study could be reproduced within a reasonable range assuming an independent practitioner would have access to the primary data and database used for the modeling. Reproducibility would be higher with access to the project report, where screenshots of the model with its respective flow quantities were shown.
Sources of the Data: Description of all primary and secondary data sources	Primary data are collected using a specifically adapted spreadsheet. Similar checks are made on the software model developed during the study. MLC content database has been used for secondary data sources.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	ArcelorMittal uses spreadsheets describing processes inputs and outputs that have been developed and updated for over 20 years. Each site in ArcelorMittal must yearly report processes inputs and outputs for each process using these spreadsheets. Measurement of on-site emissions takes place based on local environmental regulations and on group minimum requirements. Emissions that are linked to the provision of thermal and electrical energy are considered in specific processes. ArcelorMittal sites are also audited by an independent third party on the reported data. Uncertainty is nevertheless inherently in data collection, data secondary sources and modelling approach. All the procedures mentioned above aim to reduce uncertainty.

3.8 PERIOD UNDER REVIEW

The period of review for the XCarb® and structural steel sections and merchant bars produced with conventional electricity grid at ArcelorMittal sites was taken from January 01, 2021 through December 31, 2021.

3.9 COMPARABILITY AND BENCHMARKING

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

3.10 ESTIMATES AND ASSUMPTIONS

Foreground data electricity consumption was modeled using residual mix electricity datasets from the consumption share of 2021 year, composed by France, Belgium and Spain residual mixes.

Following the suggested approach on section 2.8.8 of the UL Part A Product Category Rules, the EPD shows an additional result table reporting separately the results using a renewable electricity grid mix.

As it is not possible to know where the deconstruction will take place and whether the building will be dismantled or demolished. For this reason, a generic scenario was used for module C1. For the same reasons, default distances for module C2 were used, assuming 100 km from the point of deconstruction/dismantling to the waste processing site and further 200 km for the final destination (reuse, recycling or landfill).

3.11 UNITS

All data and results are presented using SI units.

4. Technical Information and Scenarios

4.1 MATERIAL COMPOSITION

XCarb® structural shapes are hot rolled steel products used in various construction applications. Their main component is iron. Alloys are generally added in the form of ferro-alloys. Packaging is not relevant. Chemical composition for a specific grade will follow the applicable ASTM standard mentioned in section 2.1. no substances required to be reported as hazardous are associated with the production of this product.

4.2 MANUFACTURE

The production of hot rolled structural shapes goes through main technological steps such as:

- Scrap melting in Electric Arc Furnace
- Steel refining in Ladle Furnace
- Continuous casting
- Hot rolling
- Cooling and Finishing

The rolled structural shapes branded as XCarb® use 100% scrap and 100% renewable electricity using Guarantees of Origin.

4.3 DISPOSAL

Within this EPD, the modules C1-C4 are included. These modules consider the dismantling of the considered product (C1), the transportation of the dismantled components to their End of Life (EoL) destination (C2), the waste processing for recovery or recycling (C3) as well as the disposal (C4), if given. At EoL, the steel material leaves the product system in C3 for recycling in Module D. The environmental impacts from grinding, sorting and transportation of steel scrap are not included. The considered End-of-Life scenario for the steel material is 97 % recycling and 3 % landfill.

Table 4. *Assumptions for scenario development*

Name		Unit	Value
Assumptions for scenario development			
Collection process (specified by type)	Collected separately	kg	1,000
	Collected with mixed construction waste	kg	0
Recovery (specified by type)	Reuse	kg	0
	Recycling	kg	970
	Landfill	kg	30
	Incineration	kg	0
	Incineration with energy recovery	kg	0
	Energy conversion (specify efficiency rate)		0
Disposal (specified by type)	Product or material for final deposition	kg	0
Removals of biogenic carbon (excluding packaging)		kg CO_2	0

4.4 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY

Potential environmental benefits are given for the net steel scrap that is produced at the end of a final product's life. This net scrap is determined as follows:

Net scrap = Amount of steel recycled at end-of-life – Scrap input from previous product life cycles.

According to data for steel products collected by the American Iron and Steel Institute (AISI & SMA, 2021) and UL Part A Product Category Rules (UL Environment, 2022), the following End-o-Life scenario is implemented: 97 % recycling, 3 % landfill: In the production of structural steel sections and merchant bars, 1192 kg of external scrap material was utilized. Upon reaching the end of its life cycle, 970 kg of scrap is reclaimed for recycling. Consequently, the system demonstrates a net output of – 223.7 kg of scrap (calculated as + 970 - 1194). This net value is reflected in module D and can be considered as either an environmental credit or burden, depending on the specific impact category.

According to ISO 14021:2016, the average recycled content, which includes pre- and post-consumer recycled scrap and additional sources of Fe (such as Ferro alloys), is approximately 98%.

Table 5. *End-of-Life credentials*

Name	Unit	Value
Recycling rate of product	%	97
Recycled content of product	%	98

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
The following environmental impact category indicators are reported using characterization factors based on:

- TRACI 2.1 (Bare, Young, Qam, Hopton, & Chief, 2012)
- CML-IA (CML, 2016)

For global warming calculations, the CML characterization factors are based on IPCC 2013, while TRACI 2.1 global warming calculations are based on IPCC 2007.

Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.

Table 6. *Impact category indicators*

Impact Category CML-IA	Unit	Impact Category TRACI 2.1	Unit
Global climate change	kg CO_2 eq	Global warming potential	kg CO_2 eq
Ozone depletion	kg CFC 11 eq	Acidification potential	kg SO_2 eq
Acidification	kg SO_2 eq	Eutrophication potential	kg N eq
Eutrophication	kg $(PO_4)^3$ eq	Smog Formation Potential	kg O_3 eq
Photochemical Smog formation	kg C_2H_4 eq	Ozone depletion potential	kg CFC 11 eq
Depletion of abiotic resources – fossil fuels	kg Sb eq	Fossil fuel depletion	MJ eq
Depletion of abiotic resources – non fossil fuels	MJ, LHV	-	

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined in LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported.

Table 7. Indicators on resources, waste and output flows

Indicator on use of resources	Unit	Indicators on waste categories and output flows	Unit
RPRe: Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ, calorific value ([H_i] lower calorific value)	**HWD:** Hazardous waste to be disposed	kg
RPRm: Use of renewable primary energy used as raw materials	MJ, calorific value ([H_i] lower calorific value)	**NHWD:** Disposed non-hazardous waste	kg
NRPRe: Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials	MJ, calorific value ([H_i] lower calorific value)	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
NRPRm: Use of non-renewable primary energy resources used as raw materials	MJ, calorific value ([H_i] lower calorific value)	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Use of secondary materials	kg	**CRU:** Components for re-use	kg
RSF: Use of renewable secondary fuels	MJ, calorific value ([H_i] lower calorific value)	**MR:** Materials for recycling	kg
NRSF: Use of non-renewable secondary fuels	MJ, calorific value ([H_i] lower calorific value)	**MER:** Materials for energy recovery	kg
RE: Recovered Energy	MJ, calorific value ([H_i] lower calorific value)	**EE**: Recovered energy exported from the product system	MJ, calorific value ([Hi] lower calorific value)
FW: Net use of fresh water resources	m^3		

Table 8. *Life Cycle Impact Assessment (LCIA) results for 1 metric ton of standard structural shapes. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Impact Category	Life cycle stage							
	A1	A2	A3	C1	C2	C3	C4	D
CML-IA								
GWP [kg CO_2 eq]	1.95E+02	2.96E+01	2.51E+02	4.15E+01	2.60E+01	1.35E+00	4.28E-01	3.85E+02
AP [kg SO_2 eq]	6.44E-01	1.83E-01	3.36E-01	2.01E-01	1.31E-01	3.03E-03	2.57E-03	8.03E-01
EP [kg $(PO_4)^3$ eq]	4.81E-02	3.80E-02	5.25E-02	5.13E-02	3.35E-02	4.19E-04	2.92E-04	5.16E-02
POCP [kg C_2H_4 eq]	4.54E-02	-3.91E-02	7.37E-02	-7.71E-02	-5.10E-02	2.30E-04	1.92E-04	1.84E-01
ODP [kg CFC 11 eq]	3.41E-10	1.25E-11	1.94E-09	1.82E-11	4.06E-12	2.59E-11	1.35E-12	-6.14E-10
ADPE [kg Sb eq]	8.81E-05	2.28E-06	2.19E-05	3.29E-06	2.08E-06	2.69E-07	1.37E-07	2.16E-03
ADPF [MJ, LHV]	4.14E+03	4.07E+02	1.46E+03	5.75E+02	3.60E+02	1.59E+01	5.81E+00	4.02E+03
TRACI 2.1								
GWP [kg CO_2 eq]	1.94E+02	2.95E+01	2.50E+02	4.14E+01	2.59E+01	1.34E+00	4.26E-01	3.82E+02
AP [kg SO_2 eq]	6.37E-01	2.32E-01	3.88E-01	2.75E-01	1.79E-01	3.37E-03	2.75E-03	7.65E-01
EP [kg N eq]	2.04E-02	1.51E-02	2.64E-02	2.06E-02	1.34E-02	3.21E-04	1.21E-04	4.57E-02
SFP [kg O_3 eq]	8.61E+00	5.17E+00	9.11E+00	6.21E+00	4.05E+00	5.76E-02	5.22E-02	8.25E+00
ODP [kg CFC 11 eq]	6.17E-12	2.24E-13	3.38E-11	3.25E-13	7.24E-14	4.65E-13	2.41E-14	-1.05E-11
FFP [MJ eq]	4.42E+02	5.81E+01	1.90E+02	8.21E+01	5.16E+01	1.48E+00	7.60E-01	4.88E-01

Table 9. *Resource use and waste flows for 1 metric ton of standard structural shapes. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	Life cycle stage							
	A1	A2	A3	C1	C2	C3	C4	D
Resource use								
RPR_E [MJ]	2.75E+02	3.24E+01	5.62E+02	4.68E+01	2.63E+01	1.51E+01	9.78E-01	-1.53E+02
RPR_M [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ]	4.33E+03	4.13E+02	5.34E+03	5.83E+02	3.62E+02	2.71E+01	6.00E+00	3.86E+03
$NRPR_M$ [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	1.19E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	1.00E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m³]	1.55E+00	3.42E-02	1.18E+00	4.96E-02	2.88E-02	1.22E-02	1.52E-03	3.93E+01
Waste flows								
HWD [kg]	4.82E-07	6.49E-10	8.64E-08	9.53E-10	1.12E-09	-1.96E-09	1.31E-10	2.89E-05
NHWD [kg]	2.43E+01	6.59E-02	6.17E+00	9.69E-02	5.52E-02	1.87E-02	3.00E+01	-4.68E+01
HLRW [kg]	5.25E-05	1.61E-06	8.02E-04	2.33E-06	5.83E-07	3.12E-06	6.97E-08	-4.26E-07
ILLRW [kg]	6.69E-02	1.99E-03	1.37E+00	2.88E-03	6.77E-04	3.99E-03	6.83E-05	-4.23E-04
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.70E+02	0.00E+00	0.00E+00
MEF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Comparability: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant impacts. Such comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

For GWP-100 associated to fabrication of structural shapes in the United States, the user should use the average value from the American Institute of Steel Construction (AISC) average EPD (AISC, 2021), in addition to GWP A1-A3 reported in this EPD.

Product stage	**GWP 100 [kg CO2 eq.]**
Transport to fabrication	4.46E+01
Fabrication	9.67E+01

GWP-100 information related to oversee transport can be found on the web page: XCarb™ recycled and renewably produced - Sections (arcelormittal.com)
For its calculation, the default scenario from Gabi was used, with container ship vessel type with a payload capacity of 15000to, and utilization rate of 60%. The associated average distance for oceanic going transport was assessed through SEADISTANCES.ORG - Distances.

6. LCA: Interpretation

As expected, in all categories the product stage (A1-A3) contributes with the highest shares (Figure 13). This is explained by the fact that steel production is an energy-intensive industry. Impacts are mostly related to the consumption of gases and ferro-alloys.

Overall, modules C3 and C4 have a minimized contribution under the base scenario. Modules C1 and C2 contribution towards the indicators associated to the potential of acidification, eutrophication, and smog formation are responsible for around a 30% share of the overall results. This contribution results from the direct nitrogen monoxide and dioxide emissions caused by the diesel consumption of the demolition equipment (C1) and trucks (C2). GWP and FFD in such modules, contribute up to 20% in the overall results. The main responsible is again the diesel consumption in the machinery and trucks.

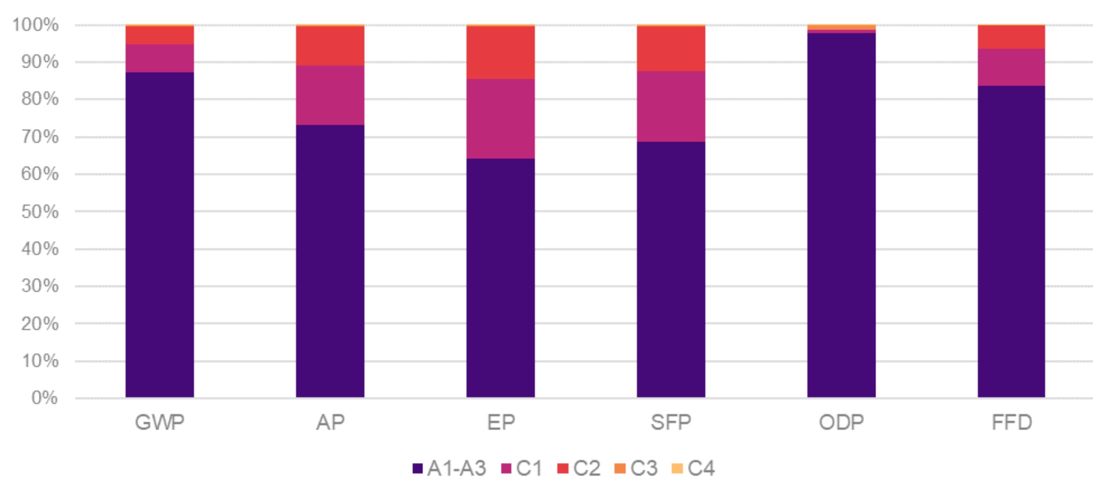

Figure 2. *Relative contribution of the different life-cycle modules to the total (TRACI 2.1 indicators).*

7. Facility Specific GWP-100 Results

This EPD contains results for 5 different ArcelorMittal mills, which have been presented as a weighted average throughout this document. For further detail on how GWP-100 results differ between production sites, mill specific data is presented below.

Table 10. *Mill specific GWP 100 results per metric ton (conventional electricity grid).*

GWP 100 [kg co2 eq.]	Life cycle stage
	A1 – A3
TRACI 2.1	
Belval (LU)	4.28E+02
Differdange (LU)	4.41E+02
Rodange (LU)	4.98E+02
Bergara (ES)	5.09E+02
Olaberria (ES)	5.32E+02

8. Additional Environmental Information

8.1 ENVIRONMENT AND HEALTH DURING INSTALLATION

In case of mechanical destruction, no risks are expected to occur in terms of environment and human health. The product does not cause any adverse health effects or release of VOCs to indoor air.

8.2 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

ArcelorMittal Belval, Differdange, Rodange, Olaberria, and Bergara are covered by ISO 9001, ISO 14001, ISO 45001, ISO 50001. ArcelorMittal Belval and Differdange are Responsible Steel™ certified. XCarb® recycled and renewably produced is certified as cradle-to-cradle gold.

8.3 FURTHER INFORMATION

https://sections.arcelormittal.com/

9. References

- AISI, & SMA. (2021). American Iron and Steel Institute Technical Report. Determination of Steel Recycling Rates in the US. Retrieved 9 29, 2023, from https://www.steel.org/wp-content/uploads/2021/08/AISI-and-SMA-Steel-Recycling-Rates-Report-Final-07-27-2021.pdf
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and Framework
- ISO 14044: 2006/Amd 1:2017/ Amd 2:2020 Environmental Management – Life cycle assessment – Requirements and Guidelines.
- ISO 21930: 2017 Sustainability in building construction – Environmental declaration of building products.
- SCS Type III Environmental Declaration Program: Program Operator Manual. V12.0 November 2023. SCS Global Services.
- Part A: Life Cycle Assessment Calculation Rules and Report Requirements. UL Environment. Version 3.2. December 2018.
- Product Category Rule (PCR) Guidance for Building-Related Products and Services Part B: Designated Steel Construction Product EPD Requirements. UL Environment. Version 2.0. August 26
- ASTM A913/A913M-19, Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
- EN 10025-2:2019. Hot rolled products of structural steels. Technical delivery conditions for non-alloy structural steels
- EN 10025-4:2019, Hot rolled products of structural steels. Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels.
- ASTM A572. ASTM A572 / A572M-21e1:2021, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM International, West Conshohocken, PA, 2021.
- ASTM A6. ASTM A6 / A6M-22:2022, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, ASTM International, West Conshohocken, PA, 2022.
- CML. (2016). *CML-IA Characterisation Factors.* University of Leiden. Department of Industrial Ecology. Retrieved September 2023, from https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
- CSA 260W, CSA 300W, CSA 350W, 400W, 450W.
- CSA G40.20:2013, General requirements for rolled or welded structural quality steel. Canadian Standard Association.

10. Annex

This annex shows LCA results for one metric ton of EAF structural shapes produced with renewable electricity, and 100% scrap, labeled as XCarb® recycled and renewably produced.
Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The following environmental impact category indicators are reported using characterization factors based on:

- TRACI 2.1 (Bare, Young, Qam, Hopton, & Chief, 2012)
- CML-IA (CML, 2016)

For global warming calculations, the CML characterization factors are based on IPCC 2013, while TRACI 2.1 global warming calculations are based on IPCC 2007.

Results reported in MJ are calculated using lower heating values. All values are rounded to two significant digits.

Table 11. *Life Cycle Impact Assessment (LCIA) results for 1 metric ton of XCarb® structural steel shapes . Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Impact Category	Life cycle stage							
	A1	A2	A3	C1	C2	C3	C4	D
CML-IA								
GWP [kg CO_2 eq]	1.95E+02	2.96E+01	1.60E+02	4.15E+01	2.60E+01	1.35E+00	4.28E-01	3.85E+02
AP [kg SO_2 eq]	6.44E-01	1.83E-01	2.30E-01	2.01E-01	1.31E-01	3.03E-03	2.57E-03	8.03E-01
EP [kg $(PO_4)^3$ eq]	4.81E-02	3.80E-02	3.52E-02	5.13E-02	3.35E-02	4.19E-04	2.92E-04	5.16E-02
POCP [kg C_2H_4 eq]	4.54E-02	-3.91E-02	6.40E-02	-7.71E-02	-5.10E-02	2.30E-04	1.92E-04	1.84E-01
ODP [kg CFC 11 eq]	3.41E-10	1.25E-11	2.28E-08	1.82E-11	4.06E-12	2.59E-11	1.35E-12	-6.14E-10
ADPE [kg Sb eq]	8.81E-05	2.28E-06	1.17E-04	3.29E-06	2.08E-06	2.69E-07	1.37E-07	2.16E-03
ADPF [MJ, LHV]	4.14E+03	4.07E+02	1.10E+02	5.75E+02	3.60E+02	1.59E+01	5.81E+00	4.02E+03
TRACI 2.1								
GWP [kg CO_2 eq]	1.94E+02	2.95E+01	1.60E+02	4.14E+01	2.59E+01	1.34E+00	4.26E-01	3.82E+02
AP [kg SO_2 eq]	6.37E-01	2.32E-01	2.66E-01	2.75E-01	1.79E-01	3.37E-03	2.75E-03	7.65E-01
EP [kg N eq]	2.04E-02	1.51E-02	1.46E-02	2.06E-02	1.34E-02	3.21E-04	1.21E-04	4.57E-02
SFP [kg O_3 eq]	8.61E+00	5.17E+00	6.60E+00	6.21E+00	4.05E+00	5.76E-02	5.22E-02	8.25E+00
ODP [kg CFC 11 eq]	6.17E-12	2.24E-13	4.05E-10	3.25E-13	7.24E-14	4.65E-13	2.41E-14	-1.05E-11
FFP [MJ eq]	4.42E+02	5.81E+01	8.92E+00	8.21E+01	5.16E+01	1.48E+00	7.60E-01	4.88E-01

Table 12. *Resource use and waste flows for 1 metric ton XCarb® structural steelshapes. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	Life cycle stage							
	A1	A2	A3	C1	C2	C3	C4	D
Resource use								
RPR_E [MJ]	2.75E+02	3.24E+01	7.00E+03	4.68E+01	2.63E+01	1.51E+01	9.78E-01	-1.53E+02
RPR_M [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ]	4.33E+03	4.13E+02	1.20E+02	5.83E+02	3.62E+02	2.71E+01	6.00E+00	3.86E+03
$NRPR_M$ [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	1.19E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	1.00E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m³]	1.55E+00	3.42E-02	6.30E-02	4.96E-02	2.88E-02	1.22E-02	1.52E-03	3.93E+01
Waste flows								
HWD [kg]	4.82E-07	6.49E-10	-2.14E-06	9.53E-10	1.12E-09	-1.96E-09	1.31E-10	2.89E-05
NHWD [kg]	2.43E+01	6.59E-02	8.07E+00	9.69E-02	5.52E-02	1.87E-02	3.00E+01	-4.68E+01
HLRW [kg]	5.25E-05	1.61E-06	2.71E-06	2.33E-06	5.83E-07	3.12E-06	6.97E-08	-4.26E-07
ILLRW [kg]	6.69E-02	1.99E-03	3.24E-03	2.88E-03	6.77E-04	3.99E-03	6.83E-05	-4.23E-04
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.70E+02	0.00E+00	0.00E+00
MEF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Comparability: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant impacts. Such comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Facility Specific GWP 100 Results

This EPD contains results for 5 different ArcelorMittal mills, which have been presented as a weighted average throughout this document. For further detail on how GWP-100 results differ between production sites, mill specific data is presented below.

Table 13. *Mill specific GWP 100 results per metric ton (Renewable electricity grid)*

GWP 100 [kg co2 eq.]	Life cycle stage
	A1 – A3
TRACI 2.1	
Belval (LU)	3.98E+02
Differdange (LU)	4.09E+02
Rodange (LU)	4.67E+02
Bergara (ES)	3.41E+02
Olaberria (ES)	3.64E+02

For more information, contact:

ArcelorMittal Europe – Long Products
66, rue de Luxembourg, L-4221 Esch-sur-Alzette (Luxembourg)
https://sections.arcelormittal.com/
Tel. : +352 5313 3105

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.510.452.8000 | fax +1.510.452.8001