Environmental Product Declaration

EPD of multiple products, based on the average results of the product group.
In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Steel long products (section, wire rod, and bar), BOF route

from

ArcelorMittal Europe – Long Products

Programme:	The International EPD® System, www.environdec.com
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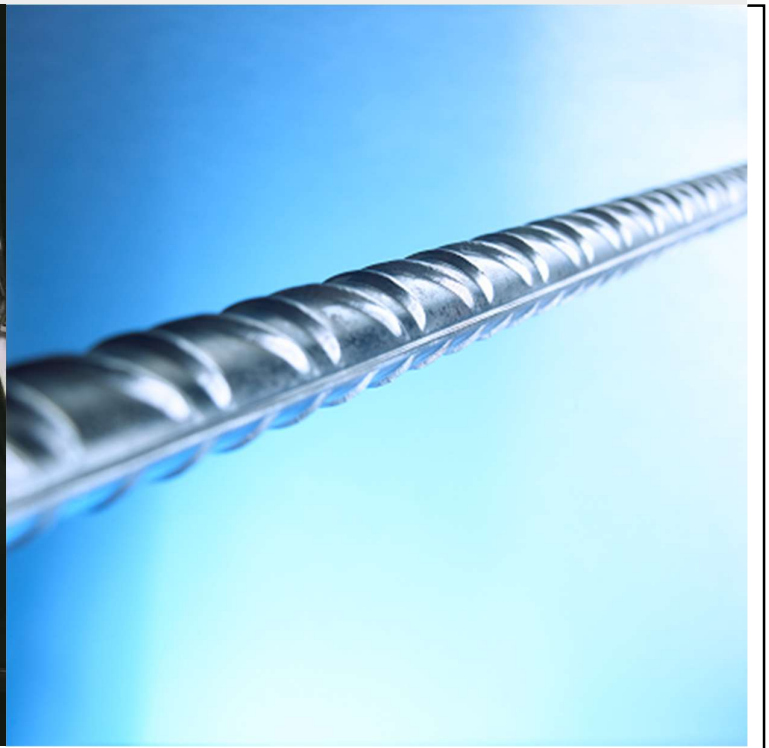
An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com



General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction products, version 1.3.3 Published on 2023.06.20. Based on CEN standard EN 15804. ISO standard ISO 21930 and CEN standard EN 15804 serves as the core PCR. UN CPC code 412*
PCR review was conducted by: The Technical Committee of the International EPD®System. See www.environdec.com/TCfor a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA)
LCA accountability: *Luxemburg Institute of Science and Technology (LIST)*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third party verifier: *Matt Fishwick, Fishwick Environmental Ltd*      Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

☒ Yes ☐ No

[Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period. The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update is identified, the EPD shall be re-verified by a verifier]

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: ArcelorMittal Europe – Long Products.
66, rue de Luxembourg
L-4221 Esch-sur-Alzette
Luxembourg

Contact:
sections@arcelormittal.com
barsandrods@arcelormittal.com

Description of the organisation:
ArcelorMittal Europe Long Products operates different production sites in ten countries and is a leader in the manufacture of structural sections, merchant bars, sheet piles, rails, quality wire rod, rebars, bars and wire drawing.

ArcelorMittal Europe has a long and rich tradition of producing long products in its locations in Germany, France, Spain, Poland, Bosnia Herzegovina, and Morocco. These plants are at the forefront of technical innovation and provide best-in-class customer service. They offer a wide spectrum of wire rods as well as special bar quality (SBQ) and forging billets, these products covering the full range of final applications. Bars and rods find applications in every major market segment – construction, infrastructure, automotive, mechanical engineering, yellow goods, and energy.

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 CO_2 emissions in its European operations by 35% by 2030.

Product-related or management system-related certifications:
The Gijón, Duisburg, Dąbrowa, and Rodange sites producing long products covered in this EPD have major certifications, including ISO 9001, ISO 14001, ISO 45001, ISO 50001, OHSAS 18001, ISO TS 16949, BES 6001, and others.

Name and location of the production site(s) based on blast furnace (BF)/ basic oxygen furnace (BOF) route:

ArcelorMittal Gijón plant is located in the Asturias region in north-west Spain in a strategic location with port services close to the factory. The Gijón site consists of a steel plant with two oxygen converters, secondary metallurgy (including two ladle furnaces and an RH degasser), a bloom caster and a billet caster, as well as a wire rod mill and a rail mill. The site produces high quality wire rod for the most demanding applications (steel for tyre-cord, cold heading applications, springs for shock absorbers, etc.).

ArcelorMittal Duisburg plant is located in the Ruhr region in north-west Germany. ArcelorMittal Duisburg is equipped with a Blast Oxygen Furnace and works to develop new applications and new products for the automotive, energy and mechanical industries. The billet mill produces high quality square billets and big round SBQ for the forging industry. The new wire rod mill supplies the automotive market with cold heading, spring grades, bearing and other special wire rod grades.

ArcelorMittal Dabrowa Gornicza plant is in Silesia region in South Poland, and it is an integrated site which consists of a steel plant with three oxygen converters, secondary metallurgy (including two ladle furnaces and an RH degasser), a bloom, billet and slab caster, as well as a Medium and Heavy Section Mill for structural products production, such as beams and channels. This site, together with site located in Chorzów produces also Rails & Special Sections for the mining industry by supplying mining profiles and arch roof supports.

ArcelorMittal Sosnowiec wire rod mill is in Sosnowiec, city in Silesia region in South Poland and it use billets from local AM Dabrowa Gornicza steel plant with three oxygen converters, secondary metallurgy (including two ladle furnaces and an RH degasser), three Continuous Caster Machines.

ArcelorMittal Rodange plant is in Luxembourg. The product produced at the Mill A of Rodange and covered by this EPD are merchant bars, angles, special bars for mining as well others including cathode bars.

Product information

Product name: Steel long products (section, wire rod, and bar), BOF base.

Product identification:
Steel long products from ArcelorMittal Europe, produced by BF/ BOF route and followed by hot rolling and finishing. This EPD covers multiple products, based on representative average values for the product group. Hence, the declared product is not available for purchase on the market and the results are not representative for any specific product.

Product description:
Traditionally, steel long products are used as raw material in various sectors such as building and construction, automotive, mechanical and electrical engineering, energy, infrastructure, etc. Carbon steel reinforcing bars ("rebar") are used to provide tensile strength in reinforced concrete building elements. Additional information can be obtained from the Bars&Rods website About bars and rods - Bars & Rods (arcelormittal.com) and Sections web site Sections (arcelormittal.com). Example of the Bars&Rods product offer, range, location, quality and all associated infromation can be find in the product catalogues: Documentation - Bars & Rods (arcelormittal.com) Example of products for mining application can be downloaded on this web page.

For the placing on the market of the structural products, the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a Declaration of Performance taking into consideration /EN 10025-1:2004 Hot rolled products of structural steels – Part 1: General technical delivery conditions/ and the CE-marking. For the application and use the respective national provisions apply.

The list of applicable standards related to steel long products is provided in the reference section.

Content information:
The base material of steel long products is iron. Alloying elements are added in the form of ferroalloys or metals (most common elements are Manganese, Chromium and Vanadium). Some small quantities of other elements may be present in the steel. No substances listed on the "Candidate List of Substances of Very High Concern for Authorisation" by the European Chemicals Agency EC 1907-2006 are contained in the steel in declarable quantities.

The requirement of chemical composition can be found in respective standards, such as (list not exhaustive):

- Structural steel sections and merchant bars: EN 10025, ASTM A6, ASTM A572.
- Wire rod and bars: ISO 683, EN 10263, EN 16120, EN 10083, EN 10087, EN 10089, EN 10084, EN 10267.

Manufacturing process:
Integrated steel plants are complex operations comprising multiple production processes as described below.

• **Boilers/CHP**: generates the steam used on site and some of the electricity (the remainder is sourced from the national grid of each country). This process also supplies the blast air used in the blast furnace.

• **Air separation unit**: generates the gases and compressed air used in the production process (e.g. nitrogen, oxygen, hydrogen, argon, etc.).

• **Lime plant**: converts limestone and dolomite into lime/dololime for use in the basic oxygen furnace and sinter plant.

• **Coke ovens**: converts coking coal into coke that is used as a reducing agent in the blast furnace and as a fuel in the sinter plant. Various co-products are generated from this process including coke oven gas (used as a fuel elsewhere on site), benzene, ammonium sulphate, sulphuric acid, and tar.

• **Sinter plant**: agglomerates iron ore fines with other materials (e.g. lime and limestone) to form nodules of iron rich material that are suitable for charging into the blast furnace.

• **Blast furnace**: ferrous rich materials (sinter, iron ore, pellets and steel scrap), slag-forming materials (such as limestone), reducing agents (such as coke) and fuels (such as blast furnace gas and natural gas) with process gases and blast air generates molten iron ("hot metal") and slag and blast furnace gas (which is used as fuel in various site operations). The hot metal also undergoes desulphurisation to remove this unwanted element from the product.

• **Steelmaking**: covers the BOF and secondary steelmaking steps in which the carbon content of the hot metal is reduced and alloying materials are added to give the desired physical properties to the finished steel, which are formed into billets. BOF gas is also generated and is used as a fuel in various site operations). Slags are also generated from these processes, some of which are recycled in the sinter plant.

• **Rolling mills**: converts the steel billets into the final products from the steel mill such as reinforcing bars, wire rod and steel profiles. Offcuts, millscale, etc. are recycled within the steelworks.

Applications:
Structural steel 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. For example:

- Single-storey buildings (industrial and storage halls, etc.)
- Multi-storey 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.)

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: The standards of /EN 1993/ and /EN 1994/, respectively of /ANSI/AISC 36/ 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 (/EN 1993/,/ANSI/AISC 360/) and composite steel and concrete structures (/EN 1994/, /ANSI/AISC 360/).
- Product standards: /EN 10025/, /ASTM A36/, /A572/, /A588/, /A709/, /A913/A913M/ and /A992/.
- Fabrication standards: /EN 1090-2/, /AISC 303-10/, /AWS D1.1/D1.1M/. The Standard /EN 1090-2/ applies to the execution of steel structures and includes the requirements for factory production control.

Some typical applications for Bars&Rods are:
• Steel cord and tire cord for rubber reinforcement
• Soft wires for typical application like fencing wires, cork wires
• Bolts and nuts (fasteners) or other cold formed parts made by cold heading, cold extrusion, or hot forming
• Precision machined parts like small shafts made from our wide range of free cutting steels

• Cold drawn mechanical parts for automotive or machinery and various industrial applications
• Alloyed spring grades for valves, transmission, clutch and engines
• Suspension springs
• Wire rod for stabilisator bars or rail clips
• Bearings
• Ropes & cables
• Welding
• Forged parts for the automotive industry, e.g. engines, electric motors, transmission, chassis, and steering parts
• Cryogenic construction thanks to our special concrete reinforcing steel bar
• Mesh and Rebars for construction
• Prestressed concrete wire/strands
• Bedding & seating wire among many other applications

Geographical scope: Global.

LCA information

Declared unit: 1 metric ton of steel long products (section, wire rod, bar, or special section/tail), BOF base.
The average EPD is calculated considering a production volume weighted approach and is representative for all steel products covered by the declared unit.

Reference service life: A reference service life for steel long products is not declared. These are various products with many different applications purposes. The lifetime therefore will be limited by the service life of the work.

Time representativeness: The collection of the foreground data refers to the year 2021.

Database(s) and LCA software used: The background data has been taken from Sphera Managed LCA Content 2022.2 and the LCA model was created using LCA Sphera for Experts software, version 10.6.2.9.

Calculation methods: Potential environmental impacts are calculated following EN 15804:2012 +A2:2019. The characterization models and factors correspond to the latest update of the defaults list (EF 3.1), referred to as Version 2.0.

Description of system boundaries: Cradle-to-gate with options, modules C1–C4, and module D.

System diagram:

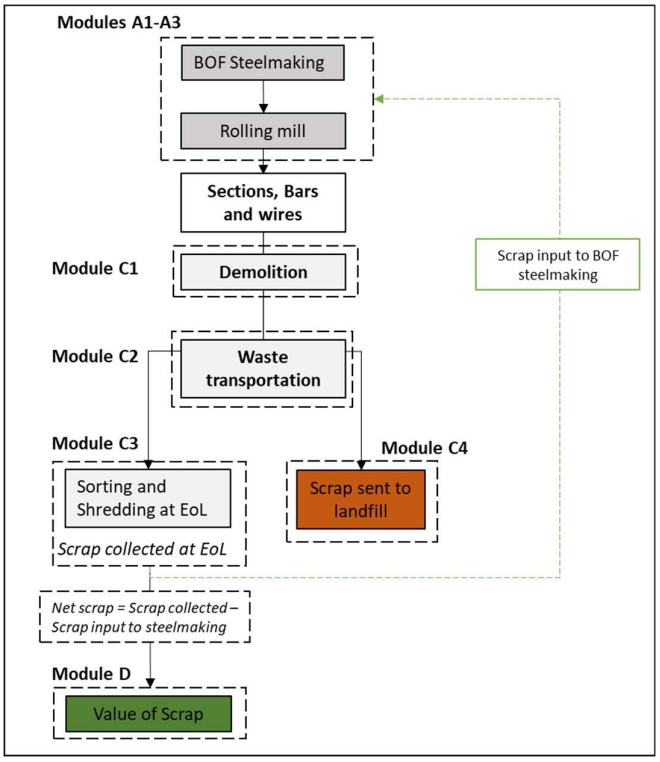


Figure 1: Life cycle stages and unit processes of the product

- *Module A1 to A3:*

The BF/BOF steelmaking includes processes from coke making to continuous casting (CC) and the related input and output flows. The production of structural steel through BOF route is the conventional route for steel production and consists basically in producing pig iron from iron ore and coke reacting in a blast furnace, then transformed into steel through BOF. Some alloying elements are added to obtain the desired steel grade, and after the CC in Duisburg, Aviles-Gijon and Dabrowa, steel goes through hot rolling mills in Duisburg, Gandrange and Rodange (for continuous caster in Duisburg), in Gijon (for CC in Aviles-Gijon) and in Dabrowa, Sosnowiec, Krolewska and Rodange (for continuous caster in Dabrowa). No emissions or waste from packaging is considered in modules A1-A3, as all raw materials, semi-products as well as the final products are transported bulk/loose.

The electricity mixes considered for the processing sites are country-specific (national generic background data) and are representative of the average consumption mix for the country. They were chosen according to the plant location. The resulting weighted average emission factor for the GWP-GHG indicator for the residual mix is 0.716 $kgCO_2eq./kWh$.

The modelling is based on datasets from the 2022.2 Managed LCA Content (Sphera) database.

- *Module C1 to C4:*

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.

Category	Subcategory	Unit	Quantity
Collection process	Collected separately	kg	1000
	Collected with mixed construction waste	kg	0
Recovery	Reuse	kg	0
	Recycling	kg	1000 (sections) 980 (wire rod)
	Landfill	kg	20 (wire rod)
	Incineration	kg	0
	Incineration with energy recovery	kg	0
	Energy conversion efficiency rate	kg	0
Disposal	Material for final disposal	kg	0
Transport	Deconstruction site to scrap processing plant	km	100
	Scrap processing plant to site for end of waste	km	200

The considered EoL scenarios are listed here below:

- Reference scenario: 98% recycling, 2% landfill.
- Scenario A1 (only for section): 100% reuse.
- Scenario A2 (only for section): 100% recycling.

- *Module D:*

Module D includes any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state in the form of reuse, recovery and/or recycling potentials.

Metals are assumed to reach the end of waste status directly at the construction site. The treatment as well as net benefits and loads of reuse or recycling potentials (for the net scrap amount only) are grouped to module D. 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.
For the product under study, in case of 100% recycling for sections, 98% recycling and 2% landfill for wire rod:
In the production of steel long products, 116 kg of external scrap material was utilized. Upon reaching the end of its life cycle, 1000 kg of scrap is reclaimed for recycling in case of sections while 980 kg is reclaimed for recycling in case of wire rod. Consequently, the system demonstrates a net flow of 884 kg of scrap (calculated as 1000 kg – 116 kg) in case of sections and 864 kg of scrap (calculated as 980 kg – 116 kg) in case of wire rod. 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.

Cut-off criteria:
The environmental impact of the product studied has been assessed by considering all significant processes, materials, and emissions. Excluded flows are assumed to have a negligible impact, contributing less than 5% to the cumulative impact assessment categories. The production of capital equipment, facilities, and infrastructure required for manufacture has not been considered.

Data quality and sources:
Data quality is compliant with ISO 14025:2006. All primary data were collected for 2021. All background data come from the Sphera Managed LCA Content 2022.2 databases and are representative for the years 2018-2023.

Allocation:
Allocation of different sizes / profiles was carried out on a mass basis so there is no difference in per tonne impact.

Primary data are allocated using the partitioning approach developed by Worldsteel/EUROFER. Steel production generates a number of co-products from the coke oven, the BF, and the BOF. They are reused internally or sold to and used by other industries. The co-products include slags, process gases and organic products from coke making. The processes that produce these co-products cannot be further sub-divided into sub-processes related to each product, inducing some allocations required.

Coke Oven
For the plants of Aviles, products and co-products from coke making, namely coke, coke oven gas, tar, benzene and sulphur are allocated on the basis of total energy content expressed in terms of net calorific value.
BF and BOF
The standard allocation applied is the economic allocation, allocating 99% of the input and output flows to the hot metal produced, 1% to the blast furnace slag, which is a co-product.

CO gas, BF and BOF Gases balances
As several plants is considered, the amount of CO, BF and BOF gases are respectively allocated on a mass basis, considering the total input of hot metal to the rolling mills associated to each BOF site, compared to the total outcome of CC for each site.

Mill scales and other potential co-products
Considering the relatively small volumes and low value of mill scales, dusts and sludge generated during steelmaking, these by-products have been treated as waste, with no environmental burdens allocated to them.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results)

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	NR	NR	NR	NR	NR	NR	NR	NR	NR	X	X	X	X	X
Geography	EU	EU	EU	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>95%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

NR- Not reported. MNR- Module not declared.

Content information

Section, Wire rod and Bar

Product content	**Weight, kg**	**Post-consumer material, weight[1]**	**Biogenic material, weight**
Steel	1000	4.1%	0% and 0 kg C / kg
Chemical composition			
Iron	> 971.8		
Carbon	< 2.00	-	-
Manganese	< 17.00	-	-
Silicon	< 5.50	-	-
Copper	< 5.50	-	-
Other	< 2.2	-	-

[1]the average recycled content, which includes pre- and post-consumer recycled scrap and additional sources of Fe (such as Ferro alloys), is approximately 11.6%.

The products do not contain any of the substances of very high concern (SVHC) regulated by the Regulation (EC) No 1907/2006 (REACH) or the Regulation (EC) No 1272/2008 of European parliament. No packaging is considered in the scenario.

Results of the environmental performance indicators

The environmental performance of the functional unit of one metric ton of steel long products, are reported below using the parameters and units as specified in PCR 2019:14 v1.3.3.
The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Mandatory impact category indicators according to EN 15804+A2:2019

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	2.57E+03	4.35E+01	2.13E+01	1.53E+00	2.35E-01	-1.71E+03
GWP-fossil	kg CO_2 eq.	2.57E+03	4.32E+01	2.11E+01	1.53E+00	2.42E-01	-1.71E+03
GWP-biogenic	kg CO_2 eq.	1.69E+00	1.83E-03	1.53E-02	4.83E-03	-7.18E-03	2.74E+00
GWP-luluc	kg CO_2 eq.	5.46E-01	2.82E-01	1.45E-01	9.15E-04	4.47E-04	-4.59E-01
ODP	kg CFC 11 eq.	3.42E-10	1.33E-11	2.12E-12	1.99E-11	5.69E-13	4.74E-09
AP	mol H^+ eq.	5.22E+00	2.46E-01	1.27E-01	3.77E-03	1.72E-03	-4.69E+00
EP-freshwater	kg P eq.	1.08E-03	1.52E-04	7.70E-05	4.47E-06	4.10E-07	-3.05E-04
EP-marine	kg N eq.	1.08E+00	1.19E-01	6.20E-02	1.03E-03	4.39E-04	-9.78E-01
EP-terrestrial	mol N eq.	1.18E+01	1.32E+00	6.87E-01	1.11E-02	4.82E-03	-1.06E+01
POCP	kg NMVOC eq.	4.17E+00	2.31E-01	1.20E-01	2.83E-03	1.33E-03	-3.26E+00
ADP-minerals&metals*	kg Sb eq.	6.65E-04	4.45E-06	2.17E-06	3.85E-07	2.48E-08	3.77E-05
ADP-fossil*	MJ	2.20E+04	5.82E+02	2.83E+02	2.68E+01	3.17E+00	-1.27E+04
WDP*	m^3	4.79E+01	6.26E-01	2.41E-01	3.12E-01	2.65E-02	3.58E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment.EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator. We discourage the use of the results of modules A1-A3 without considering the results of module C.*

Resource use indicators according to EN 15804+A2:2019

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	5.71E+02	4.44E+01	1.96E+01	1.39E+01	4.76E-01	1.85E+03
PERM	MJ	-3.26E-07	2.10E-10	8.61E-11	-6.77E-10	1.06E-11	3.03E-08
PERT	MJ	5.71E+02	4.44E+01	1.96E+01	1.39E+01	4.76E-01	1.85E+03
PENRE	MJ	2.21E+04	5.85E+02	2.84E+02	2.68E+01	3.18E+00	-1.29E+04
PENRM	MJ	6.43E-02	2.47E-02	1.23E-02	1.98E-03	1.00E-04	5.14E-01
PENRT	MJ	2.21E+04	5.85E+02	2.84E+02	2.68E+01	3.18E+00	-1.29E+04
SM	kg	1.16E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.23E-05	0.00E+00	1.89E-07	4.12E-08	3.65E-09	1.30E-05
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.92E+00	5.04E-02	2.27E-02	1.32E-02	8.06E-04	-1.11E+00
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Waste indicators according to EN 15804+A2:2019

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.48E-06	4.07E-09	1.50E-09	1.20E-07	1.63E-10	6.36E-07
Non-hazardous waste disposed	kg	5.15E+00	1.03E-01	4.63E-02	1.88E-02	1.62E+01	-2.43E+01
Radioactive waste disposed	kg	5.76E-02	2.86E-03	5.27E-04	3.95E-03	3.53E-05	2.13E-01

Output flow indicators according to EN 15804+A2:2019

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	0.00E+00	9.84E+02	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Other environmental performance indicators according to EN 15804+A2:2019

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG	kg CO_2 eq.	2.57E+03	4.35E+01	2.13E+01	1.53E+00	2.43E-01	-1.71E+03
Biogenic carbon content in product	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in packaging	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

References

- General Programme Instructions of the International EPD® System. Version 4.0.
- PCR 2019:14. Construction Products, Version 1.3.3
- Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; CEN/TR 15941:2010
- CPR: Regulation (EU) No 305/2011 of the European parliament and of the council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.
- EN 15804: EN 15804:2012+A2:2019: Sustainability of construction works -Environmental Product Declarations - Core rules for the product category of construction products.
- EN ISO 14025: EN ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- EN ISO 14040: EN ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
- EN ISO 14044: EN ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements and guidelines.
- LCA FE: LCA FE Software System and Database for Life Cycle Engineering, Sphera Solution GmbH, Leinfelden-Echterdingen, 2022 (https://www.gabi-software.com/support/gabi)
- ASTM A572 / A572M-21e1:2021, Standard: Specification for High-Strength Low-Alloy Columbium- Vanadium Structural Steel, ASTM International, West Conshohocken, PA, 2021.
- 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.
- BS 4482:2005+A1 - Steel Wire for the Reinforcement of Concrete Products – Specification
- BS 4449:2005+A3:2016 Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification.
- ISO 9001: 2015, Quality management systems — Requirements
- ISO 45001:2018, Occupational health and safety management systems — Requirements with guidance for use
- ISO 14001:2015, Environmental management systems — Requirements with guidance for use
- ISO 50001: 2018, Energy Management

Annex A

Additional End-of-Life scenarios according to EN 15804+A2:2019

For additional information and transparency, this annex lists End-of-Life scenarios that could be useful, to precisely describe a project situation.

A1. LCIA results (Section: 100% reuse)

This scenario for section describes the case for the application when 100% reuse is considered.

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	2.57E+03	4.35E+01	2.13E+01	1.53E+00	0.00E+00	-2.53E+03
GWP-fossil	kg CO_2 eq.	2.57E+03	4.32E+01	2.11E+01	1.53E+00	0.00E+00	-2.53E+03
GWP-biogenic	kg CO_2 eq.	1.69E+00	1.83E-03	1.53E-02	4.83E-03	0.00E+00	-2.79E+00
GWP-luluc	kg CO_2 eq.	5.46E-01	2.82E-01	1.45E-01	9.15E-04	0.00E+00	-6.05E-01
ODP	kg CFC 11 eq.	3.42E-10	1.33E-11	2.12E-12	1.99E-11	0.00E+00	-6.32E-10
AP	mol H^+ eq.	5.22E+00	2.46E-01	1.27E-01	3.77E-03	0.00E+00	-5.99E+00
EP-freshwater	kg P eq.	1.08E-03	1.52E-04	7.70E-05	4.47E-06	0.00E+00	-1.40E-03
EP-marine	kg N eq.	1.08E+00	1.19E-01	6.20E-02	1.03E-03	0.00E+00	-1.12E+00
EP-terrestrial	mol N eq.	1.18E+01	1.32E+00	6.87E-01	1.11E-02	0.00E+00	-1.22E+01
POCP	Kg NMVOC	4.17E+00	2.31E-01	1.20E-01	2.83E-03	0.00E+00	-4.47E+00
ADP-minerals&metals*	kg Sb eq.	6.65E-04	4.45E-06	2.17E-06	3.85E-07	0.00E+00	-4.21E-04
ADP-fossil*	MJ	2.20E+04	5.82E+02	2.83E+02	2.68E+01	0.00E+00	-2.13E+04
WDP*	m^3	4.79E+01	6.26E-01	2.41E-01	3.12E-01	0.00E+00	-3.95E+01

Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment. EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

A2. LCIA results (Section: 100% recycling)

This scenario for section describes the case for the application when 100% recycling is considered.

Results per one metric tonne of steel long products (section, wire rod, and bar), BOF base.							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	2.57E+03	4.35E+01	2.13E+01	1.53E+00	0.00E+00	-1.71E+03
GWP-fossil	kg CO_2 eq.	2.57E+03	4.32E+01	2.11E+01	1.53E+00	0.00E+00	-1.72E+03
GWP-biogenic	kg CO_2 eq.	1.69E+00	1.83E-03	1.53E-02	4.83E-03	0.00E+00	2.74E+00
GWP-luluc	kg CO_2 eq.	5.46E-01	2.82E-01	1.45E-01	9.15E-04	0.00E+00	-4.60E-01
ODP	kg CFC 11 eq.	3.42E-10	1.33E-11	2.12E-12	1.99E-11	0.00E+00	4.75E-09
AP	mol H^+ eq.	5.22E+00	2.46E-01	1.27E-01	3.77E-03	0.00E+00	-4.70E+00
EP-freshwater	kg P eq.	1.08E-03	1.52E-04	7.70E-05	4.47E-06	0.00E+00	-3.06E-04
EP-marine	kg N eq.	1.08E+00	1.19E-01	6.20E-02	1.03E-03	0.00E+00	-9.81E-01
EP-terrestrial	mol N eq.	1.18E+01	1.32E+00	6.87E-01	1.11E-02	0.00E+00	-1.06E+01
POCP	Kg NMVOC	4.17E+00	2.31E-01	1.20E-01	2.83E-03	0.00E+00	-3.27E+00
ADP-minerals&metals*	kg Sb eq.	6.65E-04	4.45E-06	2.17E-06	3.85E-07	0.00E+00	3.78E-05
ADP-fossil*	MJ	2.20E+04	5.82E+02	2.83E+02	2.68E+01	0.00E+00	-1.27E+04
WDP*	m^3	4.79E+01	6.26E-01	2.41E-01	3.12E-01	0.00E+00	3.59E+01

Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment. EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

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