

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A1

Owner of the Declaration	ArcelorMittal Europe
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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XCarb® Recycled and renewably produced
Reinforcing steel in bars
ArcelorMittal Europe

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XCarb®
Recycled and renewably
produced

General Information

<p>ArcelorMittal Europe</p> <hr/> <p>Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany</p> <hr/> <p>Declaration number EPD-ARC-20210245-CBA1-EN</p> <hr/> <p>This declaration is based on the product category rules: Structural steels, 30.11.2017 (PCR checked and approved by the SVR)</p> <hr/> <p>Issue date 29/10/2021</p> <hr/> <p>Valid to 28/10/2026</p>	<p>XCarb® Recycled and renewably produced Reinforcing steel in bars</p> <hr/> <p>Owner of the declaration ArcelorMittal Europe-Long Products 66, rue de Luxembourg L-4221 Esch-sur-Alzette Luxembourg</p> <hr/> <p>Declared product / declared unit 1 metric tonne of XCarb® Recycled and renewably produced Reinforcing steel in bars.</p> <hr/> <p>Scope: The declaration applies to 1 metric tonne of XCarb® Recycled and renewably produced Reinforcing steel in bars produced by ArcelorMittal.</p> <p>The Life Cycle Assessment is based on data collected from one ArcelorMittal plant producing rebar (Warsaw in Poland). It covers >95% of the annual production with 2019 data for deliveries based on Guarantee of Origins renewable electricity supply.</p> <p>The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.</p> <p>The EPD was created according to the specifications of <i>EN 15804+A1</i>. In the following, the standard will be simplified as <i>EN 15804</i>.</p> <hr/> <p>Verification</p> <table border="1"> <tr> <td colspan="2">The standard <i>EN 15804</i> serves as the core PCR</td> </tr> <tr> <td colspan="2">Independent verification of the declaration and data according to <i>ISO 14025:2010</i></td> </tr> <tr> <td><input type="checkbox"/> internally</td> <td><input checked="" type="checkbox"/> externally</td> </tr> </table> <hr/> <p> Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)</p> <hr/> <p> Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.)</p> <hr/> <p> Matthias Klingler (Independent verifier)</p>	The standard <i>EN 15804</i> serves as the core PCR		Independent verification of the declaration and data according to <i>ISO 14025:2010</i>		<input type="checkbox"/> internally	<input checked="" type="checkbox"/> externally
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Product

Product description/Product definition

This EPD applies to 1 metric tonne of XCarb™ Recycled and renewably produced Reinforcing steel in bars for the building industry based on steel production in Electric Arc Furnace with renewable electricity supply with Guarantee of Origins.

Rebar (Reinforcing Steel in bars, including standard rebars, special rebars – Krybar®, rock bolt and tie bars - and threaded bars) covers carbon steel for geotechnical use and the reinforcement of concrete. The surface of rebars is patterned to form a better bond with soil and concrete; in addition the ribs on threaded bars, rock bolts and tie bars allow for bolting.

For the placing on the market in the European Union/European Free Trade Association (EU/EFTA)

(with the exception of Switzerland) the following legal provisions apply:

EN 10080:2005, Steel for the reinforcement of concrete - Weldable reinforcing steel - General

The CE-marking takes into account the proof of conformity with the respective harmonized standards based on the legal provisions above. For the application and use the respective national provisions apply.

Application

Reinforcement bars are steel rods that are used as a tension device in concrete. Typical applications are in the construction of buildings, bridges, roads and other

civil works (infrastructures, superstructures, etc.) as well as mining.

Technical Data

This EPD is valid for XCarb® Recycled and renewably produced Reinforcing steel in bars of various steel grades and different forms of delivery produced with a certified supply of renewable electricity.

Performance data of the product in accordance with the Declaration of Performance.

Constructional data

Name	Value	Unit
Density	7850	kg/m ³
Modulus of elasticity	210000	N/mm ²
Coefficient of thermal expansion	12	10 ⁻⁶ K ⁻¹
Thermal conductivity	48	W/(mK)
Melting point	1536	°C
Minimum yield strength	460 - 900	N/mm ²
Tensile strength	483 - 1100	N/mm ²
Shear modulus	81000	N/mm ²

Product not harmonised in accordance with the CPR but in accordance with other provisions for harmonisation of the EU: *EN 10080:2005*, Steel for the reinforcement of concrete - Weldable reinforcing steel - General (the relevant test procedures are detailed in *EN 10080*).

For the application and use the respective national provisions apply.

For the application and use of the products the following standards apply: *EN 1992-1-1*, *EN 1992-1-2*, *EN 1992-2*, *EN 1992-3*.

Base materials/Ancillary materials

The base material of XCarb® Recycled and renewably produced Reinforcing steel in bars is iron. Alloying elements are added in the form of ferroalloys or metals (most common elements are Manganese and Silicon). 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.

This product contains substances listed in the *candidate list* (date: 22.2.2021) exceeding 0.1 percentage by mass: no

Reference service life

A reference service life for XCarb® Recycled and renewably produced Reinforcing steel in bars is not declared. These are construction products with many different applications purposes. The lifetime therefore will be limited by the service life of the work.

LCA: Calculation rules

Declared Unit

The declaration refers to the declared unit of 1 metric tonne of XCarb® Recycled and renewably produced Reinforcing steel in bars as specified in Part B requirements on the EPD for reinforcing steel.

Foreground data for the production are integrated into the software model for the considered production site/company. The LCI is assessed as per the annual production data of ArcelorMittal Europe at the site Warszawa. The background data are taken from *GaBi* ts Documentation.

Declared unit

Name	Value	Unit
Declared unit	1	t
Density	7850	kg/m ³
Conversion factor to 1 kg	1000	-

System boundary

Type of the EPD: cradle-to-gate - with options. Module A1-A3, Modules C3-C4 and Module D were considered.

Modules A1-A3 include the following:

- The provision of resources, additives, and energy

- Transport of resources and additives to the production site
- Production processes on-site including energy, production of additives, disposal of production residues, and consideration of related emissions
- Recycling of production/manufacturing scrap. Steel scrap is assumed to reach the end-of-waste status once is shredded and sorted, thus becomes input to the product system in the inventory.

For the environmental impact, the use of green electricity was calculated. The proportion of the electricity demand covered by green electricity in the total electricity demand of the on-site production at Warszawa is 100%.

Modules C3-C4 take into account the sorting and shredding of after-use steel, as well as the nonrecovered scrap due to sorting efficiency which is landfilled. A conservative value of 10% landfill is considered.

Module D refers to the End-of-Life, including recycling.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared

were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

For the life cycle modelling of the product under study, the GaBi Software System for Life Cycle Engineering, content version 2021.1, is used (*GaBis*).

LCA: Scenarios and additional technical information

Current practice for the average rebar product consists of 91% recycling, 1% reuse and 8% landfill according to *SteelConstruction-info*.

This EPD considers a conservative approach of 90% recycling and 10% landfill:

End of life (C3 - C4)

Name	Value	Unit
Landfilling	10	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Recycling	90	%

LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 t XCarb™ Recycled and renewably produced Reinforcing steel in bars

Parameter	Unit	A1-A3	C3	C4	D
Global warming potential	[kg CO ₂ -Eq.]	3.00E+2	1.60E+0	1.43E+0	2.46E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.69E-11	4.69E-14	7.83E-15	5.75E-13
Acidification potential of land and water	[kg SO ₂ -Eq.]	8.66E-1	2.99E-3	8.57E-3	3.97E-1
Eutrophication potential	[kg (PO ₄) ³ -Eq.]	6.24E-2	4.48E-4	9.72E-4	2.04E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	5.79E-2	2.60E-4	6.58E-4	1.23E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.89E-3	4.70E-7	1.44E-7	5.48E-4
Abiotic depletion potential for fossil resources	[MJ]	3.25E+3	1.82E+1	1.95E+1	2.32E+3

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 t XCarb™ Recycled and renewably produced Reinforcing steel in bars

Parameter	Unit	A1-A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	6.29E+3	1.22E+1	2.70E+0	-2.07E+2
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	6.29E+3	1.22E+1	2.70E+0	-2.07E+2
Non-renewable primary energy as energy carrier	[MJ]	3.37E+3	2.82E+1	2.01E+1	2.25E+3
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.37E+3	2.82E+1	2.01E+1	2.25E+3
Use of secondary material	[kg]	1.05E+3	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m ³]	4.57E-1	1.18E-2	4.95E-3	1.14E+0

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 t XCarb™ Recycled and renewably produced Reinforcing steel in bars

Parameter	Unit	A1-A3	C3	C4	D
Hazardous waste disposed	[kg]	1.57E-6	6.99E-9	2.13E-9	-6.28E-7
Non-hazardous waste disposed	[kg]	5.86E+0	1.89E-2	1.00E+2	-2.71E+1
Radioactive waste disposed	[kg]	3.30E-2	3.89E-3	2.10E-4	-8.16E-5
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.00E+2	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0

References

EN 10080

EN 10080:2005, Steel for the reinforcement of concrete - Weldable reinforcing steel - General

EN 1992-1-1

EN 1992-1-1:2004, Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings

EN 1992-1-2

EN 1992-1-2:2004, Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

EN 1992-2

EN 1992-2:2005, Eurocode 2 - Design of concrete structures - Concrete bridges - Design and detailing rules

EN 1992-3

EN 1992-3:2006, Eurocode 2 - Design of concrete

structures - Part 3: Liquid retaining and containment structures

Candidate List of Substances of Very High Concern for Authorisation

Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). <https://echa.europa.eu/candidate-list-table>

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

DIN EN ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

GaBi ts

GaBi ts dataset documentation for the GaBi Software System and Database for Life Cycle Engineering, thinkstep AG, Leinfelden-Echterdingen, 2021 (<http://documentation.gabi-software.com/>)

IBU 2021

IBU 2021, General Instructions for the EPD programme of Institut Bauen und Umwelt e.V. Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 www.ibu-epd.de

IBU Part A

PCR - Part A: Calculation rules for the Life Cycle Assessment and Requirements on the Background Report, version 1.8, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2019

IBU Part B

PCR – Part B: Requirements of the EPD for Metal Ceilings, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2019

SteelConstruction-info

https://www.steelconstruction.info/The_recycling_and_reuse_survey

Worldsteel 2011

Life cycle assessment (LCA) methodology report <http://www.worldsteel.org/publications/>

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