# ENVIRONMENTAL PRODUCT DECLARATION

## XCARB™ RECYCLED AND RENEWABLY PRODUCED STRUCTURAL STEEL SECTIONS AND MERCHANT BARS

ARCELORMITTAL

XCarb™ recycled and renewably produced applies to products made via the Electric Arc Furnace route using 100% scrap and 100% renewable energy. The electricity used in the steelmaking process is independently verified, with a 'Guarantee of Origin' given that it is from renewable sources. This is ensured by our purchasing of 'Renewable Energy Certificates' (RECs), a market-based offering that certifies the bearer owns a specific amount (in megawatt-hours) of electricity generated from a renewable energy resource.

ArcelorMittal is the world's leading steel and mining company, with a presence in 60 countries and an industrial footprint in 18 countries.

We are driven by a goal to help build a better world with smarter steels. Steels that are cleaner, stronger, and reusable. Steels that emit significantly less carbon, reduce end-use costs, and that are made using innovative processes that minimize energy use. With steel at our core, and drawing on our inventive people and entrepreneurial culture, we will support the world in making that change.

XCarb™ is the brand name for ArcelorMittal's ongoing global program of steelmaking innovation targeted at carbon-neutral steel by 2050. The initiatives that are part of XCarb™ aim to reduce the carbon footprint of ArcelorMittal and of our customers.

This EPD helps our customers to calculate the total $CO_2$ impact of their project using our products. The figures reported in this EPD are independently certified by a third-party.

Institut Bauen und Umwelt e.V.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

# ENVIRONMENTAL PRODUCT DECLARATION

ArcelorMittal

XCarb™ Recycled and renewably produced Structural steel sections and merchant bars.
ArcelorMittal

**According to EN 15804 and ISO 14025**
**Dual Recognition by UL Environment and Institut Bauen und Umwelt e.V.**

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

| | |
|---|---|
| PROGRAM OPERATOR | UL Environment |
| DECLARATION HOLDER | ArcelorMittal Europe |
| ULE DECLARATION NUMBER | 4790466306.101.1 |
| IBU DECLARATION NUMBER | EPD-ARC-20210132-CBB1-EN |
| DECLARED PRODUCT | XCarb™ Recycled and renewably produced<br>Structural steel sections and merchant bars |
| REFERENCE PCR | Product Category Rules Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report, 01.2021<br>Product Category Rules Part B: Structural steels, 11.2017 |

| | |
|---|---|
| DATE OF ISSUE | July 19th, 2021 |
| PERIOD OF VALIDITY | 5 Years |

| | |
|---|---|
| SCOPE | This EPD is Manufacturer Declaration (1a) – Declaration of a specific product from a manufacturer's plant. The owner of the declaration shall be liable for the underlying information and evidence. |
| CONTENTS OF THE DECLARATION | Product definition<br>Information about basic material and the material's origin<br>Description of the product's manufacture<br>Indication of product processing<br>Life cycle assessment results<br>Testing results and verifications |

| | |
|---|---|
| The PCR review was conducted by: | IBU – Institut Bauen und Umwelt e.V.<br>PCR was approved by the Independent Expert Committee (IEC) of IBU |
| The CEN Norm EN 15804 serves as the core PCR. This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories<br>☐ INTERNAL ☒ EXTERNAL | Cooper McC<br>Cooper McCollum, UL Environment |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: | Institut Bauen und Umwelt e.V. (IBU) |

# 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) |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
| Declaration number | EPD-ARC-20210132-CBB1-EN |
| Issue date | 19/07/2021 |
| Valid to | 18/07/2026 |

XCarb™ Recycled and renewably produced
Structural steel sections and merchant bars

## ArcelorMittal Europe

Institut Bauen und Umwelt e.V.

**www.ibu-epd.com | https://epd-online.com**

ECO PLATFORM EPD EN 15804 VERIFIED

## General Information

ArcelorMittal Europe

XCarb™ Recycled and renewably produced structural steel sections and merchant bars

**Programme holder**
IBU – Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

**Owner of the declaration**
ArcelorMittal Europe – Long Products
66, rue de Luxembourg
L-4221 Esch-sur-Alzette
Luxembourg

**Declaration number**
EPD-ARC-20210132-CBB1-EN

**Declared product / declared unit**
1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars.

**This declaration is based on the product category rules:**
Structural steels, 11.2017
(PCR checked and approved by the SVR)

**Scope:**
The declared unit is 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars produced by ArcelorMittal.
The Life Cycle Assessment is based on data collected from the EAF plants involved in the production: Differdange & Esch-Belval (sites of Belval, Differdange and Rodange) in Luxembourg; Bergara & Olaberria in Spain. The data used represent >95% of annual production with 2019 data for deliveries based on Guarantee of Origins renewable electricity supply.

**Issue date**
19/07/2021

**Valid to**
18/07/2026

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.
The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.

**Verification**

| |
|---|
| The standard *EN 15804* serves as the core PCR |
| Independent verification of the declaration and data according to *ISO 14025:2010* |
| ☐ internally ☒ externally |

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Matthias Klingler
(Independent verifier)

## Product

**Product description/Product definition**
This EPD applies to 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars in usual structural steel grades for building industry based on a steel production in Electric Arc Furnace with renewable electricity supply with Guarantee of Origins.

For the placing on the market of the product in 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.

**Application**
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.)

**Technical Data**
This EPD is valid for XCarb™ Recycled and renewably produced structural sections and merchant 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 |
| Shear modulus | 81000 | N/mm² |

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 10025-1:2004*.

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 360-16* 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: *EN 10025*, *ASTM A36-14*, *ASTM A572-15*, *ASTM A588-15*, *ASTM A709-13*, *ASTM A913/A913M-19* and *ASTM A992-11*.
- Fabrication standards: *EN 1090-2*, *AISC 303-10*, *AWSD1.1/D1.1M*. The Standard *EN 1090-2* applies to the execution of steel structures and includes the requirements for factory production control.

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

**Base materials/Ancillary materials**
The base material of XCarb™ Recycled and renewably produced structural steel sections and merchant 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 structural steel sections and merchant 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 functional unit of 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars as specified in Part B requirements on the EPD for structural steels.

The final results reflect the weighted average per production volume of plants: Differdange & Esch-Belval (sites of Belval, Differdange and Rodange) in Luxembourg; Bergara & Olaberria in Spain.

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 | 0.001 | - |

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

**Modules A1-A3** of the structural steel production 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.

**Module C3** takes into account the sorting and shredding of after-use steel to allow its orientation towards the recycling solutions. This process will also produce losses due to efficiency that will be oriented towards landfill sites. A conservative value of 1% landfill is then considered in C4.

**Module C4** takes into account the waste disposal including physical pre-treatment and management of the disposal site. Steel is an inert material which does not require any specific treatment on disposal site.

**Module D** refers to the end of life of the structural steel sections and merchant bars, including reuse and 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.

*GaBi ts Software* version 10.0.1.92 was used with GaBi Database 2021.1 to calculate this EPD.

## LCA: Scenarios and additional technical information

The end of life for average structural steel sections and merchant bar products consists of 11% reuse, 88% recycling and 1% landfill, with the corresponding benefits and burdens. This is based on the *European Commission – Science Research Development Report* and on the *Umweltbundesamt (*German Environmental Agency).

**End of life (C1 - C4)**

| Name | Value | Unit |
|---|---|---|
| Reuse | 110 | kg |
| Recycling | 880 | kg |
| Landfilling | 10 | kg |

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

| Name | Value | Unit |
|---|---|---|
| Reuse | 11 | % |
| Recycling | 88 | % |

# 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 metric to of XCarb™ structural steel sections

| Parameter | Unit | A1-A3 | C3 | C4 | D |
|---|---|---|---|---|---|
| Global warming potential | [kg $CO_2$-Eq.] | 3.33E+2 | 1.60E+0 | 1.43E-1 | 2.14E+2 |
| Depletion potential of the stratospheric ozone layer | [kg CFC11-Eq.] | 4.84E-11 | 4.69E-14 | 7.83E-16 | -4.74E-12 |
| Acidification potential of land and water | [kg $SO_2$-Eq.] | 7.46E-1 | 2.99E-3 | 8.57E-4 | 3.22E-1 |
| Eutrophication potential | [kg $(PO_4)^{3-}$-Eq.] | 7.51E-2 | 4.48E-4 | 9.72E-5 | 1.25E-2 |
| Formation potential of tropospheric ozone photochemical oxidants | [kg ethene-Eq.] | 8.27E-2 | 2.60E-4 | 6.58E-5 | 1.16E-1 |
| Abiotic depletion potential for non-fossil resources | [kg Sb-Eq.] | 4.04E-4 | 4.70E-7 | 1.44E-8 | 5.13E-4 |
| Abiotic depletion potential for fossil resources | [MJ] | 3.81E+3 | 1.82E+1 | 1.95E+0 | 1.94E+3 |

## RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 metric to of XCarb™ structural steel sections

| Parameter | Unit | A1-A3 | C3 | C4 | D |
|---|---|---|---|---|---|
| Renewable primary energy as energy carrier | [MJ] | 7.53E+3 | 1.22E+1 | 2.70E-1 | -1.04E+3 |
| 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] | 7.53E+3 | 1.22E+1 | 2.70E-1 | -1.04E+3 |
| Non-renewable primary energy as energy carrier | [MJ] | 4.00E+3 | 2.82E+1 | 2.01E+0 | 1.85E+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] | 4.00E+3 | 2.82E+1 | 2.01E+0 | 1.85E+3 |
| Use of secondary material | [kg] | 1.16E+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 | [$m^3$] | 6.10E-1 | 1.18E-2 | 4.95E-4 | 1.09E+0 |

## RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 metric to of XCarb™ structural steel sections

| Parameter | Unit | A1-A3 | C3 | C4 | D |
|---|---|---|---|---|---|
| Hazardous waste disposed | [kg] | 1.52E-6 | 7.00E-9 | 2.13E-10 | -8.06E-7 |
| Non-hazardous waste disposed | [kg] | 2.02E+0 | 1.89E-2 | 1.00E+1 | -2.78E+1 |
| Radioactive waste disposed | [kg] | 5.46E-2 | 3.89E-3 | 2.10E-5 | -6.09E-3 |
| Components for re-use | [kg] | 0.00E+0 | 1.10E+2 | 0.00E+0 | 0.00E+0 |
| Materials for recycling | [kg] | 0.00E+0 | 8.80E+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 |

1163,1 kg scrap is used in the manufacturing of 1 tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars. After use, 880 kg steel is recycled, 110 kg is reused, and 10 kg is landfilled. The potential environmental impact calculated for module D depends on the net amount of scrap left in the system, which is 880-1163,1 + 127,94 = -155,17 kg.
This means that the system has a net negative output of 155,17 kg scrap, which carries a potential credit then, module D shows an environmental burden.

# References


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

**PCR Part A**
PCR - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2021.

**PCR 2017, Part B**
Requirements on the EPD for Structural steels - Institut Bauen und Umwelt e.V., Berlin (pub.): From the range of Environmental Product
Declarations of Institute Construction and Environment e.V. (IBU), 2017.

**GaBi ts Software**
GaBi ts Software and Databases for Life Cycle Engineering. LBP, University of Stuttgart und PE International, 2013.

**GaBi ts Documentation**
GaBi ts Documentation of the GaBi datasets for Life Cycle Engineering. LBP, Universitity of Stuttgart and PE International, 2011.
http://documentation.gabi-software.com

**ASTM A36-14**
ASTM A36-14:2014, Standard specification for carbon structural steel.

**ASTM A572-15**
ASTM A572-15:2015, Standard specification for highstrength low-alloy Columbium-Vanadium structural quality steel.

**ASTM A588-15**
ASTM A588-15:2015, Standard specification for highstrength low-alloy structural steel, up to 50 ksi [345 MPa] minimum yield point, with atmospheric corrosion resistance.

**ASTM A709-13**
ASTM A709-13:2013, Standard specification for structural steel for bridges.

**ASTM A913/913M-19**
ASTM A913/913M-19:2019, Standard specification for high-strength low-alloy steel shapes of structural quality, produced by quenching and self-tempering process (QST).

**ASTM A992-11**
ASTM A992-11:2015, Standard specification for structural steel shapes.

**EN 10025-1**
EN 10025-1:2004, Hot rolled products of structural steels. General technical delivery conditions.

**EN 1090-2**
EN 1090-2:2008, Execution of steel structures and aluminum structures – Part 2: technical requirements for steel structures.

**AISC 303-10**
AISC 303-10:2010, Code of Standard Practice for Structural Steel Buildings and Bridges

**AWSD1.1/D1.1M**
AWSD1.1/D1.1M:2015, Structural Welding Code–Steel.

**EN 1993**
EN 1993:2005, Eurocode 3: Design of steel structures.

**EN 1994**
EN 1994:2004, Eurocode 4: Design of composite steel and concrete structures.

**ANSI/AISC 360-16**
ANSI/AISC 360-16:2016, Specification for Structural Steel Buildings.

**Candidate list - REACH**
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

**Sales Programme Sections & Merchant Bars**
ArcelorMittal Europe - Long Products available at http://sections.arcelormittal.com.

**Umweltbundesamt**
Instrumente zur Wiederverwendung von Bauteilen und hochwertigen Verwertung von Baustoffen. Texte 93/2015.
http://www.umweltbundesamt.de/publikationen/instrumente-zur-wiederverwendung-von-bauteilen

**European Commission – Science Research Development Report**
Life-Cycle Assessment (LCA) for steel construction. Technical steel research, 2002.

**Publisher**
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

**Programme holder**
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

**Author of the Life Cycle Assessment**
ArcelorMittal Europe – Long Products – Sections
Rue de Luxembourg 66
4221 Esch-sur-Alzette
Luxembourg

Tel +352 5313 3010
Fax -
Mail sections.sales@arcelormittal.com
Web **sections.arcelormittal.com**

**Owner of the Declaration**
ArcelorMittal Europe – Long Products – Sections
Rue de Luxembourg 66
4221 Esch-sur-Alzette
Luxembourg

Tel +352 5313 3010
Fax -
Mail sections.sales@arcelormittal.com
Web **sections.arcelormittal.com**