Environmental Product Declaration

according to ISO 14025 and EN 15804

This declaration is for:

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

Provided by:

ArcelorMittal Europe – Long Products – Sections

program operator
Stichting MRPI®
publisher
Stichting MRPI®
www.mrpi.nl

MRPI® registration
1.1.00435.2023
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COMPANY INFORMATION

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MRPI® REGISTRATION

1.1.00435.2023

DATE OF ISSUE

11-04-2023

EXPIRY DATE

11-04-2028

PRODUCT

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

DECLARED UNIT/FUNCTIONAL UNIT

1 ton

DESCRIPTION OF PRODUCT

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.

VISUAL PRODUCT

MORE INFORMATION

http://sections.arcelormittal.com

SCOPE OF DECLARATION

This MRPI®-EPD certificate is verified by **Ulbert Hofstra, SGS INTRON BV.**
The LCA study has been done by **Arthur De Jaegher, Enperas.**
The certificate is based on an LCA-dossier according to ISO14025 and EN15804+A2/Bepalingsmethode. It is verified according to the 'MRPI®-EPD verification protocol November 2020.v4.0'. EPDs of construction products may not be comparable if they do not comply with EN15804+A2/Bepalingsmethode. Declaration of SVHC that are listed on the 'Candidate List of Substances of Very High Concern for authorisation' when content exceeds the limits for registration with ECHA.

PROGRAM OPERATOR

Stichting MRPI®
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ir. J-P den Hollander, Managing director MRPI®

DEMONSTRATION OF VERIFICATION
CEN standard EN15804 serves as the core PCR[a]
Independent verification of the declaration and data, according to EN ISO 14025:2010: internal: external: X
Third party verifier: Ulbert Hofstra, SGS INTRON BV
[a] PCR = Product Category Rules

DETAILED PRODUCT DESCRIPTION

Manufacturing process

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.

The production of rolled XCarb® Recycled and renewably produced structural steel sections and merchant bars 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.

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.

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.).

Installation

Main materials for fixation and installation of steel sections are included. This EPD includes the impacts of all processes, generally used for steel sections installing/mounting according to following scenario(s): the results of this EPD are based on an installation scenario using bolts. It is expected that the results are also representative for the welding scenario. A confined sensitivity analysis based on generic Ecoinvent datarecords expects that 100m of welding still has a similar or even lower impact than using bolts. However, consider that currently very limited information is available on the welding scenario and its environmental impact. The product is used in various construction applications, and produced in a wide range of dimensions. The declaration covers the whole range.

Technical data

Performance data of the product is 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 A572-21E1, ASTM A588-19, ASTM A709-21, ASTM A913/A913M19 and ASTM A992-22.

• 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.

Technical property	Value	Unit
Density	7850	kg/m3
Modulus of elasticity	210000	N/mm2
Coefficient of thermal expansion	12	10-6K-1
Thermal conductivity	48	W/(mK)
Melting point	1536	degrees Celsius
Shear modulus	81000	N/mm2

Reference service life
The reference service life is estimated at 100 years. It's based on results available in the European assessment document EAD 200022-00-0302: Thermomechanically quenched and self-tempered hot-rolled long products made of weldable fine grain structural steel of special steel grades.
Corrosion protection could be required in some cases under specific conditions, in order to ensure reference service life.

COMPONENT > 1% of total mass	[%]
Steel scrap	99%
Alloying elements in the form of ferroalloys or metals (most common elements are Manganese, Chromium and Vanadium).	1%

SCOPE AND TYPE

This is a specific EPD from a single company, ArcelorMittal.

The EPD is representative for steel sections produced by ArcelorMittal at production sites in Differdange, Belval, Rodange (Luxembourg) and Olaberria&Bergara (Spain), and sold on the Dutch market.

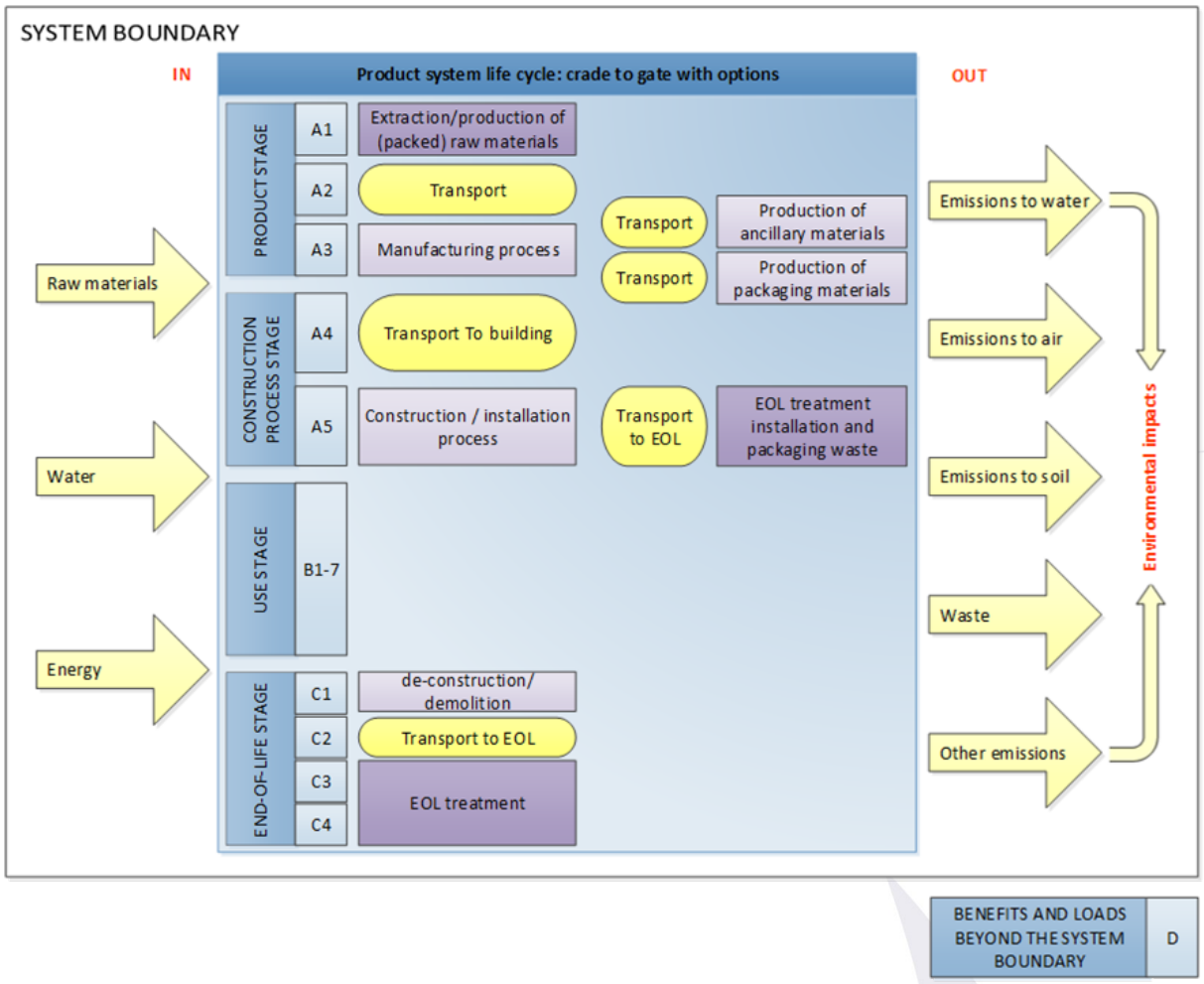
Software and background database

For the calculation of the LCA results, the software program SimaPro 9.3.0.3 (PRé Consultants, 2021) has been used. Ecoinvent 3.8 is used as LCA background database.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport gate to 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	x	x	x	x	x	x	x	ND	ND	x	x	x	x	x

X = Modules Assessed

ND = Not Declared



LCA process diagram according to EN 15804 (7.2.1)

REPRESENTATIVENESS

The data used in this study are based on the weighted average of the data collected at the factories located in Differdange, Belval, Rodange and Olaberria&Bergara. A variability study is performed in the LCA background report and shows that the weighted average is representative for the four production locations. The variability is lower than 15%, except for particulate matter, where some factories have a significantly lower impact. These can still be included as the EPD describes a more conservative impact.

ENVIRONMENTAL IMPACT per functional unit or declared unit (indicators A1)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
ADPE	kg Sb eq.	1.94 E-4	2.24 E-5	1.20 E-3	1.42 E-3	6.33 E-5	3.44 E-4	0.00	0.00	0.00	0.00	0.00	1.99 E-6	1.80 E-5	5.56 E-6	1.37 E-7	2.33 E-5
ADPF	MJ	8.40 E+2	1.84 E+2	4.89 E+3	5.91 E+3	5.17 E+2	6.07 E+2	0.00	0.00	0.00	0.00	0.00	6.54 E+1	1.02 E+2	1.83 E+1	1.66 E+0	1.57 E+3
GWP	kg CO2 eq.	6.94 E+1	1.22 E+1	3.05 E+2	3.86 E+2	3.15 E+1	4.56 E+1	0.00	0.00	0.00	0.00	0.00	4.72 E+0	6.67 E+0	1.36 E+0	6.55 E-2	1.87 E+2
ODP	kg CFC11 eq.	2.57 E-6	2.12 E-6	3.44 E-5	3.91 E-5	5.86 E-6	3.28 E-6	0.00	0.00	0.00	0.00	0.00	7.98 E-7	1.21 E-6	6.70 E-8	1.75 E-8	7.45 E-6
POCP	kg ethene eq.	2.06 E-2	2.52 E-3	1.15 E-1	1.38 E-1	4.19 E-3	1.58 E-2	0.00	0.00	0.00	0.00	0.00	7.69 E-4	8.47 E-4	1.42 E-4	1.73 E-5	1.23 E-1
AP	kg SO2 eq.	4.11 E-1	8.02 E-2	7.01 E-1	1.19 E+0	8.86 E-2	1.88 E-1	0.00	0.00	0.00	0.00	0.00	3.49 E-2	1.84 E-2	2.96 E-3	4.04 E-4	5.29 E-1
EP	kg (PO4)3- eq.	4.64 E-2	1.10 E-2	7.90 E-2	1.36 E-1	9.88 E-3	2.97 E-2	0.00	0.00	0.00	0.00	0.00	7.36 E-3	2.27 E-3	5.93 E-4	6.59 E-5	8.15 E-2

Toxicity indicators for Dutch market

HTP	kg DCB eq.	6.15 E+1	5.19 E+0	1.63 E+2	2.29 E+2	1.44 E+1	2.41 E+1	0.00	0.00	0.00	0.00	0.00	1.52 E+0	2.58 E+0	1.99 E-1	2.29 E-2	1.01 E+2
FAETP	kg DCB eq.	3.56 E+0	1.40 E-1	2.40 E+0	6.10 E+0	4.09 E-1	7.72 E-1	0.00	0.00	0.00	0.00	0.00	2.51 E-2	7.74 E-2	5.25 E-3	6.16 E-4	-2.44 E+0
MAETP	kg DCB eq.	1.24 E+4	5.52 E+2	9.25 E+3	2.22 E+4	1.62 E+3	2.18 E+3	0.00	0.00	0.00	0.00	0.00	8.63 E+1	2.90 E+2	2.11 E+1	2.21 E+0	-5.69 E+3
TETP	kg DCB eq.	1.88 E-1	1.56 E-2	1.36 E+0	1.56 E+0	4.38 E-2	1.73 E-1	0.00	0.00	0.00	0.00	0.00	1.66 E-3	8.41 E-3	7.11 E-3	1.14 E-4	-7.03 E+0
ECI	Euro	1.25 E+1	1.58 E+0	3.50 E+1	4.91 E+1	3.53 E+0	5.80 E+0	0.00	0.00	0.00	0.00	0.00	5.95 E-1	7.01 E-1	1.08 E-1	7.96 E-3	2.06 E+1
ADPF	kg Sb. eq.	4.92 E-1	8.69 E-2	2.14 E+0	2.72 E+0	2.43 E-1	3.08 E-1	0.00	0.00	0.00	0.00	0.00	3.11 E-2	4.83 E-2	1.02 E-2	8.06 E-4	1.32 E+0

ADPE = Abiotic Depletion Potential for non-fossil resources
ADPF = Abiotic Depletion Potential for fossil resources
GWP = Global Warming Potential
ODP = Depletion potential of the stratospheric ozone layer
POCP = Formation potential of tropospheric ozone photochemical oxidants
AP = Acidification Potential of land and water
EP = Eutrophication Potential
HTP = Human Toxicity Potential
FAETP = Fresh water aquatic ecotoxicity potential
MAETP = Marine aquatic ecotoxicity potential
TETP = Terrestrial ecotoxicity potential
ECI = Environmental Cost Indicator
ADPF = Abiotic Depletion Potential for fossil resources expressed in [kg Sb-eq.]

ENVIRONMENTAL IMPACT per functional unit or declared unit (core indicators A2)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	7.15 E+1	1.23 E+1	3.14 E+2	3.98 E+2	3.18 E+1	4.70 E+1	0.00	0.00	0.00	0.00	0.00	4.77 E+0	6.73 E+0	1.38 E+0	6.67 E-2	1.98 E+2
GWP-fossil	kg CO2 eq.	7.11 E+1	1.23 E+1	3.14 E+2	3.97 E+2	3.17 E+1	4.62 E+1	0.00	0.00	0.00	0.00	0.00	4.77 E+0	6.72 E+0	1.38 E+0	6.66 E-2	1.98 E+2
GWP-biogenic	kg CO2 eq.	2.50 E-1	6.26 E-3	2.59 E-1	5.16 E-1	2.07 E-2	7.77 E-1	0.00	0.00	0.00	0.00	0.00	9.55 E-4	2.43 E-3	3.65 E-3	6.63 E-5	-1.25 E-1
GWP-luluc	kg CO2 eq.	1.24 E-1	7.92 E-3	7.62 E-2	2.08 E-1	1.76 E-2	4.29 E-2	0.00	0.00	0.00	0.00	0.00	4.93 E-4	1.29 E-2	4.95 E-4	5.47 E-5	-4.55 E-3
ODP	kg CFC11 eq.	2.80 E-6	2.68 E-6	3.95 E-5	4.50 E-5	7.39 E-6	3.75 E-6	0.00	0.00	0.00	0.00	0.00	1.01 E-6	1.53 E-6	7.81 E-8	2.21 E-8	5.26 E-6
AP	mol H+ eq.	5.04 E-1	1.03 E-1	8.74 E-1	1.48 E+0	1.09 E-1	2.36 E-1	0.00	0.00	0.00	0.00	0.00	4.89 E-2	2.31 E-2	3.78 E-3	5.33 E-4	6.65 E-1
EP-freshwater	kg PO4 eq.	3.38 E-3	1.27 E-4	2.72 E-3	6.23 E-3	4.12 E-4	2.28 E-3	0.00	0.00	0.00	0.00	0.00	1.95 E-5	5.47 E-5	7.50 E-5	1.31 E-6	8.98 E-3
EP-marine	kg N eq.	1.03 E-1	3.08 E-2	1.96 E-1	3.30 E-1	2.39 E-2	6.20 E-2	0.00	0.00	0.00	0.00	0.00	2.16 E-2	5.91 E-3	9.90 E-4	1.81 E-4	1.51 E-1
EP-terrestrial	mol N eq.	1.16 E+0	3.40 E-1	2.23 E+0	3.73 E+0	2.66 E-1	6.41 E-1	0.00	0.00	0.00	0.00	0.00	2.37 E-1	6.50 E-2	1.13 E-2	2.00 E-3	1.78 E+0
POCP	kg NMVOC eq.	3.68 E-1	9.66 E-2	6.47 E-1	1.11 E+0	1.00 E-1	2.20 E-1	0.00	0.00	0.00	0.00	0.00	6.53 E-2	2.19 E-2	3.10 E-3	5.80 E-4	1.06 E+0
ADP-minerals & metals	kg Sb eq.	1.94 E-4	2.24 E-5	1.20 E-3	1.42 E-3	6.33 E-5	3.44 E-4	0.00	0.00	0.00	0.00	0.00	1.99 E-6	1.80 E-5	5.56 E-6	1.37 E-7	2.33 E-5
ADP-fossil	MJ, net calorific value	8.40 E+2	1.84 E+2	4.89 E+3	5.91 E+3	5.17 E+2	6.07 E+2	0.00	0.00	0.00	0.00	0.00	6.54 E+1	1.02 E+2	1.83 E+1	1.66 E+0	1.57 E+3
WDP	m3 world eq. deprived	1.45 E+1	7.38 E-1	9.77 E+1	1.13 E+2	2.26 E+0	1.44 E+1	0.00	0.00	0.00	0.00	0.00	1.08 E-1	3.30 E-1	1.46 E-1	6.77 E-2	-4.40 E+1

GWP-total = Global Warming Potential total
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 Exceedence
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 Exceedence
POCP = Formation potential of tropospheric ozone photochemical oxidants
ADP-minerals&metals = Abiotic Depletion Potential for non fossil resources [2]
ADP-fossil = Abiotic Depletion for fossil resources potential [2]
WDP = Water (user) deprivation potential, deprivation-weighted water consumption [2]

Disclaimer [2]

- The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ENVIRONMENTAL IMPACT per functional unit or declared unit (additional indicators A2)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
PM	Disease incidence	3.61 E-5	1.23 E-6	5.55 E-6	4.28 E-5	3.50 E-6	4.26 E-6	0.00	0.00	0.00	0.00	0.00	1.31 E-6	5.83 E-7	3.37 E-8	1.03 E-8	9.19 E-6
IRP	kBq U235 eq.	2.75 E+0	8.17 E-1	1.39 E+1	1.75 E+1	2.37 E+0	2.60 E+0	0.00	0.00	0.00	0.00	0.00	2.76 E-1	4.38 E-1	3.91 E-2	6.41 E-3	-3.56 E+0
ETP-fw	CTUe	2.58 E+3	1.47 E+2	2.28 E+3	5.00 E+3	4.16 E+2	1.19 E+3	0.00	0.00	0.00	0.00	0.00	3.84 E+1	8.22 E+1	1.71 E+1	1.10 E+0	6.69 E+3
HTP-c	CTUh	3.26 E-6	5.92 E-9	5.18 E-7	3.78 E-6	1.39 E-8	2.44 E-7	0.00	0.00	0.00	0.00	0.00	1.47 E-9	2.72 E-9	8.26 E-10	3.19 E-11	-7.17 E-7
HTP-nc	CTUh	1.11 E-6	1.47 E-7	8.11 E-6	9.36 E-6	4.30 E-7	1.11 E-6	0.00	0.00	0.00	0.00	0.00	2.77 E-8	8.40 E-8	1.19 E-8	7.31 E-10	-2.79 E-5
SQP	---	3.43 E+2	1.77 E+2	3.26 E+3	3.78 E+3	5.70 E+2	2.51 E+2	0.00	0.00	0.00	0.00	0.00	8.34 E+0	7.55 E+1	1.76 E+1	3.26 E+0	3.04 E+2

PM = Potential incidence of disease due to PM emissions
IRP = Potential Human exposure efficiency relative to U235 [1]
ETP-fw = Potential Comparative Toxic Unit for ecosystems [2]
HTP-c = Potential Comparative Toxic Unit for humans [2]
HTP-nc = Potential Comparative Toxic Unit for humans, non-cancer [2]
SQP = Potential soil quality index [2]

Disclaimer [1]

- This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer [2]

- The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

RESOURCE USE per functional unit or declared unit (A1 / A2)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
PERE	MJ	1.53 E+2	3.70 E+0	2.84 E+3	2.99 E+3	1.25 E+1	8.90 E+1	0.00	0.00	0.00	0.00	0.00	4.56 E-1	1.49 E+0	2.39 E+0	3.64 E-2	0.00
PERM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	1.53 E+2	3.70 E+0	2.84 E+3	2.99 E+3	1.25 E+1	8.90 E+1	0.00	0.00	0.00	0.00	0.00	4.56 E-1	1.49 E+0	2.39 E+0	3.64 E-2	0.00
PENRE	MJ	1.13 E+3	1.87 E+2	5.46 E+3	6.78 E+3	5.29 E+2	7.44 E+2	0.00	0.00	0.00	0.00	0.00	6.52 E+1	1.03 E+2	2.31 E+1	1.71 E+0	0.00
PENRM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	1.13 E+3	1.87 E+2	5.46 E+3	6.78 E+3	5.29 E+2	7.44 E+2	0.00	0.00	0.00	0.00	0.00	6.52 E+1	1.03 E+2	2.31 E+1	1.71 E+0	0.00
SM	kg	1.20 E+3	0.00	0.00	1.20 E+3	0.00	1.15 E+1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.23 E+2
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m3	3.84 E-1	2.51 E-2	2.77 E+0	3.18 E+0	8.25 E-2	4.51 E-1	0.00	0.00	0.00	0.00	0.00	2.98 E-3	1.02 E-2	9.96 E-3	1.65 E-3	-5.31 E-1

PERE = Use of renewable energy excluding renewable primary energy resources
PERM = Use of renewable energy resources used as raw materials
PERT = Total use of renewable primary energy resources
PENRE = Use of non-renewable primary energy resources excluding non-renewable 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 resources
SM = Use of secondary materials
RSF = Use of renewable secondary fuels
NRSF = Use of non renewable secondary fuels
FW = Use of net fresh water

OUTPUT FLOWS AND WASTE CATEGORIES per functional unit or declared unit (A1 / A2)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
HWD	kg	5.37 E-4	4.15 E-4	1.73 E-2	1.83 E-2	1.20 E-3	2.18 E-3	0.00	0.00	0.00	0.00	0.00	1.77 E-4	2.65 E-4	2.37 E-5	2.46 E-6	2.63 E-2
NHWD	kg	5.05 E+1	1.28 E+1	5.43 E+1	1.18 E+2	4.46 E+1	1.57 E+1	0.00	0.00	0.00	0.00	0.00	9.05 E-2	5.71 E+0	6.61 E-2	1.00 E+1	-2.25 E+1
RWD	kg	2.38 E-3	1.23 E-3	1.77 E-2	2.13 E-2	3.47 E-3	2.61 E-3	0.00	0.00	0.00	0.00	0.00	4.47 E-4	6.83 E-4	4.31 E-5	1.01 E-5	-2.47 E-3
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10 E+2	0.00	0.00
MFR	kg	0.00	0.00	1.65 E+2	1.65 E+2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.91 E+2	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETE	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HWD = Hazardous Waste Disposed
NHWD = Non Hazardous Waste Disposed
RWD = Radioactive Waste Disposed
CRU = Components for reuse
MFR = Materials for recycling
MER = Materials for energy recovery
EEE = Exported Electrical Energy
ETE = Exported Thermal Energy

BIOGENIC CARBON CONTENT per functional unit or declared unit (A1 / A2)

	UNIT	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
BCCpr	kg C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BCCpa	kg C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BCCpr = Biogenic carbon content in product
BCCpa = Biogenic carbon content in packaging

CALCULATION RULES

The following processes are considered below cut-off:

• Packaging of ancillary materials

• Environmental impacts caused by the personnel of the production plants are not included in the LCA, e.g. waste from the cafeteria and sanitary installations, accidental pollution caused by human mistakes, or environmental effects caused by commuter traffic. Heating or cooling of the plants in order to ensure a comfortable indoor climate for the personnel for example is also neglected.

No processes were excluded for the inventory.

The characterization factors from EC-JRC (EN 15804+A2) were applied. No additional or deviating characterisation factors were used.

Manufacturer specific data have been collected for the year 2021.

Company specific data for the production at the factories in Differdange, Belval, Rodange and Olaberria&Bergara have been collected by ArcelorMittal and were provided to Enperas through an excel file. The LCI data has been checked by the EPD verifier (Agnes Schuurmans, SGS Intron NV). Enperas uses publicly available generic data for all background processes such as the production of electricity, transportation by means of a specific truck, etc. Primary data is used for modules A1, A2, A3, A4 and A5. The rest of the study is based on scenarios (modules C1-C4, and module D).

The results are based on a weighted average of the data collected at the factories located in Differdange, Belval, Rodange and Olaberria&Bergara. The weighted average has been calculated based on the respective production volumes transported to Belgium (21% from Differdange, 77% from Belval and 3% from Olaberria&Bergara). Rodange is not included in the weighted average, as the production volume is negligible compared to the other sites.

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

A4 – TRANSPORT TO THE BUILDING SITE

The transportation of the steel sections to the installation site is shown below. The scenario describes the distance from the different production plants to Utrecht, as required in the NMD Bepalingsmethode. The percentages from the different plants is based on respective production volume sold in The Netherlands. Euro6 trucks are the usual transport mode in the countries involved in the study.

Name	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Fraction	61% of 97% coming from Luxembourg	39% of 97% coming from Luxembourg	1% of 3% coming from Spain	99% of 3% coming from Spain
Fuel type and consumption of vehicle or vehicle type used for transport	Truck 16-32 ton EURO6 0,254 l diesel / km	Electric train	Truck 16-32 ton EURO6 0,254 l diesel / km	Electric train
Distance (in km)	233	233	1190	1190
Capacity utilisation (including empty returns)	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent
Bulk density of transported products	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent
Volume capacity utilisation factor	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent	Default Ecoinvent

A5 – INSTALLATION IN THE BUILDING

The results of this EPD are based on an installation scenario using bolts. It is expected that the results are also representative for the welding scenario. A confined sensitivity analysis based on generic Ecoinvent datarecords expects that 100m of welding still has a similar or even lower impact than using bolts. However, consider that currently very limited information is available on the welding scenario and its environmental impact.

The products are implemented by a combination of manual and mechanical processes. For the lifting a diesel-powered lifting crane is considered. The consumption is 6L/h of diesel at a rate of 4500 kg of profile installed per hour.

Bolts are used to connect the profiles. The bolts represent on average 1.15% of the mass of the of the finished beams. According to ArcelorMittal, the bolts are generally made from steel produced by the electric electric furnace industry (EAF).

No packaging waste at the installation site occur, as the product is transported in bulk.

1% installation losses have been considered.
No losses from the bolts are expected during the steel fabrication work. This is a valid scenario as the bolts do not break during prescribed steel works. Moreover, the bolts are typically used at the final stage before mounting steel structure, cutting the sections to the appropriate size, so no bolts will be lost together with possible cutting losses. And very often the main part of bolts usage is associated with erection of the structure, and not it's fabrication.

Parts of the installation	Quantity	Description
Processes necessary for the installation of the product	1,16E-01 kWh	Electricity to screw bolts
Processes necessary for the installation of the product	5,11E+01 MJ	Diesel to power lifting crane
Fixation materials	11,5 kg	Bolts (1,15% of mass product)
Material losses	1%	
Packaging	NA	Bulk

B – USE STAGE (EXCLUDING POTENTIAL SAVINGS)

B1: No emissions during the use phase.
B2: The product does not require maintenance.
B3: The product does not require repair.
B4: No replacement required.
B5: No refurbishment
B6: No operational energy use.
B7: No operational water use.

C – END OF LIFE

The end-of-life scenario is based on a technical report on life cycle assessment for steel construction drafted by the European commission (2003).

C1: Same energy use has been considered as during the installation.
C2: 30 km to sorting facility, 50 km from sorting to landfill.
C3: 88% recycling, 11% reuse. It is assumed that the end-of-life is reached after the sorting.
C4: 1% landfill.

Type of vehicle (truck/boat/etc.)	Fuel consumption	Distance	Capacity utilisation	Density	Assumptions
Truck 16-32 ton EURO6	0,254 l diesel / km	30 km	Default Ecoinvent	1750 kg/m3	Transport to sorting facility
Truck 16-32 ton EURO6	0,254 l diesel / km	50 km	Default Ecoinvent	1751 kg/m3	Transport from sorting facility to landfill

D – BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES

For the steel sections the secondary scrap leaving the product system (880+110*1,15880 kg) is lower than the steel scrap used in module A1 (1150 kg). Therefore module D includes a net load.

Parameter	Unit/comments	Scenario information
Net output flow specified per material	-143 kg	880+110*1,15-1150 [1]
Avoided production	None, because net output flow of scrap is <0	
Location of end-of-waste point	After sorting of steel	
Point of functional equivalence	Pig iron	
Other assumptions (e.g. description of impacts reported in module D)	/	

[1] = 880 kg scrap for recycling, 110 kg reuse. For each kg of reused steel section 1,15 kg scrap is replaced (i.e. losses during production of steel sections)

DECLARATION OF SVHC

The product does not contain materials listed in the “Candidate list of Substances of Very High Concern for authorization” in declarable quantities.

REFERENCES

ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.

ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.

ISO 14025:2006: Environmental labels and Declarations-Type III Environmental Declarations - Principles and procedures.

EN 15804+A2:2019

Bepalingsmethode ‘Milieuprestatie Bouwwerken’ versie 1.1, Maart 2022

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8>

Project report: Life cycle assessment for MRPI of XCarb® Recycled and renewably produced steel sections and merchant bars (7850 kg/m³)

SimaPro 9.3.0.3

REMARKS

None