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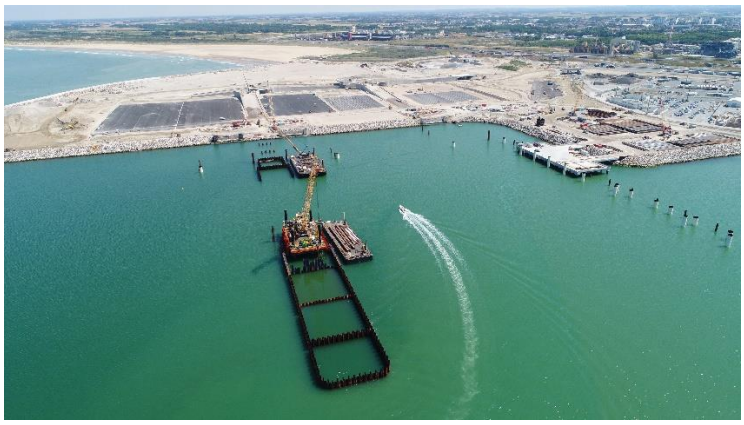
ArcelorMittal

EcoSheetPile™ Plus



ISSUED 17.11.2023
VALID UNTIL 17.11.2028

THIRD PARTY VERIFIED
in accordance with EN 15804+A2, ISO 14025
and B-EPD-PCR

Dieter De Lathauwer
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MODULES DECLARED
1 metric ton of EcoSheetPile™ Plus steel sheet piles from cradle-to-grave

A123	A4	A5	B	C	D
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The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on www.b-epd.be. The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

TABLE OF CONTENTS

1 PRODUCT DESCRIPTION

1.1 Product name

EcoSheetPile™ Plus

1.2 Product description and intended use

An EcoSheetPile™ Plus is a hot rolled steel sheet pile used in various construction and infrastructure applications. EcoSheetPile™ Plus can be produced in a wide range of shapes and dimensions, lengths, steel grades and specifications. The declaration covers the whole range of steel sheet piles produced in the Luxemburgish mills of Belval and Differdange: Z-type, U-type, straight-web and H-type.

The EcoSheetPile™ Plus is a final product ready to be installed.

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

EcoSheetPile™ Plus is a hot rolled steel sheet pile used to build quite impervious retaining walls and cut-off walls, in permanent or temporary applications in the construction and infrastructure field. The main goal is to retain soil and/or water. Typical applications are:

- ports and waterways: quay walls, jetties, breakwaters, riverbanks, embankments, flood protection walls, locks, temporary cofferdams, …
- on land: retaining walls, underground car parks, basements, underpasses, bridge abutments, cut-off walls (polluted soils), pit excavations, …

1.3 Reference flow / declared unit

1 metric ton of uncoated hot rolled structural steel EcoSheetPile™ Plus sheet piling with a density of 7850 kg/m^3, a modulus of elasticity of 210000 N/mm^2 and a reference service life of 75 years.

The product is manufactured in a very large number of different geometries, which is why it is impossible to make a statement per m^2. 1 tonne of steel sheet piles can be used to build a wall of between 4.0 m^2 (profile: AZ52-700[1]) and 14.3 m^2 (profile: GU6N[2]), depending on the profile chosen.

The product is transported in bulk and does not contain packaging.

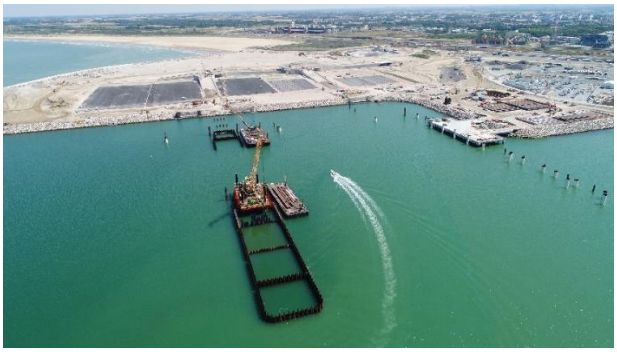
The weight per reference flow is 1 metric ton.
The density of the product is 7850 kg / m^3.

[1] https://sheetpiling.arcelormittal.com/products/az-52-700/

[2] https://sheetpiling.arcelormittal.com/products/gu-6n/

1.4 Installation

This EPD considers the impact of all installation processes, i.e., impact driving, vibratory driving and pressing the steel sheet piles into the ground. The profiles are installed using a hydraulic hammer, diesel hammer, a vibratory hammer and/or a hydraulic press, depending on the soil conditions and the installer. The installation data is an average based on an inquiry at ArcelorMittal's customers.
Detailed information on this scenario can be found in the chapter "Data of the underlying scenario's".



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1.5 Composition and content

Components	Composition / content / ingredients	Quantity
Product	– Steel scrap – Alloying elements in the form of ferroalloys or metals (most common elements are Manganese, Chromium and Vanadium).	99% 1%
Packaging	– NA	

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

1.6 Reference service life

Sheet piling is used in a variety of applications.
For buildings, a design life of 75 years can be claimed.

In other structural applications, for example bridge abutments, the design life may be even longer as it must match the life of the construction where the sheet piling is used.
It is important for the engineer to dimension the steel sheet piles in such a way as to respect the design life of the construction, by choosing a section with adequate geometrical (section modulus, thickness, etc.) and mechanical (yield strength, etc.) properties.

1.7 Description of geographical representativity

The EPD is representative for the Belgian market.

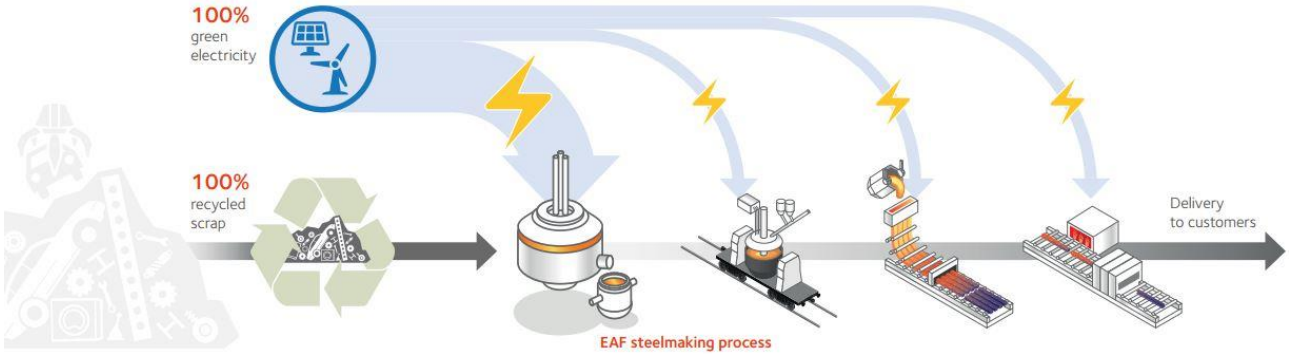
1.8 Description of the production process and technology

EcoSheetPile™ Plus applies to steel sheet piles made via the Electric Arc Furnace route using almost 100% scrap and 100% renewable electricity. 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 source.
The production of EcoSheetPile™ Plus goes through following main technological steps:
Steel mill:

- Scrap melting in Electric Arc Furnace;
- Steel refining in Ladle Furnace;
- Continuous casting;

Rolling mill:

- Hot rolling;
- Cooling and Finishing.



2 TECHNICAL DATA / PHYSICAL CHARACTERISTICS

Information on mechanical properties and chemical composition, as well as tolerances on shape and dimensions can be found in following standards:

- European standards: EN 10248-1, EN 10248-2;
- ASTM International: ASTM A6, ASTM A572, ASTM A690;
- Canadian Standard Association (CSA): G40.20/G.40/21 260W, 300W, 350W, 400W, 450W.

Information on execution of steel sheet piles can be found in following standard:

- European standard: EN 12063.

EcoSheetPile™ Plus can also be delivered according to following ArcelorMittal mill specification: steel grade AMLoCor.

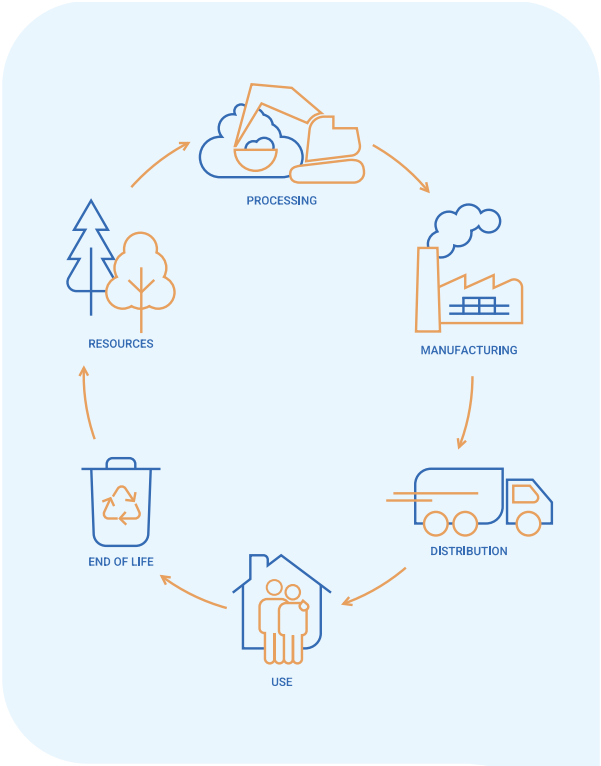
Additional information on the design and installation of steel sheet pile walls can be obtained from ArcelorMittal's website: https://sheetpiling.arcelormittal.com.

Technical property	Value	Unit	Comment
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/mm^2	

3 LCA-STUDY

3.1 Date of LCA-study

June 2023



3.2 Software

For the calculation of the LCA results, the software program SimaPro 9.3.0.3 (PRé Consultants, 2021) has been used.

3.3 Information on allocation

No coproducts are produced.

Allocation of factory data:
At ArcelorMittal, different products are produced. The product considered for the study is manufactured at the mills in Belval and Differdange (Luxembourg). Only facility level data was available for the use of electricity, natural gas, etc. The facility level data has been allocated based on the produced mass. Material inputs and outputs, which were not available at the product level, such as waste, were allocated similarly.

3.4 Information on cut off

The following processes are considered below cut-off, conform to EN 15804+A2:

- Packaging of ancillary materials.
- Infrastructure and land use of the factory.
- 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 to ensure a comfortable indoor climate for the personnel for example is also neglected.

3.5 Information on excluded processes

No processes were excluded from the inventory.

3.6 Information on biogenic carbon modelling

The product does not contain biogenic carbon.

Biogenic carbon content	(kg C / FU)
Biogenic carbon content in product (at the gate)	0.00
Biogenic carbon content in accompanying packaging (at the gate)	NA

3.7 Information on carbon offsetting

Carbon offsetting is not allowed in the EN 15804 and hence not considered in the calculations.

3.8 Additional or deviating characterisation factors

The characterization factors from EC-JRC were applied (EF 3.0). No additional or deviating characterisation factors were used.

3.9 Description of the variability

The data used in this study are based on the weighted average of the data collected at the factories located in Belval and Differdange (Luxembourg). A variability study is performed in the LCA background report and shows that the weighted average is representative for the two production locations. The variability is lower than 15%.

3.10 Specificity

The data used for the LCA are specific for this product which is manufactured by a single manufacturer in multiple production sites.

3.11 Period of data collection

Manufacturer specific data have been collected for the year 2021.

3.12 Information on data collection

Company specific data for the production at the factories in Belval and Differdange have been collected by ArcelorMittal and were provided to Enperas through an Excel file. The LCI data has been checked by the EPD verifier (Naeem Adibi, WeLoop). 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 Belval and Differdange. The weighted average has been calculated based on the respective production volumes transported to Belgium (92,2% from Belval, 7,8% from Differdange).

3.13 Database used for background data

Ecoinvent 3.8 (September 2021).

3.14 Energy mix

The EcoSheetPile™ Plus are produced using 100% renewable electricity, for which ArcelorMittal obtains a 'Guarantee of Origin' (GoO). The renewable mix contains wind and solar energy from France and Belgium.

4 PRODUCTION SITES

ArcelorMittal Belval (Luxembourg)
ArcelorMittal Differdange (Luxembourg)

5 SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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 = included in the EPD
☐ = module not declared

THE PRODUCT CONTAINS 99% RECYCLED CONTENT, I.E. STEEL SCRAP.

THE END-OF-LIFE SCENARIO IS BASED ON AN INTERNAL SURVEY BY ARCELORMITTAL AND INCLUDES 25% REUSE AND 60% RECYCLING, IN WHICH THE END-OF-LIFE IS REACHED AFTER THE SORTING.

DURING THE PRODUCTION ELECTRIC ARC FURNACE SLAG IS PRODUCED, AND CONSIDERED TO BE LANDFILLED. THIS MEANS THAT NO COPRODUCTS ARE PRODUCED AND THE MANUFACTURING IS 100% ALLOCATED TO THE SHEETPILES.

6 POTENTIAL ENVIRONMENTAL IMPACTS PER REFERENCE FLOW

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
GWP total (kg CO2 equiv/FU)	5.77E+01	1.19E+01	2.99E+02	1.07E+01	4.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E+01	6.11E+00	5.76E-01	7.91E-01	0.00E+00
GWP fossil (kg CO2 equiv/FU)	5.74E+01	1.19E+01	2.98E+02	1.06E+01	4.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E+01	6.11E+00	5.73E-01	7.90E-01	0.00E+00
GWP biogenic (kg CO2 equiv/FU)	1.87E-01	6.32E-03	2.83E-01	1.36E-02	9.08E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E-03	2.18E-03	1.63E-03	4.41E-04	0.00E+00
GWP luluc (kg CO2 equiv/FU)	7.82E-02	8.14E-03	8.79E-02	1.95E-02	4.90E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E-03	2.44E-03	1.07E-03	7.46E-04	0.00E+00
ODP (kg CFC 11 equiv/FU)	2.34E-06	2.64E-06	8.80E-06	1.64E-06	8.06E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.19E-06	1.42E-06	6.10E-08	3.20E-07	0.00E+00
AP (mol H+ eq/FU)	4.60E-01	1.01E-01	8.81E-01	9.73E-02	3.96E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-01	1.73E-02	1.95E-03	7.43E-03	0.00E+00
EP - freshwater (kg (PO4)3- equiv/FU)	2.58E-03	1.28E-04	3.60E-03	2.79E-04	1.64E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.60E-05	4.35E-05	1.28E-05	8.28E-06	0.00E+00
EP - marine (kg (PO4)3- equiv/FU)	9.71E-02	2.78E-02	1.01E-01	3.84E-02	1.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-01	3.45E-03	5.61E-04	2.57E-03	0.00E+00
EP - terrestrial (kg (PO4)3- equiv/FU)	1.09E+00	3.08E-01	1.19E+00	4.23E-01	1.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E+00	3.84E-02	6.37E-03	2.83E-02	0.00E+00
POCP (kg Ethene equiv/FU)	3.28E-01	8.90E-02	4.96E-01	1.12E-01	5.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-01	1.48E-02	1.79E-03	8.23E-03	0.00E+00
ADP Elements (kg Sb equiv/FU)	1.74E-04	2.23E-05	1.15E-03	2.33E-05	2.74E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-05	1.65E-05	4.79E-06	1.21E-06	0.00E+00
ADP fossil fuels (MJ/FU)	6.34E+02	1.82E+02	3.75E+03	1.47E+02	5.50E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E+02	9.26E+01	1.74E+01	2.21E+01	0.00E+00
WDP (m^3 water eq deprived /FU)	1.37E+01	7.34E-01	8.19E+01	1.06E+00	1.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.21E-01	2.82E-01	1.55E-01	9.93E-01	0.00E+00

GWP TOTAL = TOTAL GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); GWP-LULUC = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE) LAND USE AND LAND USE CHANGE; ODP = OZONE DEPLETION POTENTIAL; AP = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; EP = EUTROPHICATION POTENTIAL; POCP = PHOTOCHEMICAL OZONE CREATION; ADPE = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; ADPF = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS; WDP = WATER USE (WATER (USER) DEPRIVATION POTENTIAL, DEPRIVATION-WEIGHTED WATER CONSUMPTION)

7 RESOURCE USE

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PERE (MJ/FU, net calorific value)	1.45E+02	3.74E+00	2.74E+03	9.78E+00	3.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E+00	1.30E+00	2.18E+00	1.84E-01	0.00E+00
PERM (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/FU, net calorific value)	1.45E+02	3.74E+00	2.74E+03	9.78E+00	3.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E+00	1.30E+00	2.18E+00	1.84E-01	0.00E+00
PENRE (MJ/FU, net calorific value)	8.39E+02	1.86E+02	4.27E+03	1.60E+02	5.53E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.95E+02	9.31E+01	1.85E+01	2.22E+01	0.00E+00
PENRM (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ/FU, net calorific value)	8.39E+02	1.86E+02	4.27E+03	1.60E+02	5.53E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.95E+02	9.31E+01	1.85E+01	2.22E+01	0.00E+00
SM (kg/FU)	1.19E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m^3 water eq/FU)	3.30E-01	2.51E-02	2.35E+00	5.24E-02	4.42E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-02	9.22E-03	5.22E-03	2.32E-02	0.00E+00

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 RESOURCES; SM = USE OF SECONDARY MATERIAL; RSF = USE OF RENEWABLE SECONDARY FUELS; NRSF = USE OF NON-RENEWABLE SECONDARY FUELS; FW = NET USE OF FRESH WATER

8 WASTE CATEGORIES & OUTPUT FLOWS

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (kg/FU)	4.09E-04	4.07E-04	1.54E-02	3.35E-04	1.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-03	2.42E-04	2.04E-05	3.34E-05	0.00E+00
Non-hazardous waste disposed (kg/FU)	5.66E+01	1.22E+01	2.15E+02	1.47E+00	4.53E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.40E-01	4.85E+00	4.42E-02	1.50E+02	0.00E+00
Radioactive waste disposed (kg/FU)	2.10E-03	1.22E-03	1.02E-02	9.45E-04	3.64E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-03	6.26E-04	1.56E-04	1.45E-04	0.00E+00
Components for re-use (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+02	0.00E+00	0.00E+00
Materials for recycling (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E+02	0.00E+00	0.00E+00
Materials for energy recovery (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (MJ/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

9 IMPACT CATEGORIES ADDITIONAL TO EN 15804

		Production			Construction process stage		Use stage							End-of-life stage				
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
	PM (disease incidence)	1.75E-05	1.15E-06	5.38E-06	5.56E-07	1.04E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-06	4.91E-07	2.60E-08	1.49E-07	0.00E+00
	IRHH (kg U235 eq/FU)	2.28E+00	8.10E-01	8.85E+00	7.63E-01	2.28E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E+00	4.02E-01	1.67E-01	9.03E-02	0.00E+00
	ETF (CTUe/FU)	2.30E+03	1.45E+02	2.36E+03	1.32E+02	3.25E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E+02	7.27E+01	8.72E+00	1.39E+01	0.00E+00
	HTCE (CTUh/FU)	3.87E-06	6.00E-09	4.77E-07	8.61E-09	1.65E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.99E-09	2.34E-09	6.19E-10	3.54E-10	0.00E+00
	HTnCE (CTUh/FU)	9.35E-07	1.40E-07	4.37E-06	1.01E-07	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-07	7.34E-08	7.13E-09	9.16E-09	0.00E+00
	Land Use Related impacts (dimensionless)	3.21E+02	1.71E+02	3.31E+03	1.07E+02	1.02E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.06E+01	6.45E+01	1.61E+01	4.63E+01	0.00E+00

HTCE = HUMAN TOXICITY – CANCER EFFECTS; HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS; ETF = ECOTOXICITY – FRESHWATER; (POTENTIAL COMPARATIVE TOXIC UNIT)
PM = PARTICULATE MATTER (POTENTIAL INCIDENCE OF DISEASE DUE TO PM EMISSIONS);
IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS (POTENTIAL HUMAN EXPOSURE EFFICIENCY RELATIVE TO U235);

9.1 Environmental impact categories explained

 Global Warming Potential	The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1. It is split up in 4: – Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc – Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc). – Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood. – Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).
 Ozone Depletion	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbonsor halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.
 Acidification potential	Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.
 Eutrophication potential	The potential to cause over-fertilization of water and soil, which can result in increased growth of biomass and following adverse effects. It is split up in 3: – Eutrophication potential - freshwater: The potential to cause over-fertilization of freshwater, which can result in increased growth of biomass and following adverse effects. – Eutrophication potential - marine: The potential to cause over-fertilization of marine water, which can result in increased growth of biomass and following adverse effects. – Eutrophication potential - terrestrial: The potential to cause over-fertilization of soil, which can result in increased growth of biomass and following adverse effects.
 Photochemical ozone creation	Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.
 Abiotic depletion potential for non-fossil resources	Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimonium (Sb). 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 experienced with the indicator.
 Abiotic depletion potential for fossil resources	Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ). 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 experienced with the indicator.

Ecotoxicity for aquatic fresh water	The impacts of chemical substances on ecosystems (freshwater). 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 experienced with the indicator.
Human toxicity (carcinogenic effects)	The impacts of chemical substances on human health via three parts of the environment: air, soil and water. 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 experienced with the indicator.
Human toxicity (non-carcinogenic effects)	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 experienced with the indicator.
Particulate matter	Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)
Resource depletion (water)	Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not. 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 experienced with the indicator.
Ionizing radiation - human health effects	This impact category deals mainly with the eventual impact on human health of low dose ionizing radiation 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.
Land use related impacts	The indicator is the “soil quality index” which is the result of an aggregation of following four aspects: – Biotic production – Erosion resistance – Mechanical filtration – Groundwater The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use. 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 experienced with the indicator.

10 DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

10.1 A1 - raw material supply

This module considers the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process.

No impact has been allocated to the steel scrap.

10.2 A2 – transport to the manufacturer

The raw materials are transported to the manufacturing site.

10.3 A3 – manufacturing

This module considers the production process: electric arc furnace, continuous casting and rolling mill.

10.4 A4 – transport to the building site

Fuel type and consumption of vehicle or vehicle type used for transport	50% Electric train	50% Inland waterways barge
Distance	233 km	233 km
Capacity utilisation (including empty returns)	Ecoinvent	Ecoinvent
Bulk density of transported products	7850 kg/m^3	7850 kg/m^3
Volume capacity utilisation factor	Ecoinvent	Ecoinvent

The transportation of the steel sheet piles to the installation site is based on specific market volumes shared by ArcelorMittal. This showed that 50% of the sheet piles is transported by train (Ecoinvent: Transport, freight train {Europe without Switzerland}| electricity | Cut-off, U), and 50% by inland waterways barge (Ecoinvent: Transport, freight, inland waterways, barge {RER}| market for transport, freight, inland waterways, barge | Cut-off, U). The distance between the production plants to Brussels is used.

10.5 A5 – installation in the building

The products are installed using a hydraulic hammer, diesel hammer, a vibratory hammer and/or a hydraulic press, depending on the soil conditions and the installer.
No packaging waste at the installation site occurs, as the product is transported in bulk.

1% installation losses have been considered.

Parts of the installation	quantity	Description
Processes necessary for the installation of the product	*1,12E+01 liter or 4,03E+02 MJ*	DIESEL TO POWER HAMMER AND/OR PRESS
Material losses	*1%*	
Packaging	*NA*	BULK

Ancillary materials for installation (specified by material)	Insert information	
Water use	None	
Other resource use	None	
Quantitative description of energy type (regional mix) and consumption during the installation process	1,12E+01 liter or 4,03E+02 MJ	Diesel to power hammer and/or press
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	1% installation losses	
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	None	
Direct emissions to ambient air, soil and water	None	
Distance	None	

10.6 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.

The end-of-life scenario is based on an internal survey from ArcelorMittal.

C1: 8,77 liter or 315 MJ diesel is used during the deconstruction.
C2: 30 km to sorting facility, 50 km from sorting to landfill.
C3: 25% reuse, 60% recycling. It is assumed that the end-of-life is reached after the sorting.
C4: 15% landfill.

10.7 C: End of life

Module C2 – Transport to waste processing

Type of vehicle (truck/boat/etc.)	Fuel consumption (litres/km)	Distance (km)	Capacity utilisation (%)	Density of products (kg/m³)	Assumptions
Truck 16-32 ton EURO6	0,254 l diesel / km	30 km	Ecoinvent	7850 kg/m³	Transport to sorting facility
Truck 16-32 ton EURO6	0,254 l diesel / km	50 km	Ecoinvent	7850 kg/m³	Transport from sorting facility to landfill

End-of-life modules – C3 and C4

Parameter	Value (kg)
Wastes collected separately	850[3]
Wastes collected as mixed construction waste	0
Waste for re-use	250
Waste for recycling	600
Waste for energy recovery	0
Waste for final disposal	150

10.8 D – Benefits and loads beyond the system boundaries

For the steel sheet piles the secondary scrap leaving the product system (600+250*1,19 kg) is lower than the steel scrap used in module A1 (1190 kg). Paragraph 6.4 of the B-PCR states that 'When the quantity of secondary materials leaving the system boundaries is lower than the quantity entering the system there is no net output flow of secondary materials, and therefore no contribution to module D'. As a result, no benefits/loads have been declared in module D for this product.

[3] The 150 kg that is considered to be landfilled, is in fact not collected but remains in place.

11 RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

11.1 Indoor air

Not relevant

11.2 Soil and water

Not relevant

12 DEMONSTRATION OF VERIFICATION

EN 15804+A2 serves as the core PCR

Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010
Internal ☐ External ☒

Third party verifier:
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13 LCA INTERPRETATION

For steel sheet piles, the production process (more specifically: the energy use) has the most significant presence on all impact categories, followed by the raw materials and transport of the raw materials. The raw materials have a significant impact on 'Particulate matter' and 'Human toxicity – cancer', resulting from the use of alloys such as ferrosilicon and ferromanganese.

Note that for the steel sheet piles the secondary scrap leaving the product system is lower than the steel scrap used in module A1. Paragraph 6.4 of the B-PCR states that 'When the quantity of secondary materials leaving the system boundaries is lower than the quantity entering the system there is no net output flow of secondary materials, and therefore no contribution to module D'. As a result, no benefits/loads have been declared in module D for this product.

14 APPLICATION UNIT

The functional unit in this declaration is one metric ton of EcoSheetPile™ Plus. However, the unit used by the customer will depend on its key purpose. A steel sheet pile is typically produced, shipped, and driven into the ground. The following units are the most common: 1 metric ton (i.e., for production, sales contract, shipping), 1 metric ton/m^2 (i.e., to verify the vertical surcharge load on the ground) and 1 metric ton/m (i.e., for lifting and handling operations, for a single or double pile). It is easy to convert the functional unit into an application unit for each specific case, and depends on its thickness and shape. For each profile, the data contained in the official sales catalogue shall be used for the conversion. For example: 1 metric ton of AZ52-700 equals 4.02 m^2.

15 ADDITIONAL INFORMATION ON REVERSIBILITY

Description	Type of fixing	Level of reversibility	Simplicity of disassembly	Speed of disassembly	Ease of handling (size and weight)	Robustness of material (material resistance to disassembly)	Damage to other elements	Comment
The products are installed using a hydraulic hammer, diesel hammer, a vibratory hammer and/or a hydraulic press, depending on the soil conditions and the installer.	Nesting, interlocking, superposition, juxtaposition	Reversible fixing	simple use of dismantling tools required	- speedy disassembly	handling requires mechanical devices	the material resists well during disassembly	disassembly is possible but should be done carefully in order not to generate any damage to the product it is attached to	

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General information

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Verifier

Naeem Adibi (WeLoop)
Date of verification: dd.mm.yyyy
External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents

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