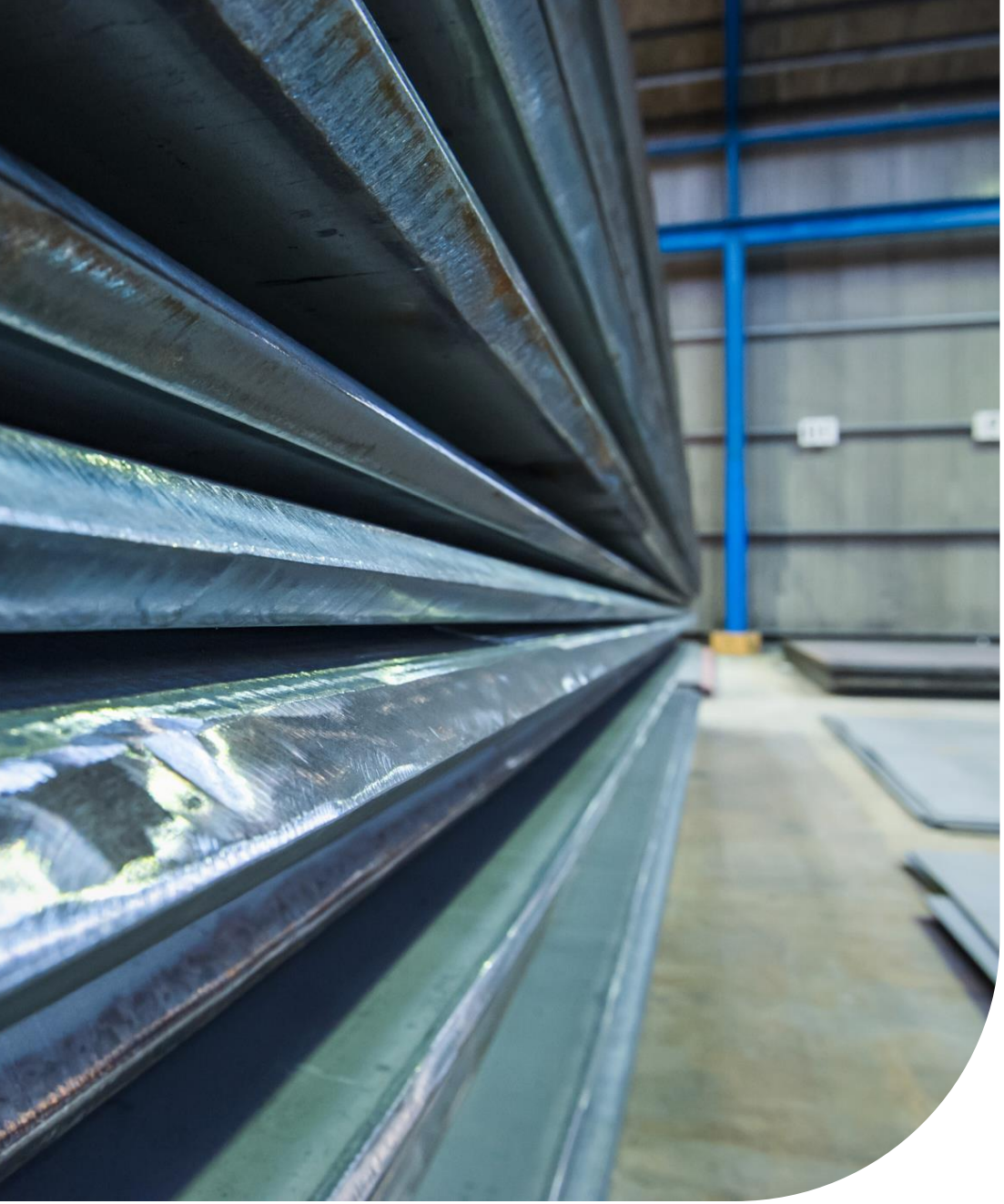


Product Carbon Footprint

IN ACCORDANCE WITH ISO 14067 & ISO 14025

NLMK DanSteel A/S

Hot-rolled Uncoated Steel Plates

EPD HUB, PCF number HUB-1336

Published on 23.04.2024, last updated on 23.04.2024, valid until 23.10.2025.

GENERAL INFORMATION

MANUFACTURER

Manufacturer	NLMK DanSteel A/S
Address	Havnevej 33, DK-3300 Frederiksvaerk, Denmark
Contact details	ds-a-edistribution@eu.nlmk.com
Website	https://eu.nlmk.com/en/plate/dansteel/

STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	ISO 14067 and ISO 14025
PCR	EPD Hub Core PCR-version 1.0, 1 Feb. 2022
Sector	Construction product
Category of PCF	Third-party verified PCF
Scope of the PCF	Cradle to gate with Modules A1-A3, C1-C4 and D
PCF author	Marcel Tutor Ale, Ph.d. - ACRYPT Denmark
PCF verification	Independent verification of this PCF and data, according to ISO 14025: ☐ Internal certification ☑ External verification
PCF verifier	Elma Avdyli, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the product carbon footprint (PCF).

PRODUCT

Product name	Hot-rolled uncoated steel plate
Additional labels	N/A
Product reference	N/A
Place of production	Frederiksvaerk, Denmark
Period for data	12/2022 – 11/2023
Averaging in PCF	No averaging
Variation in GWP-fossil for A1-A3	N/A

ENVIRONMENTAL DATA SUMMARY

Declared unit	**1 ton**
Declared unit mass	**1000 kg**
GWP-total, A1-A3 (kgCO2e)	**1,10E+03**
GWP-fossil, A1-A3 (kgCO2e)	**1,26E+03**
Secondary material, inputs (%)	**92 %**
Secondary material, outputs (%)	**12,47 %**
Total energy use, A1-A3 (kWh)	**5,84E+03**
Total water use, A1-A3 (m3e)	**2,23E+01**

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

NLMK DanSteel is an integrated part of the European plate division of NLMK Belgium Holdings ("NBH"), which has established itself as a leading supplier of premium plate products to the wind energy segment in Europe. Located in Frederiksvaerk, Denmark, NLMK DanSteel is a 100% production-on-order plate mill and offers Add-On Services: Fast Track Delivery and prefabrication at its own Steel Service Center.

PRODUCT DESCRIPTION AND APPLICATION

Hot-rolled uncoated steel plates produced by NLMK DanSteel have a rough surface texture and are without protective coatings. These plates come in thicknesses from 5 to 220 mm and can be produced in widths up to 4.2 meters and lengths up to 32 meters. The table below presents the key characteristics of standard steel, providing a detailed illustration of the product described in this PCF.

Constructional data	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	185 – 460	MPa

NLMK DanSteel's steel plates are utilized in shipbuilding for structural parts, in bridge construction for support beams, for forming frames of wind turbine towers, and in fabricating pressure vessels and boilers that demand material capable of withstanding high stress and temperatures.

PHYSICAL PROPERTIES OF THE PRODUCT

NLMK DanSteel's steel plates are non-alloy steel products, except for some boiler and pressure vessel grades and some weathering grades.

Iron is the main component of the steel plates. Alloying elements are added in the form of ferroalloys or metal, the most common elements are manganese and aluminium. Microalloying elements may be present in the steel. The composition of these elements depends on the steel designation/grade. The table below shows the average content of alloying elements:

Alloying elements	C	Mn	Si	Cr	Cu	Ni	V	Nb	Al	Mo
Average content (%)	0.15	1.25	0.24	0.03	0.04	0.02	0.014	0.014	0.04	0.003

Steel plates are produced according to product standards or codes in compliance with the customer's order and specification. Each customer order reflects specific needs in terms of material grades, mechanical properties, chemical composition, or geometrical requirements and restrictions, and is set to account for and meet the relevant design and execution standards governing the structure. Such requirements might relate to corrosion resistance, visual appearance, or special tolerances.

PRODUCT STANDARD AND CERTIFICATIONS

Plates produced by NLMK DanSteel are in accordance with the European Standard EN 10025 for Hot rolled products of structural steels and are also covered by the Construction Product Regulation (CPR) “Regulation (EU) No. 305/2011 of the European Parliament and the Council of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC”.

Examples of typical product standards and national certifications NLMK DanSteel comply with EN 1090 Series, EN 10025 services, DNVGL-OS-C101, DNVGL-OS-C401, European standards EN 10025-2-3-4-5, EN10028-2-3-4, EN10225; ASTM and ASME international standards (S)A36, (S)A516, (S)A572, A588; Canadian standard association Gr 260W, Gr 300W, Gr 400W), and shipbuilding codes according to ABS, BV, DNVGL, LR, RINA.

PRODUCT IDENTIFICATION

NLMK DanSteel’s unique identification code, product type, batch or serial number, or any other element allowing identification of NLMK DanSteel products as required under Declaration of Performance by EU-regulation 305/2011Annex III, can be downloaded on this link:

https://eu.nlmk.com/en/about/documents/?documents_filter%5Bkeywords%5D=declaration

BIOGENIC CARBON CONTENT

Product’s biogenic carbon content at the factory gate.

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	41,86

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	100	EU
Minerals	0	-
Fossil materials	0	-
Bio-based materials	0	-

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This PCF covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

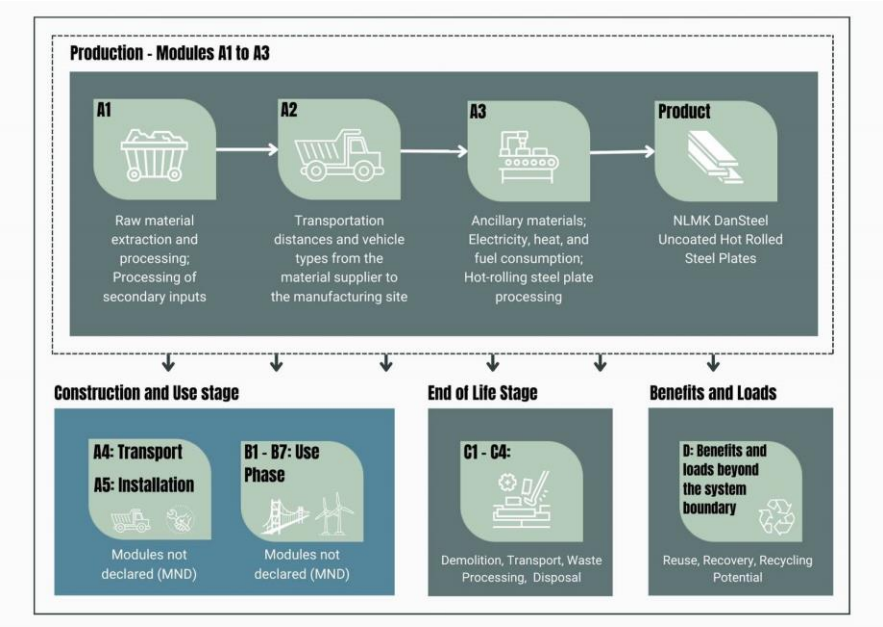
Modules not declared = MND. Modules not relevant = MNR.

The system boundary is set to include those processes that provide the material and energy inputs into the system and the following manufacturing and transport processes up to the factory gate.

The study does not exclude any modules or processes that are stated as mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw materials and energy consumption.

All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module-specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

Schematic representation of the production module (A1-A3) in relation to the life cycle stages included in the LCA:



MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage.

The following processes were considered in detail for the production stages A1-A3 of construction steel products:

- Production of raw materials, production materials, and ancillary materials (Module A1)
- Transport of raw materials, semi-finished products, and ancillary materials to the production site (Module A2)
- Production of steel plate on-site, disposal of production residues, and packaging of raw materials, also taking into account on-site emissions (Module A3).

TRANSPORT AND INSTALLATION (A4-A5)

This PCF does not cover the transportation impacts occurring from final product delivery to the construction site (A4) covering fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions (A5).

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase. Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

C1-C4 modules takes into account the diesel used for emergency generators and internal transport (i.e. lifting, stacking, or arranging of steel plates.), as well as treatment of scrap, and waste processing including wood chipping and wood slab preparation (i.e. wood spacer between plates) after initial sorting and shredding of the end-of-life of steel.

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

Potential environmental benefits are given for the scrap that is produced at the end of a final product's life. After the collection and sorting stage, the demand for scrap input to the production is fulfilled by the amount of steel recycled (already sorted and shredded) at end-of-life. The steel scrap that is generated during production can be reused in the slab production in a cycle "loop; However, this externally recycled scrap is not used to calculate the potential environmental benefit or burden that is reported in Module D.

NLMK DANSTEEL MANUFACTURING PROCESS

The NLMK DanSteel steel plates are manufactured from steel slabs. The slabs are cut up into smaller slab parts called "baby slabs" in a flame-cutting process. Some slabs are preheated before flame cutting to hinder crack formation during the cutting process.

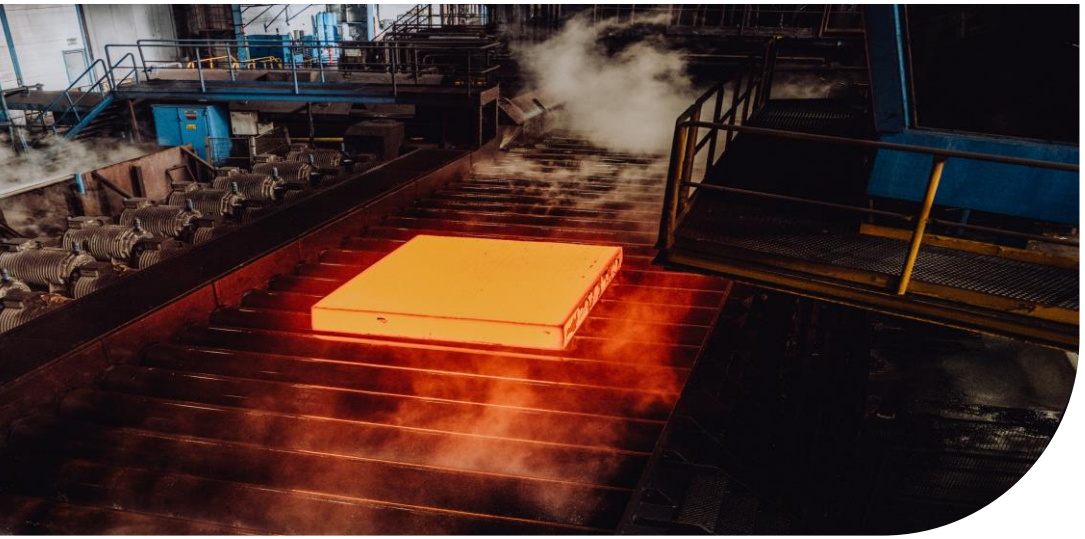
Before cutting, some baby slabs are pre-treated in a scarfing machine to remove the outer 2-3 mm layer of steel. This hinders crack formation on the hot rolled plates. Hereafter, the baby slabs are led to the heating furnaces and from there to the rolling mill where the red-hot slab/plate is rolled back and forth through the working rolls until the plate has obtained the desired thickness, length, and broadness.

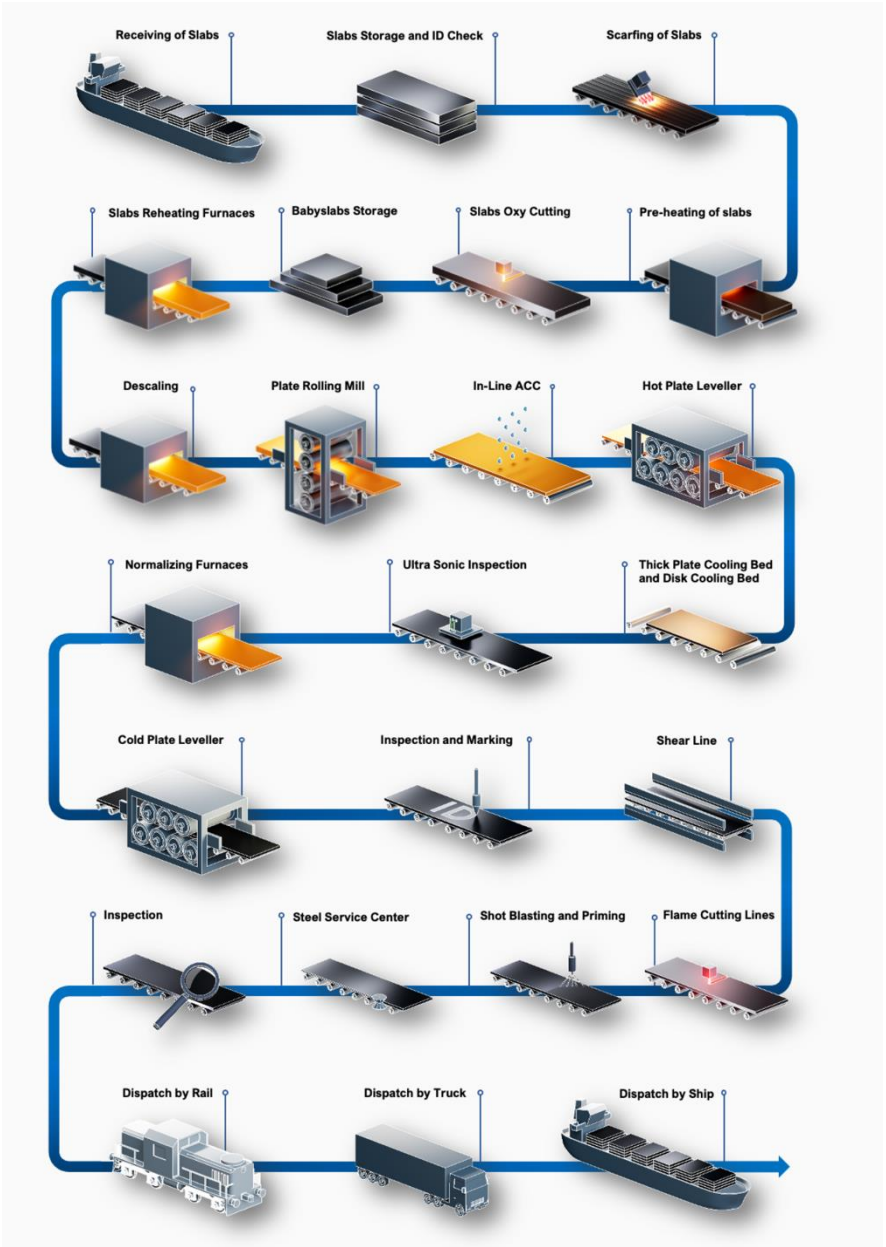
In the furnace and rolling process, scale forms on the outer surface of the plates. Scale is removed by a descaling process where water is sprayed on the hot material at high pressure. The hot rolled plate tends to warp slightly and is, therefore, led to the hot plate leveller.

Hereafter, the plate is cooled and then inspected. To obtain higher quality, some plates are normalized. In the normalizing furnaces, the plates are reheated to approx. 900 °C resulting in a fine-grained steel structure which improves the strength of the steel. Afterward, any warped plates are treated in a cold plate leveller to straighten each plate.

Finally, the plates are cut or sheared into a defined shape, length, or broadness before being shipped to the customer.

The production flowchart reported here is the general production process of NLMK DanSteel, some parts of the process may not be involved in the manufacturing of products covered by this PCF.





LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes that are stated as mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw materials and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module-specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The inventory data include raw materials, energy, and ancillary materials as well as water consumption and waste production (foreground data). The foreground data was modelled by using specific data derived from NLMK DanSteel manufacturing facility located in Frederiksvaerk, Denmark, and was analyzed by ACRYPT, Denmark. Furthermore, LCA datasets (cradle to gate) for raw materials, energy consumption, and other ancillary materials have been linked to the foreground data of the various stages of the life cycle (background data). The background data are provided by OneClick LCA from the Ecoinvent 3.8 database.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. Waste that may be marketable i.e. steel scrap, leaving the product system from modules A1-A3, shall be allocated as a co-product. In this study, allocation is conducted in the following order:

1. Allocation should be avoided.
2. Allocation should be based on physical properties (e.g. mass, volume) when the difference in revenue is small.
3. Allocation should be based on economic values.

The allocation process was implemented through the following methods:

Data type	Allocation
Raw materials	Partly allocated by mass/volume and partly by revenue.
Packaging materials	Allocated by mass or volume
Ancillary materials	Allocated by mass or volume
Manufacturing energy and waste	Allocated by mass or volume

This PCF is product and factory-specific and does not contain average calculations.

LCA SOFTWARE AND BIBLIOGRAPHY

This PCF has been created using the One Click LCA EPD Generator. The LCA and PCF have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.8, Plastics Europe, Federal LCA Commons and One Click LCA databases as sources of environmental data.

ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	8,14E+02	1,83E+02	9,94E+01	1,10E+03	MND	MND	MND	MND	MND	MND	MND	MND	MND	3,31E+00	2,57E+00	1,92E+02	5,27E-01	-1,25E+03
GWP – fossil	kg CO_2e	8,13E+02	1,83E+02	2,68E+02	1,26E+03	MND	MND	MND	MND	MND	MND	MND	MND	MND	3,31E+00	2,56E+00	2,40E+01	5,27E-01	-1,08E+03
GWP – biogenic	kg CO_2e	0,00E+00	0,00E+00	-1,68E+02	-1,68E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	1,68E+02	0,00E+00	-1,68E+02
GWP – LULUC	kg CO_2e	1,00E+00	6,83E-02	1,08E-01	1,18E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	3,30E-04	9,46E-04	3,20E-02	4,97E-04	-4,60E-01

1) GWP = Global Warming Potential. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator. LULUC = Land use, land use change. MND = module not declared.

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	7,97E+02	1,81E+02	2,64E+02	1,24E+03	MND	MND	MND	MND	MND	MND	MND	MND	MND	3,27E+00	2,54E+00	2,36E+01	5,16E-01	-1,01E+03

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS PRODUCT CARBON FOOTPRINT

This PCF has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with reference standard, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Product Carbon Footprint (PCF)
- The Life-Cycle Assessment used in this PCF
- The digital background data for this PCF

Why does verification transparency matter? Read more online
This PCF has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Product Carbon Footprint (PCF), its LCA and project report, in terms of the data collected and used in the LCA calculations, the way the LCA-based calculations have been carried out, the presentation of environmental data in the PCF, and other additional environmental information, as present with respect to the procedural and methodological requirements in ISO 14025:2010 and reference standard.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the PCF to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

Elma Avdyli, as an authorized verifier acting for EPD Hub Limited
23.04.2024