

Environmental Product Declaration



In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Hot-rolled uncoated steel plate

from
NLMK DanSteel A/S

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com



General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification	
Product Category Rules (PCR)	
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)	
Product Category Rules (PCR): <i>PCR 2019:14 Construction products (EN 15804+A2) (1.3.2)</i>	
PCR review was conducted by: <i>The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. The review was prepared by the IVL Swedish Environmental Research Institute, the Secretariat of EPD International, info@environdec.com.</i>	
Life Cycle Assessment (LCA)	
LCA accountability: <i>Marcel Tutor Ale, Ph.D. – ACRYPT, Copenhagen, Denmark – www.acrypt.dk</i>	
Third-party verification	
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:	
<input checked="" type="checkbox"/> EPD verification by individual verifier	
Third-party verifier: <i>Bárbara M. Civit - Universidad Tecnológica Nacional Facultad Regional Mendoza (UTN FRM)</i>	
Approved by: The International EPD® System	
Procedure for follow-up of data during EPD validity involves third party verifier:	
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

The EPD owner, NLMK DanSteel A/S, has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or EPD of construction products may not be comparable if they do not comply with EN 15804. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

NLMK DanSteel

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 Frederiksværk, Denmark, NLMK DanSteel is a 100% production-on-order plate mill.

NLMK DanSteel's hot-rolled steel plates are delivered “as rolled” or normalized according to standards and customer requirements. Furthermore, NLMK DanSteel offers Add-On Services: Fast Track Delivery and prefabrication at its own Steel Service Center.

Product and management system-related 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.

For more information:

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Product information

Product name:

Hot-rolled uncoated steel plate

Product identification:

NLMK DanSteel's hot-rolled uncoated steel plates are manufactured according to EN 10025-2. The 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 305/2011 Annex III, can be downloaded on this link:

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

Product Description:

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.

Product Application:

NLMK DanSteel's steel plates are prominently 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.

Technical Specification:

The table below presents the key characteristics of standard steel, providing a detailed illustration of the product described in this EPD.

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

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	Ti	Nb	Al	Mo
Average content (%)	0.15	1.25	0.24	0.030	0.036	0.019	0.014	0.002	0.014	0.040	0.0033

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. In addition, requirements relating to all stages of the structure's lifecycle from ideation and design through manufacturing and in-service to decommissioning may also be reflected in the order. Such requirements might relate to corrosion resistance, visual appearance, or special tolerances.

UN CPC code:

The UN Central Product Classification is 41211 for flat-rolled products of non-alloy steel, not further worked than hot-rolled, of a width of 600 mm or more.

Geographical scope:

Modules A1 – A3, C1 – C4, and D: Europe and Global. Given the inclusion of Module C in this study, it's important to consider the results of Modules A1-A3 alongside those of Module C.

Life-Cycle Assessment Information

Declared unit:

1 metric ton of uncoated steel plate. The mass of the product per declared unit is 1000 kg.

Time representativeness:

The reference year for the data collection is 2022.

Database(s) and LCA software used:

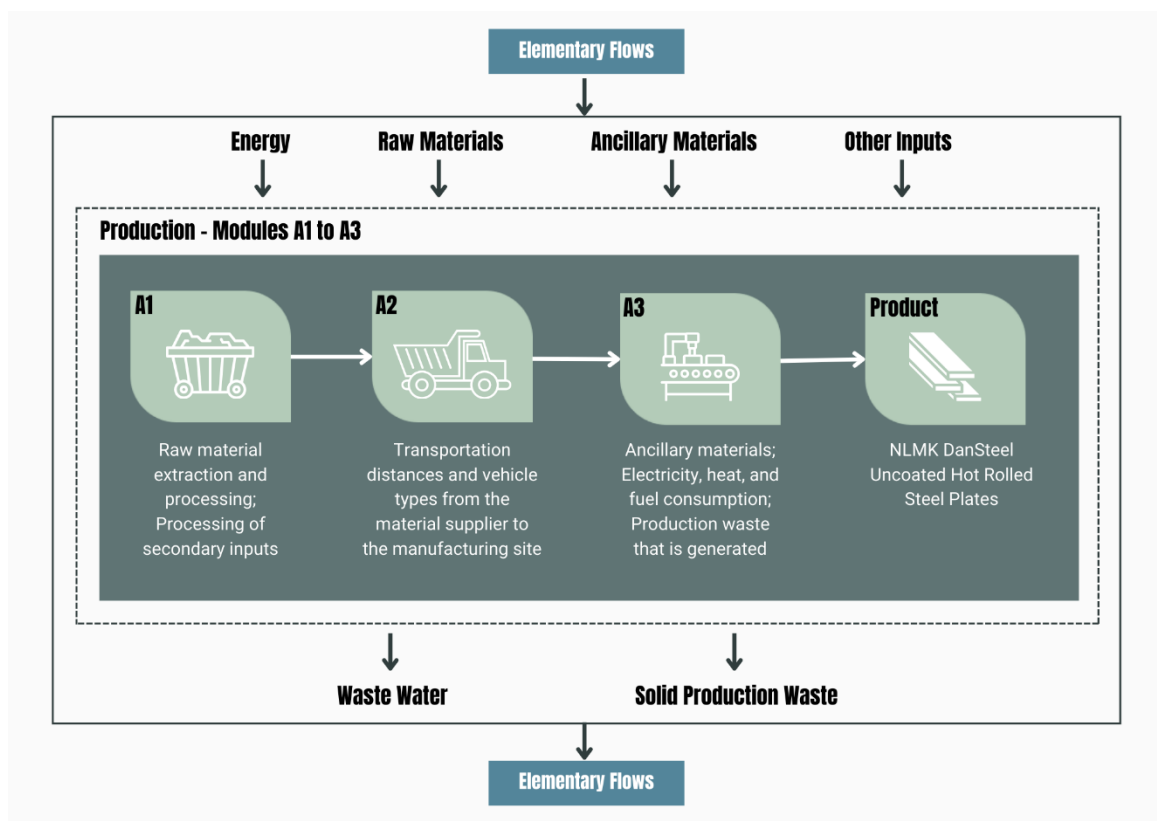
Ecoinvent 3.8 cut-off and OneClick LCA software with pre-verified EPD generator for construction products.

Description of system boundaries:

This EPD is based on a cradle-to-gate with modules A1-A3, C1-C4, and module D based on the application of LCA methodology according to reference PCR. The following life cycle stages are considered:

- Production (Modules A1-A3)
- End-of-life (Modules C1-C4)
- Benefits and loads beyond the product system boundary (Module D)

Schematic representation of the LCA system boundaries for the production module (A1-A3):



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 as well as the processing of any waste arising from those processes.

Cut-off criteria:

The study does not exclude any modules or processes that are stated mandatory in EN 15804:2012+A2:2019 and the applied PCR. The study includes all major raw materials and energy consumption. All inputs and outputs of the unit processes, for which data is available, 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 which follows the requirements in EN 15804, section 6.3.5.

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 analysed 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.

Steel scrap that enters the product system is assumed to reach the end-of-waste state after it has gone through a sorting and shredding process that takes place at demolition sites or waste processing facilities. Scrap emerging from these sites or facilities meets end-of-waste criteria, as it is a valuable commodity with a well-established existing market.

Product Lifecycle

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

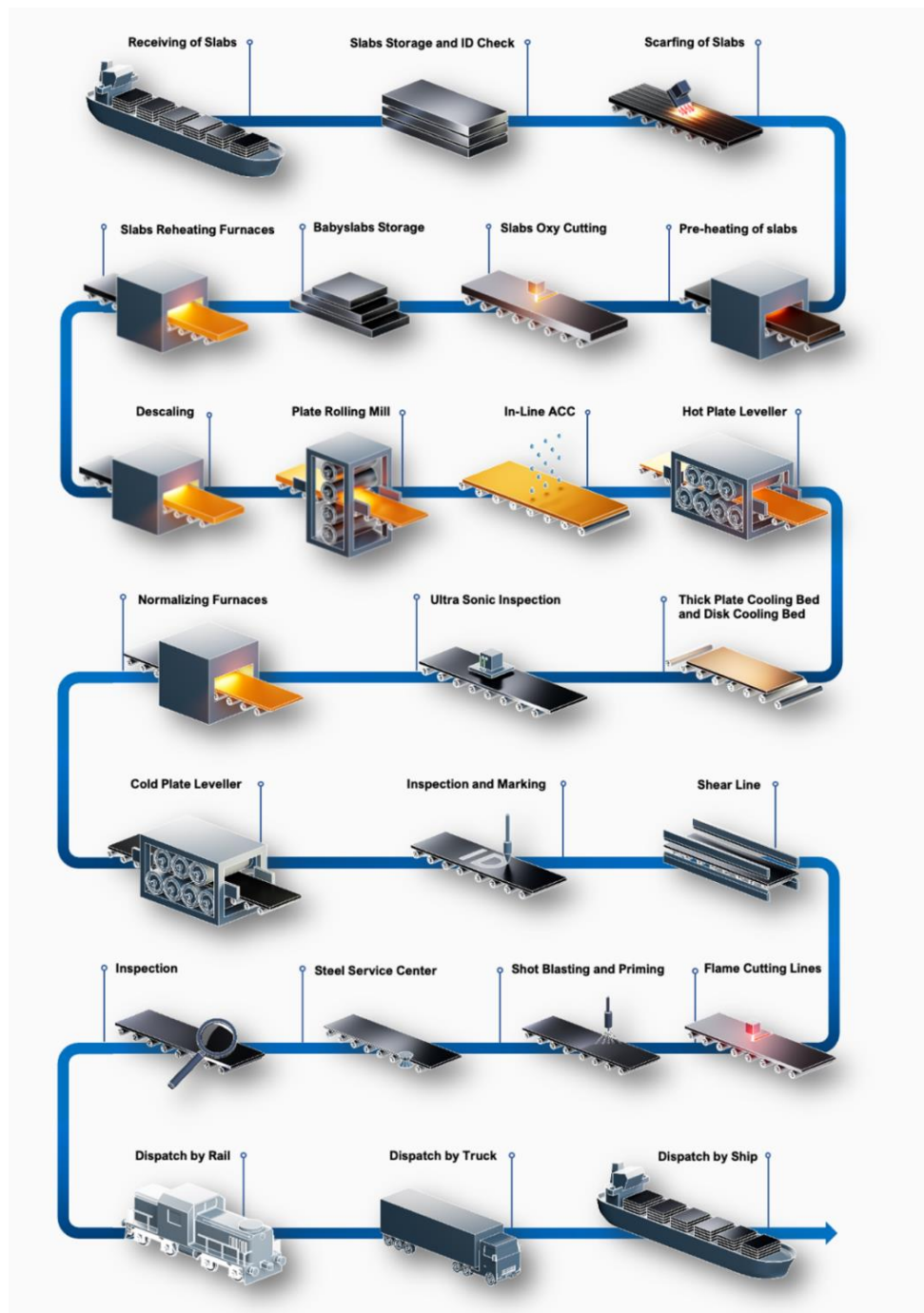
- Production of raw materials, production materials, and ancillary materials (Module A1)
- Transport of raw materials, semi-finished products, and ancillary materials to the production site (Module A2)
- Production of steel plate on-site, disposal of production residues, and packaging of raw materials, also taking into account on-site emissions (Module A3). The electricity used in the manufacturing processes in A3 is sourced from the Danish power grid, with climate impact of 0.28 kg CO₂ eq./kWh based on GWP-GHG indicator from the dataset.

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 is reported below. Please note this 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 EPD.

Manufacturing Process Diagram:



Transportation and Installation (A4–A5):

This EPD 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):

Modules B1-B7, which define the use stage of the product, are not declared for this study – those are not mandatory for the LCA “Cradle-to-gate with options” form.

Product End-of-Life (C1–C4):

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.

Benefits and Loads Beyond the System Boundary (D):

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.

Allocation, Estimates and Assumptions:

In this study, as per EN 15804 Section 6.4.3.4, 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.

Waste that may be marketable i.e. steel scrap, leaving the product system from modules A1-A3, shall be allocated as a co-product, according to PCR 2019:14 v1.3.2. Because no omission of inputs or outputs through allocation shall be done, scrap entering a product system shall come with an environmental burden if it originated from modules A1-A3 of a previous product system, and the calculation of this burden shall be based on co-product allocation.

Modules declared, geographical scope, the share of specific data (in GWP-GHG results), and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	x	x	x	ND	ND	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x
Geography	GLO	GLO	DK	-	-	-	-	-	-	-	-	-	EU	EU	EU	EU	EU
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Global = GLO; Denmark = DK; EU = Europe and the European Union; Not declared = ND.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Unalloyed steel or low alloyed steel	1000	7.2%	0%
Packaging materials	Weight, kg	Weight-% (versus the product)	Weight biogenic carbon, kg C/kg
Softwood spacer between plates	93	9.3%	41.86

The declared products contain less than 0.1% or no dangerous substances, from the list of "Candidate List of Substances of Very High Concern". All products made of materials declared here comply with the REACH Regulation (CE) n° 1907/2006, regarding the registration, evaluation, authorization, and restriction of chemical substances. (<http://echa.europa.eu/candidate-list-table>).

Results of the environmental performance indicators

All data results are representative of 1 ton (1,000 kg) of hot-rolled uncoated steel plate as a declared unit. 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. Note: additional environmental impact data may be presented in annexes.

Core Environmental Impact Indicators – EN 15804+A2.

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ eq	2,59E+03	3,31E+00	2,57E+00	2,41E+01	5,27E-01	-1,06E+03
GWP – fossil	kg CO ₂ eq	2,75E+03	3,31E+00	2,56E+00	2,40E+01	5,27E-01	-1,06E+03
GWP – biogenic	kg CO ₂ eq	-1,68E+02	0,00E+00	0,00E+00	1,68E+02	0,00E+00	0,00E+00
GWP – LULUC	kg CO ₂ eq	1,60E+00	3,30E-04	9,46E-04	3,20E-02	4,97E-04	-2,96E-01
Ozone depletion pot.	kg CFC ₁₁ eq	1,86E-04	7,07E-07	5,90E-07	2,53E-06	2,13E-07	-3,90E-05
Acidification potential	mol H ⁺ eq	1,03E+01	3,44E-02	1,09E-02	2,70E-01	4,95E-03	-3,86E+00
EP-freshwater ²⁾	kg Peq	1,06E-01	1,10E-05	2,10E-05	1,09E-03	5,52E-06	-3,87E-02
EP-marine	kg Neq	2,37E+00	1,52E-02	3,23E-03	5,70E-02	1,71E-03	-9,22E-01
EP-terrestrial	mol Neq	2,67E+01	1,67E-01	3,56E-02	6,57E-01	1,89E-02	-1,08E+01
POCP (“smog”) ³⁾	kg NMVOCeq	1,25E+01	4,59E-02	1,14E-02	1,80E-01	5,48E-03	-5,97E+00
ADP-minerals & metals ⁴⁾	kg Sbeq	3,74E-03	1,68E-06	6,01E-06	2,66E-03	1,21E-06	-2,04E-04
ADP-fossil resources	MJ	3,05E+04	4,45E+01	3,85E+01	2,93E+02	1,44E+01	-7,99E+03
Water use ⁵⁾	m ³	1,07E+03	1,20E-01	1,72E-01	5,15E+00	4,58E-02	-1,74E+02

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. The required characterization method and data are in kg P-eq. Multiply by 3,07 to get PO₄e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except for Particulate matter and Ionizing radiation, human health. 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.

Additional mandatory and voluntary impact category indicators - EN 15804+A1, ISO 21930

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
GWP-GHG	kg CO ₂ eq	2,64E+03	3,27E+00	2,54E+00	2,36E+01	5,16E-01	-9,91E+02
Ozone depletion Potential	kg CFC ₋₁₁ eq	1,76E-04	5,60E-07	4,67E-07	2,04E-06	1,69E-07	-4,76E-05
Acidification	kg SO ₂ eq	8,29E+00	2,45E-02	8,44E-03	2,18E-01	3,74E-03	-3,03E+00
Eutrophication	kg PO ₄ ³ eq	4,42E+00	5,69E-03	1,92E-03	6,95E-02	8,07E-04	-1,56E+00
POCP ("smog")	kg C ₂ H ₄ eq	1,21E+00	5,36E-04	3,29E-04	8,32E-03	1,57E-04	-7,11E-01
ADP-elements	kg Sbeq	3,57E-03	1,65E-06	5,82E-06	2,65E-03	1,19E-06	-2,15E-04
ADP-fossil	MJ	3,05E+04	4,45E+01	3,85E+01	2,93E+02	1,44E+01	-8,00E+03

GWP-GHG = Global Warming Potential-Greenhouse Gas; POCP = Photochemical ozone formation; ADP = Abiotic depletion 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.

Resource use indicators (PER = Primary Energy Resources)

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	1,70E+03	2,54E-01	4,34E-01	4,56E+01	1,25E-01	-1,01E+03
Renew. PER as material	MJ	7,25E+02	0,00E+00	0,00E+00	-7,25E+02	0,00E+00	0,00E+00
Total use of renew. PER	MJ	2,42E+03	2,54E-01	4,34E-01	-6,79E+02	1,25E-01	-1,01E+03
Non-re. PER as energy	MJ	3,05E+04	4,45E+01	3,85E+01	2,93E+02	1,44E+01	-8,00E+03
Non-re. PER as material	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	3,05E+04	4,45E+01	3,85E+01	2,93E+02	1,44E+01	-8,00E+03
Secondary materials	kg	2,80E+02	1,74E-02	1,07E-02	3,04E-01	3,03E-03	7,44E+02
Renew. secondary fuels	MJ	1,17E-01	5,70E-05	1,08E-04	1,52E-02	7,93E-05	1,34E-02
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	2,44E+01	2,70E-03	4,99E-03	1,48E-01	1,58E-02	-6,47E-01

End-of-Life Waste Indicators

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste	kg	4,67E+02	5,96E-02	5,11E-02	0,00E+00	0,00E+00	4,58E+01
Non-hazardous waste	kg	4,11E+03	4,19E-01	8,39E-01	0,00E+00	1,00E+02	-1,17E+03
Radioactive waste	kg	7,09E-02	3,13E-04	2,58E-04	0,00E+00	0,00E+00	1,63E-02

End-of-Life Output flow indicators

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,18E+02	0,00E+00	0,00E+00	9,93E+02	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

MND = Module Not Declared

Additional environmental information

Indoor Air:

The EPD does not give out information on the release of dangerous substances into indoor air because the horizontal standards on measurement of the release of regulated dangerous substances from construction products, using harmonized test methods according to the provisions of the respective technical committees for European product standards, are not available.

Soil and Water:

The EPD does not give out information on the release of dangerous substances into soil and water because the horizontal standards on measurement of the release of regulated dangerous substances from construction products, using harmonized test methods according to the provisions of the respective technical committees for European product standards, are not available.

References

General Programme Instructions of the International EPD[®] System. Version 4.0.

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ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

ISO 14044:2006 Environmental management. Life cycle assessment. Requirements and guidelines.

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https://circulareconomy.europa.eu/platform/sites/default/files/euric_metal_recycling_factsheet.pdf

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