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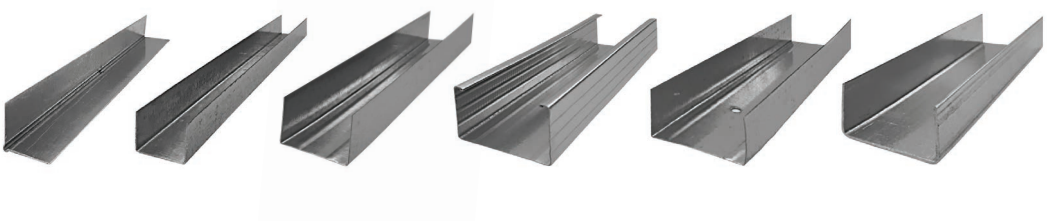
THE INTERNATIONAL EPD® SYSTEM

KNAUF

ENVIRONMENTAL PRODUCT DECLARATION OF KNAUF STEEL PROFILES

In accordance with ISO 14025:2006 and ISO 15804+A2:2019/AC:2021
This EPD covers multiple products.

EPD PROGRAM	The international EPD System, https://environdec.com/
PROGRAM OPERATOR	EPD INTERNATIONAL AB
CPC CODE	412, Products of Iron & Steel
EPD REGISTRATION NUMBER	S-P-09564
PUBLICATION DATE	2023-10-13
VALID UNTIL	2028-10-13
GEOGRAPHICAL SCOPE	Global



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.***

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Company Information

Knauf is one of the world's leading manufacturers of modern insulation materials, drylining systems, plasters and accessories, thermal insulation composite systems, paints, floor screeds, dry floor systems, and construction equipment and tools.

In Greece, Knauf Gypsopoiia operates with two factories. A factory in Stanos Amphilochia and one in Thessaloniki.

Knauf's factory in Stanos, Amphilochia, Greece, covers 100 acres of land, of which 13 acres is building cover. In the same geographical area, it operates a gypsum quarry (180 acres) owned by the company. The factory operates on a 24-hour basis while a significant part of its production is exported to the Balkan countries, Eastern Mediterranean and North Africa. Knauf has a vertical production from the raw material, gypsum, a product of its own mining that is processed in its facilities into complete structural elements (gypsum, plasterboard) with maximum added value. Inspection of all raw materials is carried out daily by the well-equipped quality control department, before their use in the production lines.

Thessaloniki factory extends over 40 acres of land, of which 10 acres are covered by buildings. It has a state-of-the-art production line of ready-to-use surface treatment materials, a production line of final color coatings, and three lines of metal profiles and dry construction components.

At the Thessaloniki factory, a two-year investment plan of €5 million was completed in May 2021, which included the creation of one of the most modern logistics centers of the Knauf group. The investment takes full advantage of Thessaloniki's strategic position, gaining better access to raw materials and greater penetration in the Balkan and Mediterranean market, while contributing to the company's environmental upgrade. The transport distance of raw materials and finished products was reduced by 400 kilometers, thus reducing the energy footprint of the company's products, while a total of 30 new jobs were created.

Product Information

This is an average EPD for Ready-to-use steel profiles for interior use produced by Thessaloniki plant in Greece. The LCIA results of the LCA represents the weighted average product. There is no significant differentiation among the environmental performance of each product. The products included are:

- **C-shaped, H-shaped & U-shaped steel profiles**
- **Spring rails**
- **Flexible corner & angle profiles**

Knauf metal profiles are produced according to the EN 14195:2014 standard and meet the DIN 18182 T1 standard. They are primarily used for the construction of plasterboard walls, but also as load-bearing elements for the construction of free-fixing plasterboard false ceilings.
The metal profiles are intended for dry building systems and are the ultimate solution for the construction of suspended ceilings and dry building partitions using plasterboards or cement boards. The profiles are a model of technical excellence and manufacturing evolution of their mechanical properties and are made of high-quality galvanized steel. In addition, they are visually differentiated due to their innovative design and have patents, industrial designs and trademarks. Technical properties are presented in table below.

Properties	Value
Reaction to fire	A1
Bending strength	140 N/mm^2

Technical properties for steel profiles

Packaging material	Mass (kg) per declared unit
Wood/Wooden pallets	1,46E-02
Plastic hoop	4,27E-04

Packaging materials per kg of product

The product under the scope of this EPD is composed of 100% galvanized steel sheets (steel D51XD).
No substance in the "Candidate List of Substances of Very High Concern (SVHC) for authorization" exceeds 0.1% wt in the final products.

System Boundaries

X= Included, MND= Module Not Declared																
	Product stage			Construction stage		Use stage							End-of-life stage				Resource recovery stage
	Raw Materials Supply	**Transport**	**Manufacturing**	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	**De-construction and demolition**	**Transport**	**Waste processing for reuse, recovery and/or recycling**	**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**	**GR**										**EU**	**EU**	**EU**	**EU**	**EU**
Variation-products	**<10%**												**-**	**-**	**-**	**-**	**-**
Variation-sites	**Not relevant**												**-**	**-**	**-**	**-**	**-**

A1: Raw Material Supply

The production starts with the material supply. This stage includes the mining and processing of raw materials, the generation of electricity and fuels required for the manufacturing and the recycling process of secondary materials. Regarding steel profiles manufactured in Thessaloniki plant, galvanized steel sheets are the main raw materials in the feed.

A2: Transportation of raw materials to manufacturer

Transportation is relevant to delivery of raw materials from the supplier to the gate of manufacturing plant. Raw materials are transported by truck and vessels from different countries all over the world.

A3: Manufacturing

Manufacturing of steel profiles includes the cold extrusion of steel sheets and shape configuration. Finally, the products are packaged in wooden pallets.

C1: De-construction, demolition

The deconstruction and demolition of the product takes place with the demolition of the whole building. For steel profiles, the necessary energy consumption was considered equal to 0,239 MJ/kg or 239 MJ/ton of product deconstructed, in accordance with the ''JRC Technical Report "Model for Life Cycle Assessment (LCA) of buildings".

C2: Transportation of waste

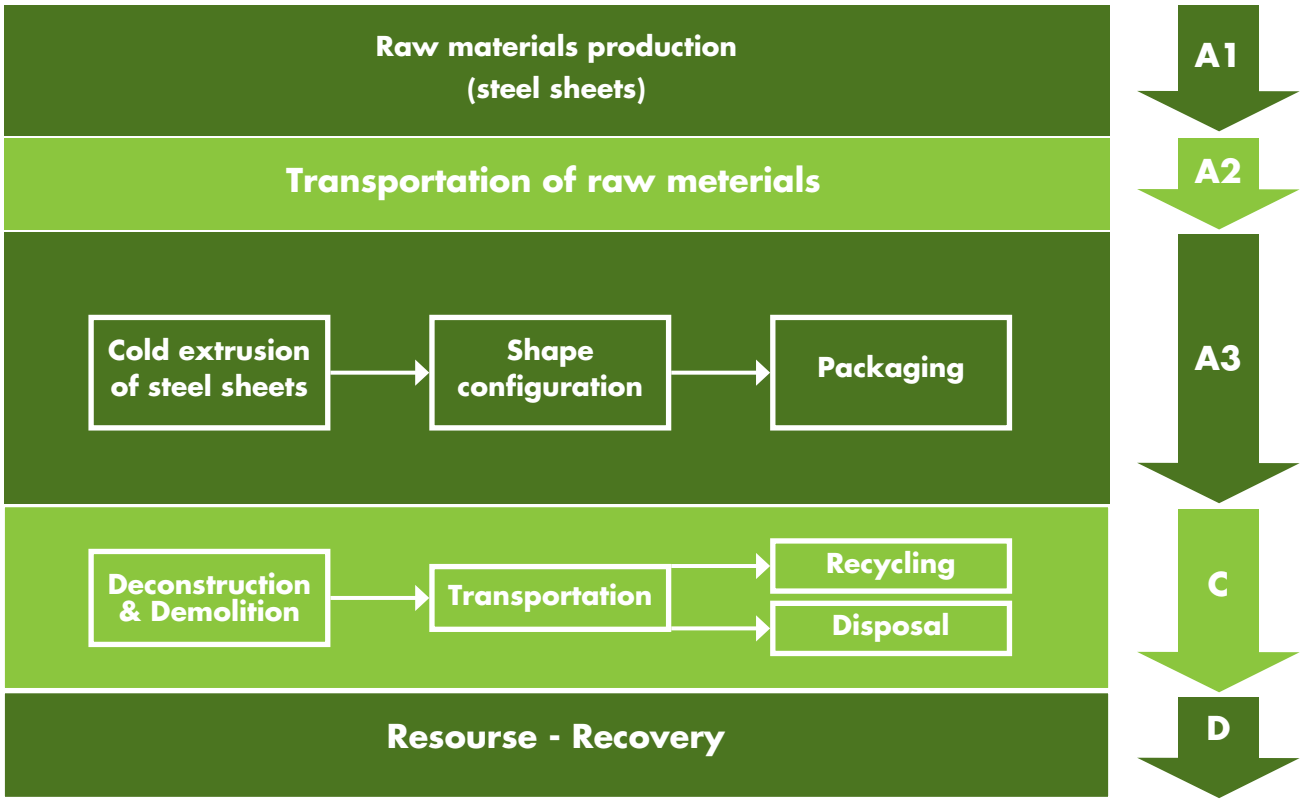
A distance of 100 km by lorry 16-32 tonnes from construction/demolition sites to disposal sites has been chosen as a conservative assumption.

C3: Waste processing for reuse, recovery and/or recycling

For steel profiles, according to ''Seventh global LCI study for steel products'' published in Worldsteel Association, an average of 85% of all steel is recycled at the end of a product's life. These values are based on expert judgement amongst the worldsteel LCA experts and are believed to be conservative values as recycling of products will improve in the future.

C4: Disposal

15% of the final product is transported for final disposal (landfill), as it is said above.
D: Reuse-Recovery-Recycling potential
The avoided burden derives from the 85% recycling rate of the final product after its life cycle.



LCA Information

Declared unit: The declared unit is 1 kg of steel profiles.

Goal and Scope: This EPD evaluates the environmental impacts of the production of 1 kg of steel profiles from Cradle to gate with module C1-C4 and D.

System Boundary: The system boundaries are set to be cradle to gate (A1-A3) with modules C+D.

Cut-off rules: The cut-off criteria adopted is as stated in "EN 15804:2012+A2:2019". Where there is insufficient data for a unit process, the cut-off criteria are 1% of the total mass of input of that process. The total of neglected input flows per module is a maximum of 5% of energy usage and mass. In this case, no cut-off criteria were applied in any stream.

Allocations: Wherever possible, allocation was avoided by dividing the unit process to be allocated into two or more sub-processes and collecting the input and output data related to these sub-processes. Where allocation cannot be avoided, the inputs and outputs of the system were partitioned between its different products or functions in a way that reflects the underlying physical or economic relationships between them. In this case, the allocation concerns the electricity for lighting and the diesel consumption for other general utilities in the manufacturing plant and it is based on the mass of the final products.

Assumptions:

Transportation: In modules A2 and C2, a EURO5 lorry 16-32 metric ton was utilized for road transportation and a bulk carrier for dry goods for sea transportation.
Module C1: It is assumed that the necessary energy consumption was considered equal to 0,239 MJ/kg or 239 MJ/ton of product deconstructed, in accordance with the ''JRC Technical Report "Model for Life Cycle Assessment (LCA) of buildings".
Module C2: A conservative assumption of 100 km by lorry 16-32 metric ton was used.
Module C3 - Module C4: According to ''Seventh global LCI study for steel products'' published in Worldsteel Association, an average of 85% of all steel is recycled at the end of a product's life. The rest 15% is going to be disposed/landfilled.

Data quality: ISO 14044 was applied in terms of data collection and quality requirements. The impact of the production of raw materials recovered from Ecoinvent database v.3.8. The data concerning the modules A2 (Transportation) and A3 (Product manufacturing) were provided by Knauf and they were extracted from the company's SAP system, production files and invoices. Regarding electricity mix, the latest (2021) national residual electricity mix as published in DAPEEP SA was utilized. The emission factor for natural gas is provided from National Inventory Report of 2021 for Greece. The end-of-life are based on the most representative scenarios for this product. Background data for these stages are retrieved from Ecoinvent v.3.8.

Geographical Scope: Worldwide

Time representativeness: Data obtained refers to the year 2021.

Software used: OpenLCA v.1.10.3

Environmental Performance

ENVIRONMENTAL IMPACTS	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	2,72E+00	2,19E-02	1,66E-02	4,89E-02	7,91E-04	-2,04E+00
GWP-fossil	kg CO2 eq	2,71E+00	2,19E-02	1,66E-02	4,89E-02	7,90E-04	-2,04E+00
GWP-biogenic	kg CO2 eq	2,82E-03	3,59E-06	5,86E-06	7,93E-06	4,41E-07	-2,18E-03
GWP-luluc	kg CO2 eq	1,43E-03	1,74E-06	6,53E-06	4,88E-06	7,46E-07	-1,09E-03
GWP-GHG	kg CO2 eq	2,61E+00	7,18E-04	1,65E-02	4,84E-02	7,74E-04	-1,95E+00
ODP	kg CFC-11 eq	1,46E-07	4,72E-09	3,85E-09	1,05E-08	3,20E-10	-8,97E-08
AP	mol H+ eq	1,16E-02	2,28E-04	6,75E-05	5,08E-04	7,43E-06	-8,31E-03
EP-freshwater	kg P eq	1,28E-03	6,60E-07	1,07E-06	1,52E-06	7,23E-08	-1,01E-03
EP-marine	kg N eq	2,55E-03	1,01E-04	2,03E-05	2,25E-04	2,58E-06	-1,68E-03
EP-terrestrial	mol N eq	2,71E-02	1,11E-03	2,22E-04	2,47E-03	2,83E-05	-1,78E-02
POCP	kg NMVOC eq	1,20E-02	3,04E-04	6,80E-05	6,78E-04	8,23E-06	-8,47E-03
ADPe	kg Sb eq	3,60E-05	8,83E-09	5,78E-08	2,52E-08	1,80E-09	-2,83E-05
ADPf	MJ	2,96E+01	3,00E-01	2,51E-01	6,71E-01	2,21E-02	-2,17E+01
WDP	m3 eq	9,82E-01	2,16E-02	1,20E-03	1,64E-03	1,02E-03	-7,70E-01

Environmental impacts per 1 kg of steel profiles

[1] GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product, with characterization factors (CFs) based on IPCC (2013).

[2] The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

RESOURCE USE	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	3,05E+00	1,56E-03	3,54E-03	3,77E-03	1,88E-04	-2,23E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,05E+00	1,56E-03	3,54E-03	3,77E-03	1,88E-04	-2,23E+00
PENRE	MJ	2,96E+01	3,00E-01	2,51E-01	6,71E-01	2,21E-02	-2,17E+01
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,96E+01	3,00E-01	2,51E-01	6,71E-01	2,21E-02	-2,17E+01
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,29E-02	1,67E-05	2,80E-05	3,83E-05	2,36E-05	-1,79E-02

Resource use per 1 kg of steel profiles

OUTPUT FLOWS AND WASTE CATEGORIES	Unit	A1-A3	C1	C2	C3	C4	D
HWD	**kg**	1,96E-04	8,10E-07	6,56E-07	1,84E-06	3,34E-08	-1,51E-04
NHWD	**kg**	1,12E+00	3,69E-04	1,29E-02	9,13E-04	1,50E-01	-8,42E-01
RWD	**kg**	7,28E-05	2,09E-06	1,70E-06	4,63E-06	1,45E-07	-4,58E-05
CRU	**kg**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	**kg**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	**kg**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	**MJ**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Output flows and waste categories per 1 kg of steel profiles

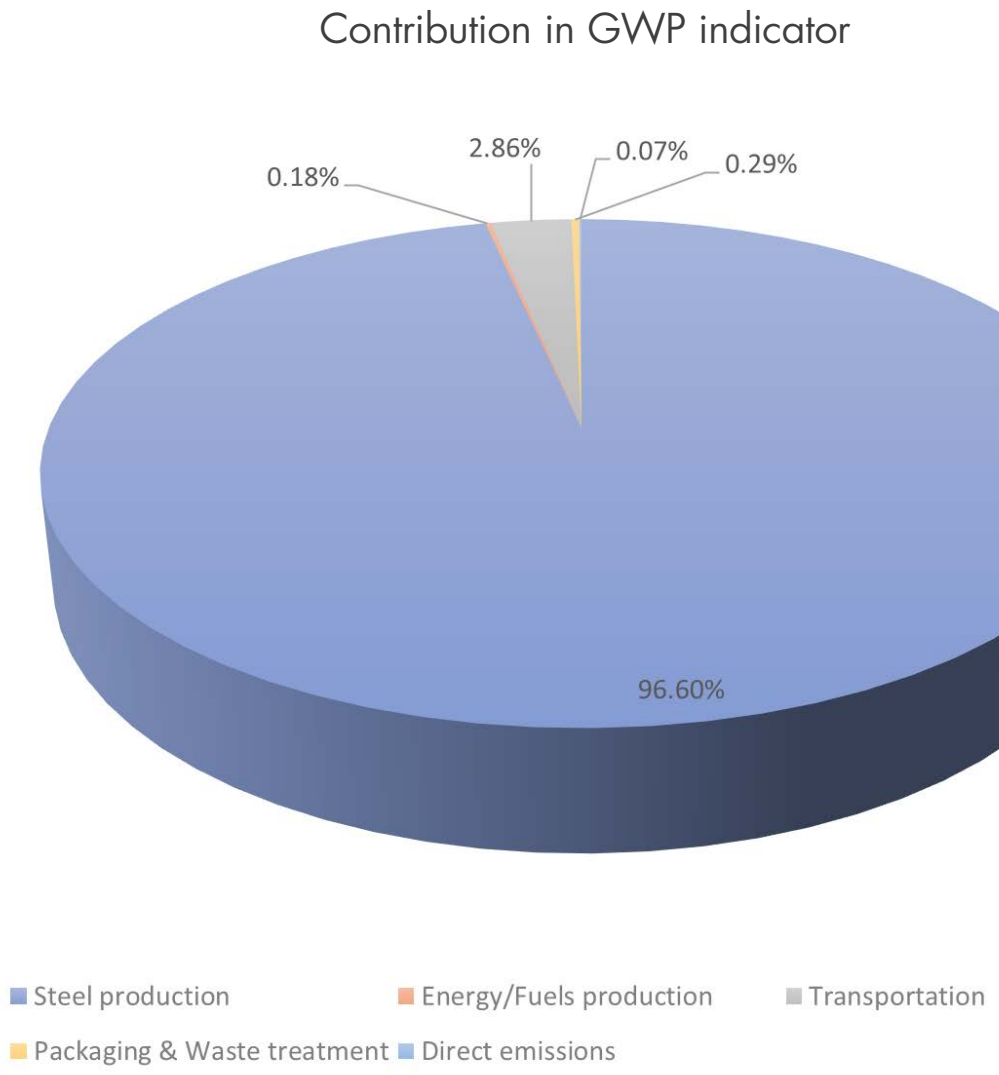
ADDITIONAL IMPACTS	Unit	A1-A3	C1	C2	C3	C4	D
PM	**Disease incidence**	1,82E-07	6,05E-09	1,16E-09	1,35E-08	1,46E-10	-1,25E-07
IRP	**kBq U235 eq**	1,66E-01	1,37E-03	1,29E-03	3,02E-03	9,80E-05	-1,22E-01
ETP-FW	**CTUe**	7,64E+01	1,67E-01	1,89E-01	3,82E-01	1,36E-02	-5,95E+01
HTP-c	**CTUh**	1,58E-08	8,39E-12	6,33E-12	1,52E-11	3,52E-13	-1,25E-08
HTP-nc	**CTUh**	6,05E-08	1,22E-10	2,06E-10	2,85E-10	1,05E-11	-4,70E-08
SQP	**dimensionless**	6,52E+00	3,61E-02	1,69E-01	8,09E-02	3,21E-02	-3,63E+00

Additional impacts per 1 kg of steel profiles

[3] Ionizing radiation potential (IRP) 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.

Interpretation

As it is presented below, production of steel sheets (DX51D) contributes the most, accounting for 96,6% of the GWP indicator. Transportation of raw materials up to the manufacturing gate attributes 2,86% of the total emissions, while production of fuels and electricity for the manufacturing process about 0,2%. Packaging & waste treatment and direct emissions from manufacturing contribute 0,29% and 0,07% respectively.



Additional information

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of 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.

Programme related information

Programme	Website	Address	E-mail
The international EPD System	www.environdec.com	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden	info@environdec.com

Accountabilities for PCR, LCA and third-party verification

Product Category Rules (PCR)

ISO standard ISO 21930 and CEN standard EN 15804 serve as the core Product Category Rules (PCR)

Product Category Rules (PCR):

PCR 2019:14 Construction products, version 1.2.5

PCR review was conducted by: The Technical Committee of the International EPD® System.
See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact

Life Cycle Assessment (LCA)

ENVIROMETRICS
Business Consultants & Engineers

LCA Accountability: ENVIROMETRICS S.A.
3 Kodrou str., 152 32, Athens, Greece
email: info@envirometrics.gr
www.envirometrics.gr

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email: knauf@knauf.gr www.knauf.gr

Third party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

[X] EPD verification by accredited certification body

Third party verification: Business Quality Verification P.C
5, Konitsis Street, Marousi Attica, GR 15125
email: info@bqv.gr
www.bqv.gr

BQV is an approved certification body accountable for third-party verification
The certification body is accredited by: Hellenic Accreditation System SA (E.S.Y.D), Accreditation No. 1218
Procedure for follow-up during EPD validity involves third party verifier

[ ] Yes [X] No

The EPD owner has the sole ownership, liability, and responsibility of the EPD.
EPDs within the same product category but registered in different EPD programmes may not be comparable. 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.

References

General Programme Instructions of the International EPD® System. Version 4.0, 2021-03-29
PCR 2019:14 v.1.2.5 Construction products. EPD System. Date 2022-11-01
EN 15804:2012+A2:2019/AC:2021, Sustainability of construction works -
Environmental Product Declarations — Core rules for the product category of construction products
ISO 14020:2000 Environmental labels and declarations — General principles
ISO 14025:2006 Environmental labels and declarations -
Type III environmental declarations — Principles and procedures
ISO 14040:2006 Environmental management - Life cycle assessment-Principles and framework
ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
Ecoinvent / Ecoinvent Centre, www.Ecoinvent.org
Residual Energy Mix 2021 from Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)
Model for Life Cycle Assessment (LCA) of buildings, European Commission, Joint Research Centre
Seventh global LCI study for steel products, Worldsteel Association

▶ List of abbreviations

LCA	Life Cycle assessment
EPD	Environmental Product Declaration
PCR	Product category rules
GLO	Global
RER	Europe
RoW	Rest of the world
GWP-total	Global Warming Potential total
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Ozone Depletion Potential
AP	Acidification Potential
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 Exceedance
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADPe	Abiotic depletion potential for non-fossil resources
ADPf	Abiotic depletion potential for fossil resources
WDP	Water use
PERE	Use of renewable primary energy excluding 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 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	Use of net fresh water
HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EE	Exported Energy
PM	Particulate matter emissions
IRP	Ionizing radiation, human health
ETP-FW	Ecotoxicity, freshwater
HTP-c	Human toxicity, cancer
HTP-nc	Human toxicity, non-cancer
SQP	Land use related impacts/Soil quality

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