Environmental Product Declaration

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

XPS (EXTRUDED POLYSTYRENE) thermal insulation product

from

MASTERPLAST Nyrt.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0020112
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Product recently on the market – Results of this EPD shall be used with care as the LCI data is not yet based on 1 year of production which may result in increased uncertainty.
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): *PCR – Construction Products (PCR 2019:14, version 1.3.4) and PCR – Thermal Insulation products (EN 16783:2024) (c-PCR-005, 2024-05-03)* *UN CPC 369 – Other plastic products*
PCR review was conducted by: *The Technical Committee of the International EPD System. See www.environdec.com 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*. c-PCR review was conducted by: *Technical Committee* CEN/TC 88 "Thermal insulating materials and products" (other information at CEN website: https://www.en-standard.eu/)
Life Cycle Assessment (LCA)
LCA accountability: *Zita Brigitta Békési, Ágnes Elvira Farkas, Renáta Bodnárné Sándor* - Bay Zoltán Nonprofit Ltd. for Applied Research
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Jan Weinzettel* Approved by: The International EPD® System as individual verifier for the third-party verification
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

"EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, 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 characterisation 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

Owner of the EPD: **Masterplast Nyrt.**
H-8143, Sárszentmihály, Árpád str 1, Hungary
https://www.masterplastgroup.com/
Contact: *Zsuzsa Szölősiné Pavelka*, Head of Secretariat, pavelkazsuzsa@masterplast.hu

Description of the organisation: The Masterplast group, founded in 1997, is the largest Hungarian-owned construction material manufacturing company in the Central European region. With its subsidiaries, it ensures direct market presence in 10 European countries and is present in the majority of European countries through its export partners. It has a decisive position in the market of facade thermal insulation, high-roof insulation and dry construction system components. Its product background is primarily ensured by production and strategic manufacturer collaborations at its ISO and TÜV certified manufacturing bases in Hungary, Serbia and Germany.

Masterplast provides competitive business services to its partners with a built-in customer-oriented sales system, continuous monitoring of the quality of manufactured and distributed products, a stable product supply background and flexible logistics solutions. The company considers the aspects of sustainability, energy efficiency and environmental protection to be extremely important both in its internal processes and in the production and development of its products.

The XPS insulation materials produced by Masterplast stand out not only with their excellent thermal insulation properties, but also play a key role in increasing energy efficiency and achieving the EU's zero neutrality goals. As part of the company's commitment to sustainable architecture, Masterplast products contribute to reducing the carbon emissions of buildings, which is not only essential for environmental protection, but also offers significant benefits to consumers by reducing heating and cooling costs.

Name and location of production site:
The Masterplast group has production sites in 9 different locations, producing different products. XPS insulation material is manufactured in Subotica, Serbia.
Masterplast Proizvodnja d.o.o - Bodrogvari Ferenc str. 172., 24000 Subotica, Serbia

Product information

Product name: **XPS (Extruded polystyrene) thermal insulation product**

Product description:
XPS sheets are produced by extrusion process, during which the solid compounds are melted and mixed with blowing agents (gases) under high pressure. When the mix leaves the extruder, the mix expands and creates a solid foam with closed-cell structure. The foam is further processed by grinders creating sheets with different surface and edge types. However, thanks to the extrusion process, the end result is a closed-cell sheet that is resistant to moisture and many environmental influences. During their production, polystyrene crystals are expanded into the desired board shape. To distinguish them, they are produced in coloured designs.
Traditional EPS sheets are cheap and have good thermal insulation properties, but they are sensitive to soaking and mechanical influences. Thus, they are not suitable for certain functions (e.g. plinth thermal insulation).

XPS boards are much more durable. Their advantages:

- excellent thermal insulation properties
- very low water absorption, so they are resistant to water and frost
- high compressive strength, they are resistant to mechanical effects and shocks
- can be cut well and precisely
- like EPS sheets, they are light
- can be plastered well
- difficult to burn, so they also partially have a fire-retardant function, which is also facilitated by the additives
- resistance to naturally occurring acids and lyes

XPS products are used as:

- basement thermal insulation
- external thermal insulation of cellar walls (up to 4 meters deep)
- thermal insulation of low and average load floors lying on the ground
- remaining formwork
- external insulation of residential buildings and garages

Product components and materials:

The raw material of the XPS product is general purpose polystyrene (GPPS). Other than GPPS, a blue pigment, a processing aid, a -blowing agent, flame retardant, and also regranulated XPS is added during production.

Constructional data of XPS products

Characteristic	Standard	Value
Thermal conductivity (W/m*K)	EN 12667	0,034
Compressive stress (kPa)	EN 826	≥ 200 (20-30 mm) ≥ 300 (≥40 mm)
Tensile strength (kPa)	EN 1607	≥ 200
Fire protection class	EN 13501-1	E
Long-term water absorption	EN ISO 16535	0,7

Resistance to heat conduction

Thickness (mm)	Resistance to heat conduction (m^2*K/W)
20	0,55
30	0,85
40	1,15
50	1,45
60	1,75
80	2,35
100	2,90
120	3,50

This thickness will be increased to 200mm next year.
UN CPC code: 369 “Other plastics products”
Geographical scope: Base materials (A1) come from outside of Europe (RoW process was applied), production takes place in Serbia, and the XPS product is used in construction around Europe.

LCA information

Declared unit: The declared unit of the life cycle assessment is **1 m^2 XPS panel product with an R value of 1 m^2*K/W** (35 mm thickness, 1,2212 kg weight) at the factory gate ready for distribution.

Size and packaging of products:

Sheet size:	1250 mm x 600 mm (straight edge formation), 1265 mm x 615 mm (L-cut formation)
Thickness:	20-120 mm – This thickness will be increased to 200mm next year.
Edge formation:	S - straight, L - cut
Surface:	G - grinded, W - waffle surface

(Different sizes by prior agreement.)

Reference service life (RSL): The XPS insulation is durable for at least 50 years if applied correctly, or even can last as long as the lifetime of the building in which it is used.

Time representativeness: 3 production months in 2024 (June, July, August)

Database(s) and LCA software used:
The LCA model for production was made using the LCA for Experts software (LfE, formerly known as GaBi Professional) system for life cycle engineering, developed by Sphera (version 10, 2024).
Applied databases are:

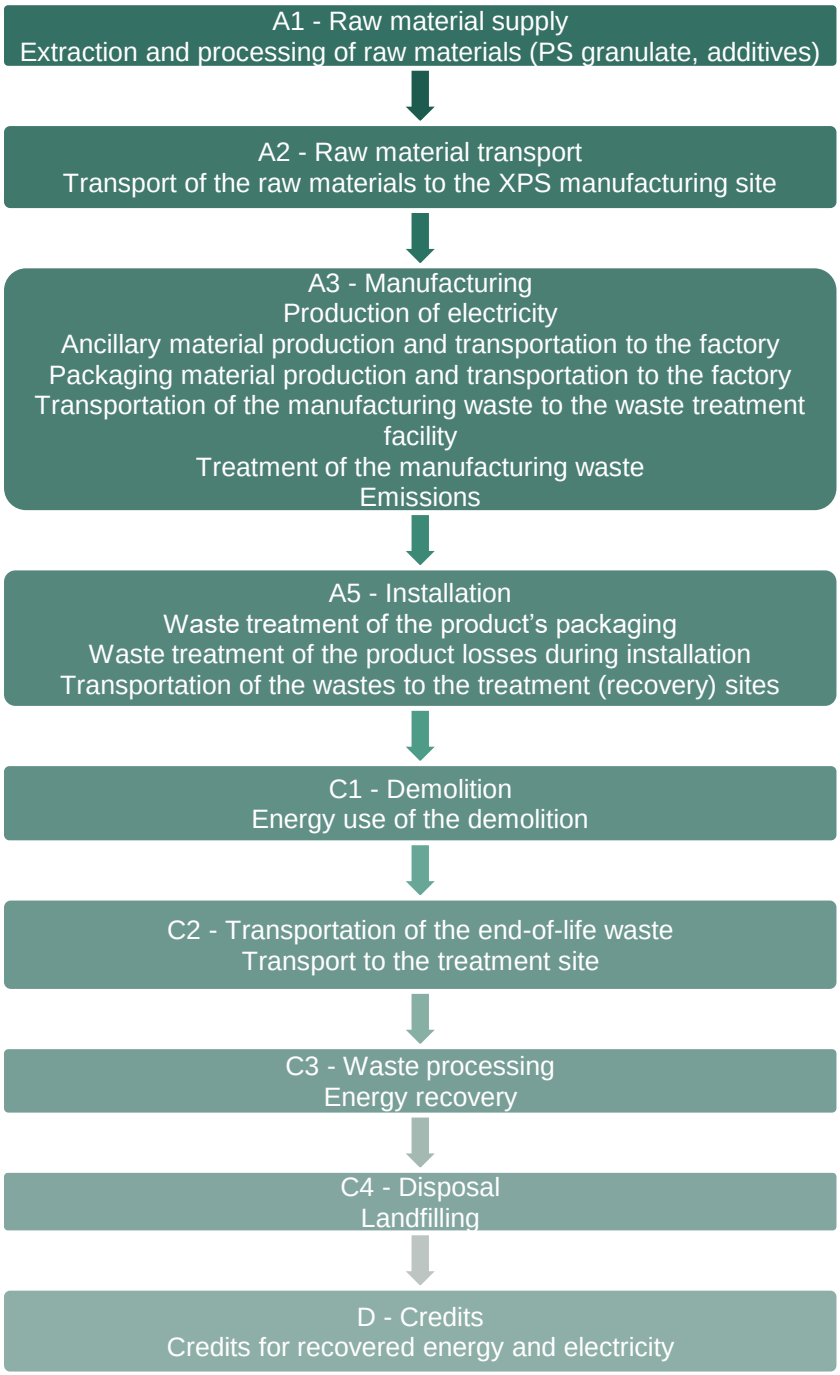
- Managed LCA content (Sphera) database (version 10, 2024),
- Ecoinvent database (version 3.10, 2024).

Description of system boundaries:
Cradle to gate" (Modules A1 to A3) with modules A5, C1-C4 and module D. Infrastructure/capital goods are excluded from upstream, core and downstream processes. The "Polluter pays" principle has been applied.

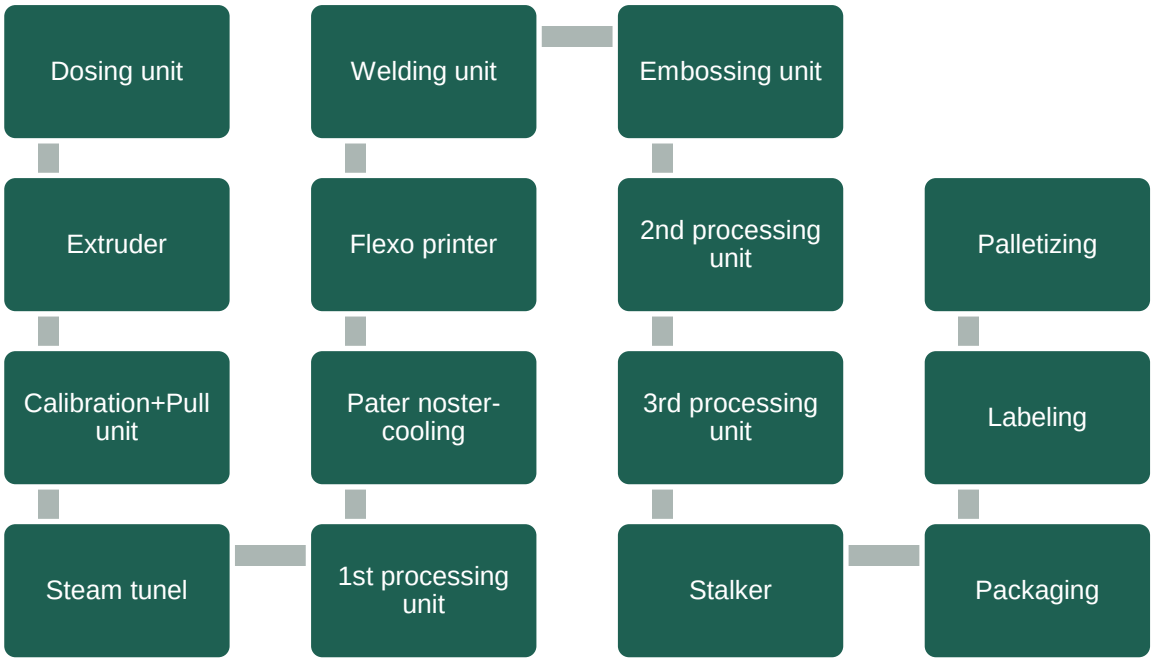
Allocation:
There was no need for allocation in connection with the production. The data quality part contains the other details: on the quality of data provision.
Since the EPS feet (or sole), which is used for packaging, is a by-product with an economic value of 0, after economic allocations, the EPS feet appears with 0 impact in the model in module A3 (as packaging).
To counterbalance the energy devoted to regranulation before the reference time, an extrusion process was used. This calculation and the extrusion process were necessary because the material balance was not correct as the company had more regranulate after the start of the technology, and the energy needed for the granulation process (which happened before the reference time period) was not included either.

Cut-off criteria:
Cut-off rules are generally applied according to the EN15804:2012+A2 Standard and Construction Products PCR, namely minimum of 99% of the declared environmental impacts shall be included.
Cut-off rules were not needed to be applied. In some cases, proxy data were used to achieve 100% completeness, as this is better than data gaps.

System diagram:



Process diagram of XPS manufacturing process (A3)



Scenario information:

Installation (A5)

According to the literature, installing extruded polystyrene onto buildings does not require water, energy or other resources.

For the waste of extruded polystyrene produced on the installation site a default 2% was used as per the recommendation of the applied c-PCR. The functional unit of this study relates to a quantity of product ready to be distributed, so the installed quantity of the XPS product is assumed to be 2% less than what was produced.

The XPS scrap and part of the packaging waste (EPS feet and glue) was assumed to be sent for incineration, this transport distance was assumed as a standard 50 km distance. The other part of packaging (the polyethylene foil) was sent for recycling, the distance for that was assumed as 50 km as well.

End-of life methodology (C Module)

Since XPS is a polystyrene product as well as the EPS, with similar purposes and similar installation methods assumed, the same assumptions can be made for the processing of their waste. According to THE EPS-INDUSTRY'S JOURNEY TOWARDS CIRCULARITY[1] report, 66% of EPS construction waste goes to incineration with energy recovery and 10% goes to recycling. In this case no recycling is assumed, meaning if the energy recovery and landfilling ratio stays constant, 73,3% construction waste goes to incineration with energy recovery and the rest goes to landfill.

[1] https://eumeps.eu/images/website/the-eps-industry-s-journey-towards-circularity-progress-report-final.pdf

Data quality

At the selection of the most suitable process, it is important to apply the local – country specific – process. Therefore, the country specific processes were chosen, for example in case of the electricity, thermal energy, process steam, but other cases – when there was no typical country specific process available – average European processes were selected. In some cases, only processes from other European countries were available.

Generic data used in the LCA study are not older than 5 years and site-specific data are not older than 2 years.

Documentation of the used energy

Module	Process				
	Name	Provider	Reference year	Validity	Factor (kg CO_2eq / kWh)
A3	RS: electricity, medium voltage, residual mix	ecoinvent	2023	-	1,1152
C	RER: Electricity grid mix	Sphera	2020	2026	0,3016

Electricity grid factors used in the Study (kg CO_2 eq./ kWh) - Source: GaBi professional 10.
Characterisation factor: EN15804+A2 (based on EF3.1), Climate Change - total

Modules declared, geographical scope, 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	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	x
Geography	GLO	GLO	RS	-	RER	-	-	-	-	-	-	-	RER	RER	RER	RER	RER
Specific data used	51,6%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

When a module is accounted for, the box in the last row is then marked with an “X“.

When a module is not accounted for, the box in the last row is then marked with “ND“, not declared.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
GPPS	8,82E-01	0	0 resp.0
XPS regranulate	3,00E-01	0	0 resp. 0
Blue pigment	4,50E-03	0	0 resp.0
Staraid	9,90E-03	0	0 resp.0
Starcell	4,00E-03	0	0 resp.0
Flame retardant	2,09E-02	0	0 resp.0
TOTAL	**1,22E+00**	**0**	**0 resp.0**
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
EPS feet	1,58E-03	0,13	0
PE foil	1,57E-02	1,28	0
Technomelt glue	1,54E-04	0,01	0
TOTAL	**1,74E-02**	**1,42**	**0**

Environment/ hazardous properties: No substance listed under the REACH Regulation is present in this product, either above the limits for registration with the European Chemicals Agency or in excess of 0,1 weight-% of the product.

Results of the environmental performance indicators

The environmental impacts of the declared unit for the following impact categories were reported in the EPD according to EN 15804:2012+A2:2019/AC:2021.

Mandatory impact category indicators according to EN 15804:2012+A2:2019/ AC:2021

Indicator	Unit	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	6,51E+00	8,91E-02	7,02E-03	1,23E-02	2,96E+00	9,40E-03	-1,11E+00
GWP-fossil	kg CO_2 eq.	6,49E+00	8,91E-02	6,96E-03	1,22E-02	2,96E+00	9,39E-03	-1,10E+00
GWP-biogenic	kg CO_2 eq.	1,39E-02	1,65E-07	6,25E-05	0,00E+00	6,94E-05	0,00E+00	0,00E+00
GWP-luluc	kg CO_2 eq.	3,79E-03	3,95E-06	1,06E-06	2,06E-04	5,41E-06	3,46E-05	-1,01E-04
ODP	kg CFC 11 eq.	2,89E-08	4,40E-15	1,58E-13	1,24E-15	1,46E-13	3,10E-14	-1,00E-11
AP	mol H^+ eq.	5,32E-02	9,20E-06	1,34E-05	7,56E-05	2,60E-04	5,62E-05	-1,17E-03
EP-freshwater	kg P eq.	6,93E-03	1,90E-09	2,88E-08	5,24E-08	3,13E-08	5,39E-06	-1,87E-06
EP-marine	kg N eq.	5,94E-03	2,44E-06	3,35E-06	3,71E-05	5,84E-05	1,21E-05	-3,56E-04
EP-terrestrial	mol N eq.	4,92E-02	4,48E-05	3,51E-05	4,12E-04	1,24E-03	1,33E-04	-3,81E-03
POCP	kg NMVOC eq.	3,92E-02	6,48E-06	8,87E-06	7,11E-05	1,72E-04	3,87E-05	-1,01E-03
ADP- minerals& metals*	kg Sb eq.	3,34E-05	6,46E-11	1,30E-09	1,05E-09	1,51E-09	6,24E-10	-9,71E-08
ADP-fossil*	MJ	1,18E+02	1,25E-02	1,46E-01	1,60E-01	3,17E-01	1,59E-01	-1,97E+01
WDP*	m^3	2,70E+00	7,21E-03	1,92E-03	1,83E-04	2,40E-01	1,21E-03	-1,23E-01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; 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; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption							

** Disclaimers:*

•"Product recently on the market – Results of this EPD shall be used with care as the LCI data is not yet based on 1 year of production which may result in increased uncertainty"

•Infrastructure/capital goods are excluded in upstream, core and downstream processes.

•The results of modules A1-A3 should not be used without considering the results of module C.

•The environmental impacts of the declared unit for the following results of the indicators and the corresponding disclaimers were reported in the EPD according to EN 15804:2012+A2:2019/AC:2021, JRC characterization factors (based on EF3.1).

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

Additional mandatory and voluntary impact category indicators

Results per declared unit (1 m^2 XPS panel product with an R value of 1 m^2*K/W)								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG	kg CO_2 eq.	6,49E+00	8,91E-02	6,96E-03	1,23E-02	2,96E+00	9,40E-03	-1,11E+00

There was no need to add additional voluntary indicators

Resource use indicators

Results per declared unit (1 m^2 XPS panel product with an R value of 1 m^2*K/W)								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	2,69E+00	3,01E-03	1,05E-01	1,35E-02	9,19E-02	2,40E-02	-6,71E+00
PERM	MJ	8,08E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,69E+00	3,01E-03	1,05E-01	1,35E-02	9,19E-02	2,40E-02	-6,71E+00
PENRE	MJ	1,18E+02	1,25E-02	1,46E-01	1,60E-01	3,17E-01	1,59E-01	-1,97E+01
PENRM	MJ	7,85E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,18E+02	1,25E-02	1,46E-01	1,60E-01	3,17E-01	1,59E-01	-1,97E+01
SM	kg	3,00E-01	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	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	6,42E-02	1,69E-04	8,07E-05	1,52E-05	5,62E-03	3,63E-05	-5,15E-03
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water							

Waste indicators

Results per declared unit (1 m^2 XPS panel product with an R value of 1 m^2*K/W)								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4,70E-02	5,83E-12	2,11E-10	5,18E-12	1,91E-10	3,92E-11	-1,36E-08
Non-hazardous waste disposed	kg	6,73E-04	3,21E-04	1,20E-04	2,49E-05	1,07E-02	3,18E-01	-1,04E-02
Radioactive waste disposed	kg	9,88E-06	5,51E-07	2,33E-05	2,07E-07	1,82E-05	2,24E-06	-1,48E-03

Output flow indicators

Results per declared unit (1 m^2 XPS panel product with an R value of 1 m^2*K/W)								
Indicator	**Unit**	**A1-A3**	**A5**	**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	0,00E+00
Material for recycling	kg	2,80E-03	1,75E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	1,60E-01	0,00E+00	0,00E+00	5,32E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	2,85E-01	0,00E+00	0,00E+00	9,47E+00	0,00E+00	0,00E+00

Identification of significant issues

The A1 module is significant in three impact categories: RU minerals and metals 88,72%, RU fossils 53,75% and WU 57,71%.
The A2 module, the transportation of raw materials by truck and ship is significant in one category: GWP-luluc (75,12%).
At most of the declared parameters the A3 module is the most significant life cycle phase: GWP total 36,21%, GWP fossil 36,38%, ODP 89,08%, AP 77,12%, ETP freshwater 99,28%, ETP marine 60,66%, ETP terrestrial 48,44% and POCP 77,12%.
The A5, C1, C2 and C4 modules are not significant issues (≥10%) in any case. C3 module is only significant in two impact categories (GWP total 36,86% and GWP fossil 30,92%) and close to significant in one (WU 8,12%).

"Product recently on the market – LCI data is not yet based on 1 year of production which may result in increased uncertainty." LCI data are based on data from shorter time period (2024.05-2024.07 – three months). The data are provided to be representative or conservative for 1-year data.
EPD will be updated and re-verified when data from 1 year of production will be available.

Completeness, consistency and sensitivity checks

The LCA study is complete; there are no relevant life cycle phases or processes excluded.
Consistency of the used data is good: high quality specific data have been collected for the A3 module, while the best available generic data have been selected for A1 and for all other life cycle processes.
Sensitivity check would be useful concerning the representativeness of the proxy for the brominated flame retardant. Such analysis is not possible because of the lack of background information.

Additional environmental information

RSL (reference service life)
The XPS insulation is durable for at least 50 years if applied correctly, or even can last as long as the lifetime of the building in which it is used.
The XPS is almost same in their use and material properties to EPS, therefore the EPS RSL references was applied. Durability studies on applied EPS show no loss of technical properties after 35 years. Additional tests with products under artificial aging show that “no deficiencies are to be expected from EPS fills placed in the ground over a normal life cycle of 100 years.” (Long-term Behaviour 2004; Long-term performance 2001)

References

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- ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines. ISO. (2006).
- ISO 14025:2006. Labels and environmental declarations
- EN15804:2012+A2:2019/AC:2021. Sustainability in construction. Product environmental statements. Commodity category rules for construction products.
- ISO – 21930:2017 – Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction product and services
- Product Category Rules (PCR) – Construction Products PCR2019:14; version 1.3.4
- Complementary Product Category Rules (c-PCR) – Thermal Insulation products (EN 16783:2024) (c-PCR-005, 2024-05-03)
- General Program Instruction (GPI) for the International EPD system; version 5.0
- Long-Term Behavior 2004: Aging Resistance of EPS with Long-Term Verification, Carbotech AG, Basel, S-E-E.ch, St. Gallen, 2004.
- T. E. Frydenlund and R. Aaboe (2001): Long term performance and durability of EPS as a lightweight filling material, EPS geofoam conference abstract, 2001
- Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method – JRC report

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