# Environmental Product Declaration

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

## White EPS (expanded polystyrene) thermal insulation sheet from

## Masterplast Nyrt.

| | |
|---|---|
| Programme: | The International EPD® System, www.environdec.com |
| Programme operator: | EPD International AB |
| EPD registration number: | EPD-IES-0010011 |
| Publication date: | 2025-02-27 |
| Valid until: | 2030-02-26 |

*EPD of multiple products, based on the average results of the product group.*
*Product list: EPS 30, EPS LF, EPS EF, EPS 70, EPS 80, EPS 100N, EPS HR 100, EPS 120, EPS 150, EPS 200*
*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*


# Programme information

| | |
|---|---|
| **Programme:** | The International EPD® System |
| **Address:** | EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm<br>Sweden |
| **Website:** | www.environdec.com |
| **E-mail:** | info@environdec.com |

| **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 c-PCR – Thermal Insulation products (EN 16783:2024) (c-PCR-005, 2024-05-03)*<br>*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*.<br>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: *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:<br><br>☒ EPD verification by individual verifier<br><br>Third-party verifier: *Jan Weinzettel*<br>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:<br><br>☐ 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 EPS 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(s): The Masterplast group has production sites in 9 different locations, producing different products. White EPS sheet products are produced in the following Masterplast group companies and sites:

| Company (member of Masterplast group) | White EPS sheet producing site address |
|---|---|
| Masterplast YU d.o.o | Bodrogvari Ferenc str. 172., Subotica, Serbia 24000 |
| MASTERFOAM Ltd. | Jászapáti úti industrial park 1., Kál, Hungary 3350 |
| T-CELL Plasztik Ltd. | Szováti útfél 3/B, Hajdúszoboszló, Hungary 4200 |
| | Zrínyi Miklós str. 101., Zalaegerszeg, Hungary 8900 |

# Product information

Product name: **White EPS (expanded polystyrene) thermal insulation sheet**
Product identification: EPS 30, EPS LF, EPS EF, EPS 70, EPS 80, EPS 100N, EPS HR 100, EPS 120, EPS 150, EPS 200
Product description: White EPS sheets are produced by expanding PS beads (that already contain all necessary additives like blowing agent, flame retardant) in a mould. The volume of the mould and the quantity of the added PS beads determine the density of the product. After the expansion, the product is cut to the desired dimensions and packaged to protect it during storage and transportation.

The products' application is wide, they can be used as thermal insulation:

- of building structures in the ground,
- in a floor on the ground or on a ceiling that cools downwards, under a screed or concrete,

- in an upward-cooling ceiling, in the interior, as large-panel covering placed under screed or concrete base, with normal load capacity, protected by waterproofing,
- in a straight layered, single-skin, warm roof that cannot be walked on,
- in an extensive green roof,
- in facade thermal insulation systems, installed above the plinth line.

During installation, the sheets are laid next to each other on a horizontal surface, glued or mechanically fixed (e.g. doweled) on an inclined or vertical surface.

Product components and materials:
The raw material of product group is white expandable polystyrene bead, which contains polystyrene as the polymer base, a flame retardant, and a blowing agent. Masterplast is not adding any other materials to the product during the production.

Product properties:
The key technical properties of the covered product portfolio are shown in the next table:

| Property | Thermal conductivity (W/mK) | Flexural strength (kPa) | Compression strength at 10% compression (kPa) | Fire protection class |
|---|---|---|---|---|
| **Standard** | **EN 12667** | **EN 12089** | **EN 826** | **EN 13501-1** |
| EPS 30 | 0,044 | 50 | >=30 | E |
| EPS LF | 0,043 | 75 | >=50 | E |
| EPS EF | 0,04 | 100 | >=60 | E |
| EPS 70 | 0,04 | 115 | >=70 | E |
| EPS 80 | 0,038 | 125 | >=80 | E |
| EPS 100N | 0,037 | 135 | >=90 | E |
| EPS HR 100 | 0,036 | 150 | >=100 | E |
| EPS 120 | 0,035 | 170 | >=120 | E |
| EPS 150 | 0,033 | 200 | >=150 | E |
| EPS 200 | 0,033 | 250 | >=200 | E |

UN CPC code: 369: Other plastic products

Geographical scope: the majority of the raw materials (A1) are produced in Europe, the product is manufactured (A3) in Serbia and Hungary, and built into (A5) houses in Europe, where the end-of-life phase also takes place (C1-C4 and D modules).

Multiple products: This EPD is representative of the average white EPS thermal insulation sheet produced by Masterplast group. The list of the products covered by this EPD can be found at the Product identification paragraph. The chemical composition is the same for all listed products, the difference in physical properties are originating from the different expansion ratios. The average was calculated based on the share by weight of each covered product within the product group. While there are some products where the GWP-GHG indicator results for A1-A3 differs from the average by more than 10%, the products' share that are within the 10% limit is almost 90% of the complete production, which justifies the chosen product grouping and calculation approach.

# LCA information

Declared unit: **1 m² white EPS insulation with R value of 1 m²K/W** (38 mm thickness, 0,5863 kg weight) at the factory gate, ready for distribution.

Reference service life: If applied correctly the lifetime of EPS insulation is equal to the building's lifetime, usually without requiring any maintenance. 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)

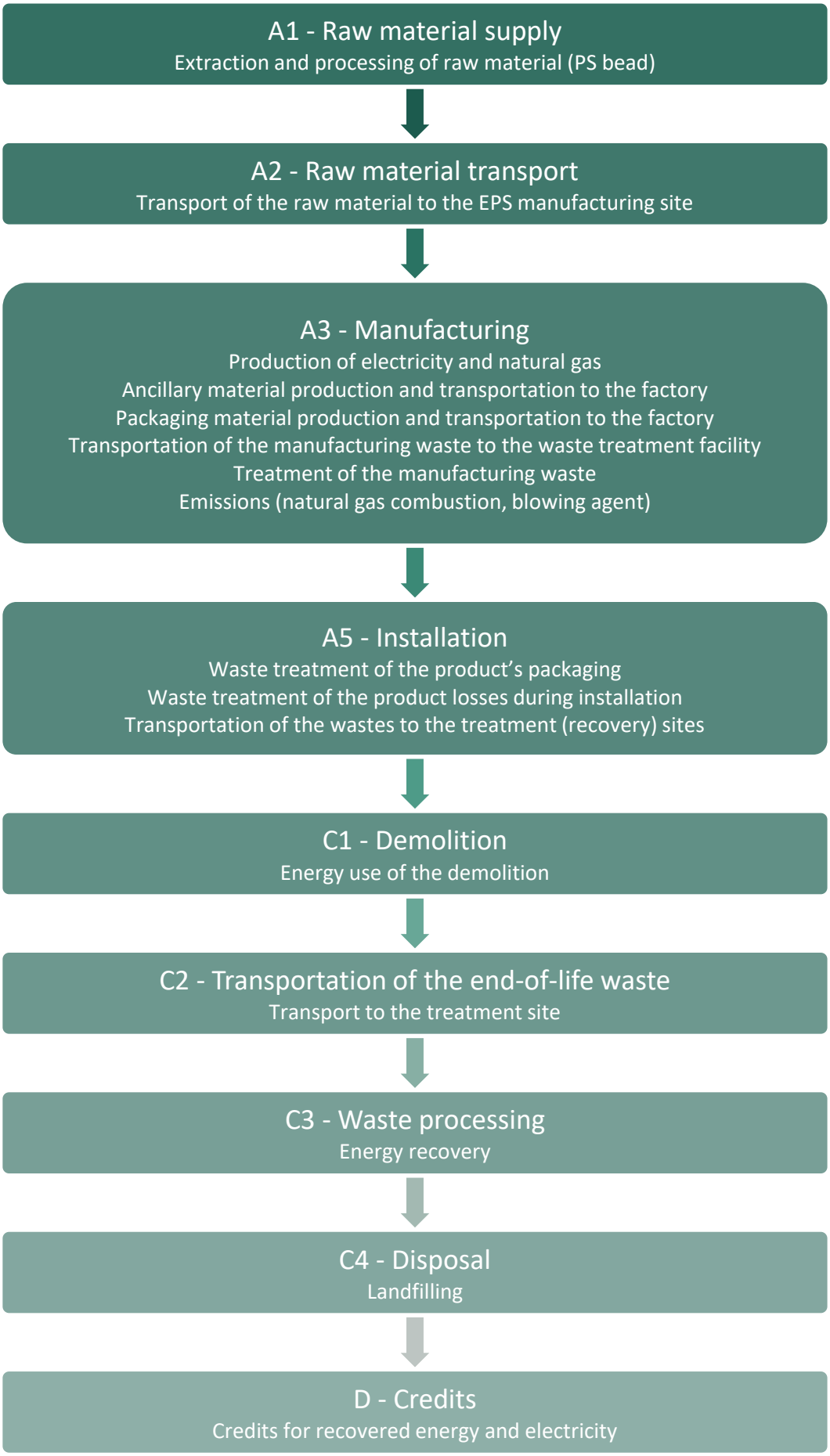
Time representativeness:
Reference years:

- 2023.01.01 – 2023.12.31 for Subotica, Hajdúszoboszló and Zalaegerszeg plants
- 2023.06.01 – 2024.05.31 for Kál plant (because EPS production at Kál started in 2023).

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.


A1 - Raw material supply
Extraction and processing of raw material (PS bead)
A2 - Raw material transport
Transport of the raw material to the EPS manufacturing site
A3 - Manufacturing
Production of electricity and natural gas
Ancillary material production and transportation to the factory
Packaging material production and transportation to the factory
Transportation of the manufacturing waste to the waste treatment facility
Treatment of the manufacturing waste
Emissions (natural gas combustion, blowing agent)
A5 - Installation
Waste treatment of the product's packaging
Waste treatment of the product losses during installation
Transportation of the wastes to the treatment (recovery) sites
C1 - Demolition
Energy use of the demolition
C2 - Transportation of the end-of-life waste
Transport to the treatment site
C3 - Waste processing
Energy recovery
C4 - Disposal
Landfilling
D - Credits
Credits for recovered energy and electricity

Process diagram of the EPS manufacturing process (A3):


Scenario information:

**Installation (A5)**

Due to the various application possibilities of the covered products, a wide range of ancillary materials can be used in varying quantities. Selecting only one scenario to observe is not reasonable and the choice was made to exclude the ancillary materials from this module.

The installation's energy need also varies significantly depending on the exact application method, so estimates could not be made for it. However, previous studies[1] indicate that this energy need is negligible (less than 0,1%) compared to the total energy need, so this omission does not come with any significant effects on the impacts.

Masterplast is operating a waste recovery system[2] in their main market (Hungary), so the consumers have the possibility to send their installation scrap back to Masterplast where it is used as an input in the EPS production process. (Due to the recent start of the program, this waste is not yet included in the input flows.) In other countries, similar collection schemes are also available as this type of scrap can be used in any EPS production.

The packaging of the products can be recycled, so the transport to a recovery site is assumed.

**Demolition (C1)**

Limited information is available on the energy demand of demolitions and no information was available for the removal of the EPS product specifically. The most common building structure in the market served by Masterplast is concrete, so the general energy of the demolition of a concrete structure was assumed, which is 0,07 MJ/kg according to the JRC report[1].

**Transport to waste processing (C2)**

The transport distance was assumed to be 100 km and the transportation method to be a truck.

**Waste processing (C3)**

According to the THE EPS-INDUSTRY'S JOURNEY TOWARDS CIRCULARITY report [3], out of all the EPS construction waste, 66% is going to incineration with energy recovery and 10% is going to recycling. However, this construction waste includes the wastes generated during installation and it is reasonable to assume that only this type of pure waste can be recycled currently, and the EOL product extracted during demolition has 0% recycling rate.

The ratio of energy recovery and landfilling is assumed to stay constant, which means that 73,3% of the waste would be incinerated with energy recovery and the rest is landfilled.

**Disposal (C4)**

The rest of the EPS construction waste (26,6%) is assumed to end up on a landfill based on the same report[3] and same assumptions as in module C3.

**Benefits (D)**

[1] JRC Report - Model for Life Cycle Assessment (LCA) of buildings (2018)
[2] https://www.masterplast.hu/hungarocell-zold-program/
[3] https://eumeps.eu/images/website/the-eps-industry-s-journey-towards-circularity-progress-report-final.pdf

Benefits are calculated based on the heat and electricity generation during the energy recovery of the EOL EPS waste. The used process describes the benefits from the incineration with average substituted heat and electricity.

Allocation:
Since the covered product portfolio is produced in the same plants and same machinery as the grey EPS products of Masterplast, physical allocation was used for the materials and energies that were shared between the two product groups.
There is also a co-product called Sole, which is used as packaging of other products. Economic allocation was applied between the EPS products (white and grey) and the Sole co-product. The Sole co-product holds no value, which means that it receives 0% of the impact.

Cut-off criteria:
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.

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, 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 $CO_2$eq / kWh) | Share within consumption (%) |
| A3 | HU: electricity, medium voltage, residual mix | ecoinvent | 2022 | | 0,4129 | 49,6 |
| | RS: electricity, medium voltage, residual mix | ecoinvent | 2022 | | 1,1152 | 44,1 |
| | HU: Electricity from photovoltaic | Sphera | 2020 | 2026 | 0,0308 | 6,3 |
| 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 | RER | GLO | HU, RS | - | RER | - | - | - | - | - | - | - | RER | RER | RER | RER | RER |
| Specific data used | 20,7% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation – products | -31,4%, +66,2% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation – sites | 0,87% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |

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 |
|---|---|---|---|
| Polystyrene with flame retardant | 0,5863 | 0 | 0 resp. 0 |
| **TOTAL** | **0,5863** | **0** | **0 resp. 0** |
| **Packaging materials** | **Weight, kg** | **Weight-% (versus the product)** | **Weight biogenic carbon, kg C/kg** |
| LDPE film | 8,34E-03 | 1,423% | 0 |
| Stretch film | 2,14E-03 | 0,366% | 0 |
| Self-adhesive label | 2,47E-04 | 0,042% | 0,3560 |
| **Total** | **1,07E-02** | **1,831%** | **0,0081** |

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

# 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 (based on EF 3.1)

**Results per declared unit (1 $m^2$ of white EPS with R=1 $m^2K/W$ thermal resistance)**

| Indicator | Unit | A1-A3 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| GWP-fossil | kg $CO_2$ eq. | 1,72E+00 | 1,74E-04 | 3,37E-03 | 5,91E-03 | 1,43E+00 | 4,55E-03 | -5,35E-01 |
| GWP-biogenic | kg $CO_2$ eq. | 3,47E-03 | 0,00E+00 | 3,03E-05 | 0,00E+00 | 3,37E-05 | 0,00E+00 | 0,00E+00 |
| GWP-luluc | kg $CO_2$ eq. | 1,31E-03 | 2,95E-06 | 5,12E-07 | 1,00E-04 | 2,63E-06 | 1,68E-05 | -4,90E-05 |
| GWP-total | kg $CO_2$ eq. | 1,72E+00 | 1,77E-04 | 3,40E-03 | 6,01E-03 | 1,43E+00 | 4,57E-03 | -5,35E-01 |
| ODP | kg CFC 11 eq. | 1,62E-09 | 1,77E-17 | 7,64E-14 | 6,00E-16 | 7,06E-14 | 1,50E-14 | -4,86E-12 |
| AP | mol $H^+$ eq. | 3,92E-03 | 1,08E-06 | 6,52E-06 | 3,67E-05 | 1,26E-04 | 2,73E-05 | -5,68E-04 |
| EP-freshwater | kg P eq. | 1,41E-04 | 7,48E-10 | 1,40E-08 | 2,54E-08 | 1,52E-08 | 2,61E-06 | -9,06E-07 |
| EP-marine | kg N eq. | 1,05E-03 | 5,30E-07 | 1,63E-06 | 1,80E-05 | 2,83E-05 | 5,87E-06 | -1,72E-04 |
| EP-terrestrial | mol N eq. | 1,11E-02 | 5,88E-06 | 1,70E-05 | 2,00E-04 | 6,00E-04 | 6,44E-05 | -1,85E-03 |
| POCP | kg NMVOC eq. | 3,05E-02 | 1,02E-06 | 4,30E-06 | 3,45E-05 | 8,35E-05 | 1,88E-05 | -4,88E-04 |
| ADP-minerals&metals* | kg Sb eq. | 1,67E-05 | 1,49E-11 | 6,31E-10 | 5,07E-10 | 7,33E-10 | 3,03E-10 | -4,71E-08 |
| ADP-fossil* | MJ | 5,28E+01 | 2,29E-03 | 7,08E-02 | 7,77E-02 | 1,54E-01 | 7,70E-02 | -9,57E+00 |
| WDP* | $m^3$ | 1,90E-01 | 2,61E-06 | 9,32E-04 | 8,87E-05 | 1,16E-01 | 5,89E-04 | -5,95E-02 |
| 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:*

- *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 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-GHG | kg $CO_2$ eq. | 1,72E+00 | 1,77E-04 | 3,37E-03 | 6,01E-03 | 1,43E+00 | 4,57E-03 | -5,35E-01 |

| Results per declared unit (1 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Particulate matter | Disease indicences | 2,80E-08 | 6,93E-12 | 5,45E-11 | 2,35E-10 | 7,28E-10 | 2,82E-10 | -4,65E-09 |
| Ionising radiation, human health | kBq U235 eq. | 5,35E-02 | 4,13E-07 | 1,86E-03 | 1,40E-05 | 1,41E-03 | 1,49E-04 | -1,18E-01 |
| Ecotoxicity, freshwater | CTUe | 2,57E+01 | 1,68E-03 | 2,05E-02 | 5,72E-02 | 6,31E-02 | 1,67E-01 | -1,37E+00 |
| Human toxicity, cancer | CTUh | 8,06E-10 | 3,39E-14 | 1,15E-12 | 1,15E-12 | 7,99E-12 | 2,47E-12 | -1,10E-10 |
| Human toxicity, non-cancer | CTUh | 2,33E-08 | 1,51E-12 | 1,77E-11 | 5,11E-11 | 5,69E-11 | 5,18E-11 | -2,57E-09 |

Disclaimer: The ionising radiation, human health 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. 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.

## Resource use indicators

| Results per declared unit (1 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| PERE | MJ | 1,21E+00 | 1,93E-04 | 5,11E-02 | 6,57E-03 | 4,45E-02 | 1,16E-02 | -3,25E+00 |
| PERM | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | MJ | 1,21E+00 | 1,93E-04 | 5,11E-02 | 6,57E-03 | 4,45E-02 | 1,16E-02 | -3,25E+00 |
| PENRE | MJ | 5,28E+01 | 2,29E-03 | 7,08E-02 | 7,77E-02 | 1,54E-01 | 7,70E-02 | -9,57E+00 |
| PENRM | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | MJ | 5,28E+01 | 2,29E-03 | 7,08E-02 | 7,77E-02 | 1,54E-01 | 7,70E-02 | -9,57E+00 |
| SM | kg | 0,00E+00 | 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 |

| Results per declared unit (1 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| FW | $m^3$ | 7,99E-03 | 2,17E-07 | 3,91E-05 | 7,38E-06 | 2,72E-03 | 1,76E-05 | -2,50E-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 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Hazardous waste disposed | kg | 1,39E-03 | 7,40E-14 | 1,02E-10 | 2,51E-12 | 9,26E-11 | 1,90E-11 | -6,58E-09 |
| Non-hazardous waste disposed | kg | 1,83E-02 | 3,56E-07 | 5,84E-05 | 1,21E-05 | 5,18E-03 | 1,54E-01 | -5,03E-03 |
| Radioactive waste disposed | kg | 2,08E-04 | 2,96E-09 | 1,13E-05 | 1,00E-07 | 8,84E-06 | 1,09E-06 | -7,19E-04 |

## Output flow indicators

| Results per declared unit (1 $m^2$ of white EPS with R=1 $m^2$K/W thermal resistance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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 | 2,73E-03 | 1,66E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | kg | 1,64E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,25E-01 | 0,00E+00 | 0,00E+00 |
| Exported energy, electricity | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,58E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy, thermal | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,59E+00 | 0,00E+00 | 0,00E+00 |

Variation of the results:

The presented results can be converted to each product specifically by multiplying them with following conversion factors:

| Product | Conversion factor (-) |
|---|---|
| EPS 30 | 0,686 |
| EPS LF | 0,820 |
| EPS EF | 0,913 |
| EPS 70 | 0,945 |
| EPS 80 | 0,972 |
| EPS 100N | 1,069 |
| EPS HR 100 | 1,103 |
| EPS 120 | 1,238 |

| Product | Conversion factor (-) |
|---|---|
| EPS 150 | 1,392 |
| EPS 200 | 1,622 |

The same conversion factors can be applied for all calculated impact categories.

The variations for the complete product portfolio, for all impact categories are -31,4% and +66,2%.

This high variation occurs because the results are proportional to the unit weight of each product, and the unit weights are different because of the different expansion ratio of each product. (In this case the unit weight is defined as the weight of 1 $m^2$ product with an R value of 1 $m^2K/W$.)

## Identification of significant issues

The contributions of the modules were assessed based on their contributions to the complete life cycle (all declared modules except D).

At most of the declared parameters the A1 module is the most significant life cycle phase. This includes the production of expandable PS beads and has a very significant contribution to the impact assessment results because it has the largest share in 7 of the 13 mandatory impact categories and it is significant in almost all categories: GWP-fossil (42,07%), GWP-biogenic (127,46%), GWP-luluc (22,15%), GWP-total (42,13%), ODP (42,45%), AP (60,62%), EP-marine (60,72%), EP-terrestrial (60,23%), POCP (10,13%), ADP-minerals&metals (99,40%), ADP-fossil (86,90%), WDP (42,89%).

The A2 module, the transportation of the expandable PS beads by truck and ship is significant in some categories: GWP-luluc (66,17%), AP (11,87%), EP-marine (20,84%), EP-terrestrial (21,19%).

The A3 module is significant in multiple impact categories: GWP-fossil (10,06%), GWP-total (10,04%), ODP (52,31%), AP (22,70%), EP-freshwater (90,80%), EP-marine (13,50%), POCP (87,79%), ADP-fossil (10,71%), WDP (18,46%).

The A5, C1, C2, and C4 modules are not significant in any impact categories.

## 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 organic flame retardant. Such analysis is not possible because of the lack of background information.

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