

# ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025, ISO 21930 and EN 15804+A2 for:

## TI 140 T

From

**KNAUF**INSULATION



|                          |   |
|--------------------------|---|
| Program:                 | The International EPD® System<br><a href="http://www.environdec.com">www.environdec.com</a> |
| Programme operator:      | EPD International AB  |
| EPD registration number: | S-P-05861   |
| Publication date:        | 2022-04-06  |
| Validity date:           | 2027-04-06  |



challenge.  
create.  
care.

## Programme-related information and verification

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

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804+A2. For further information about comparability, see EN 15804+A2 and ISO 14025.

|  |  |
|--|--|
| <b>Programme:</b>                      | The International EPD® System<br>EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm<br>Sweden<br><a href="http://www.environdec.com">www.environdec.com</a><br><a href="mailto:info@environdec.com">info@environdec.com</a> |
| <b>EPD registration number:</b>        | S-P-05861  |
| <b>Published:</b>                      | 2022-04-06   |
| <b>Valid until:</b>                    | 2027-04-06   |
| <b>EPD owner</b>                       | Knauf Insulation Sprl<br>Rue de Maestricht 95<br>4600 Visé<br>Belgium  |
| <b>Product Category Rules:</b>         | PCR 2019 :14. Construction products (EN 15804+A2)<br>Version 1.11<br>Sub-PCR-005 Thermal insulation products (EN 16783:<br>2017) Version: 2019-12-20   |
| <b>Product group classification:</b>   | UN CPC 37  |
| <b>Reference year for plant data:</b>  | 2019   |
| <b>Geographical application scope:</b> | Europe   |

|   |
|---|
| CEN standard EN 15804+A2 serves as the Core Product Category Rules (PCR)  |
| Product category rules (PCR): PCR 2019:14. Construction products (EN 15804+A2) Version 1.11<br>Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20 |
| PCR review was conducted by: The Technical Committee of the International EPD@ System   |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006.  |
| <input checked="" type="checkbox"/> EPD process certification <input type="checkbox"/> EPD verification   |
| Certified by: Bureau Veritas certification Sverige AB SE006845-3  |
| Procedure for follow-up of data during EPD validity involves third party verifier:  |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No   |

*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](http://www.environdec.com).*

## General information

### Information about the company

#### Description of the organisation:

Knauf Insulation has more than 40 years of experience in the insulation industry and is one of the most respected names in insulation worldwide. Knauf Insulation is manufacturing products and solutions mainly in Glass and Rock Mineral Wool, as well as Wood Wool. We operate more than 37 manufacturing sites globally in 15 countries and employ more than 5,000 people.

The Headquarters are located in Visé, in Belgium.



#### Product-related or management system-related certifications:

All Knauf Insulation sites which are covered by EPD process certification system, including the related site for this EPD, are ISO 9001, ISO 14001, ISO 50001 and ISO 45001 certified under the scope "Design, Development and Production of Insulation Materials and Systems".

Knauf Insulation supports the Ten Principles of the United Nations Global Compact on human rights, labor, environment and anti-corruption.

#### Name and location of production site:

The application in construction of the concerned product is Europe. The data utilized for the production stage life cycle assessment are related to production plants located in Krupka (Czech Republic) and Bernburg (Germany)

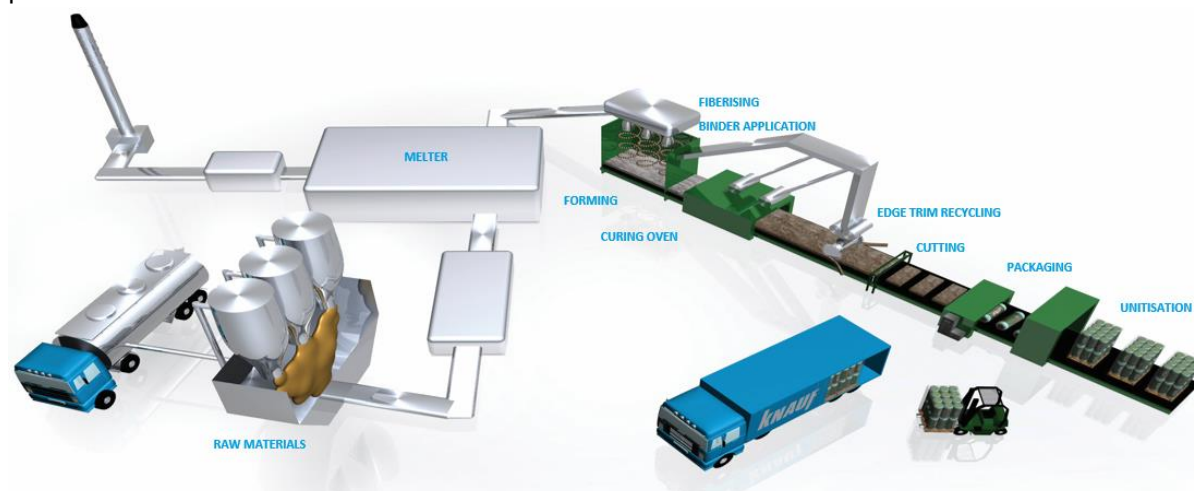
Pod dolní drahou 110, 417 42 Krupka, Czechia  
Weststraße 1, 06406 Bernburg (Saale), Germany

### Information about Glass Mineral Wool production

The Glass Mineral Wool Products for (GMW) are available in the form of slabs, rolls and boards.

In general, the density for Glass Mineral Wool ranges from 10 to 85 kg/m<sup>3</sup> and Glass Mineral Wool consists of at least 92% inert material. The inert part is made of recycled glass (external cullet, up to 80% of the composition) and mainly sand and dolomite.

The remaining fraction (less than or equal to 8%) is made of bio-based binder components. At Knauf Insulation, the binder used for the GMW products is the ECOSE Technology® binder whose origin is plant starch.



## Product information

**Product name:** TI 140 T

**Product identification:** The declared insulation TI 140 T are a compact glass mineral wool, uncoated and unfaced rolls of 1m<sup>2</sup> (considered for this EPD).

For the placing on the construction products market in the European Union/ EFTA (with exception of Switzerland), the Regulation/ (EU) No 305/2011/ applies. The concerned products need Declarations of Performance /DoP G4222KPCPR, G4335KPCPR taking into consideration the harmonized product standard /EN 13162/ and the /CE-mark/.

**Product description:** The main application for TI 140 T is internal partition and pitched roof.

**UN CPC code:**

37990: Non-metallic mineral products (including mineral wool, expanded mineral materials, worked mica, articles of mica, non-electrical articles of graphite or other carbon and articles of peat).

**Geographical scope:** The product is manufactured in Krupka (Czech Republic) and Bernburg (Germany) with their related country energy mix for electricity. Regarding the market area, the product is mainly marketed in Europe.

**Energy:**

Electricity mix and gas inputs are taken from Czech Republic and Germany with reference year 2017 (the latest available in GaBi database). 0.6 kg of CO<sub>2</sub> is released for 1 kWh of Electricity consumption from Krupka (Czech Republic), 0.5 kg CO<sub>2</sub> / kWh of electricity consumption from Bernburg (Germany).

**Technical Characteristics:**

| Parameter                                   | Value                           |
|---|---------------------------------|
| Thermal conductivity/ EN 12667              | 0.036 W/(mK) at 10°C            |
| Water vapor diffusion resistance (EN 12086) | 1                               |
| Thermal Resistance (ISO 8301)               | 1.39 m <sup>2</sup> K/W         |
| Reaction to fire (EN 13501-1)               | A1                              |
| Declared density range/ EN 1602             | 16.8 kg/m <sup>3</sup> (+/-10%) |

## LCA information

### Functional unit / declared unit

The declared unit is 1m<sup>2</sup> of unfaced and uncoated Glass Mineral Wool TI 140 T with a thickness of 50 mm. The declared lambda is 0.036 W/mK. The density used for the calculation of this specific LCA is 16.8 kg/m<sup>3</sup>.

Reference service life: The RSL or durability of TI 140 T is as long as the lifetime of the building equipment in which it is used (at least 50 years).

### Time representativeness & Information on Specific Data:

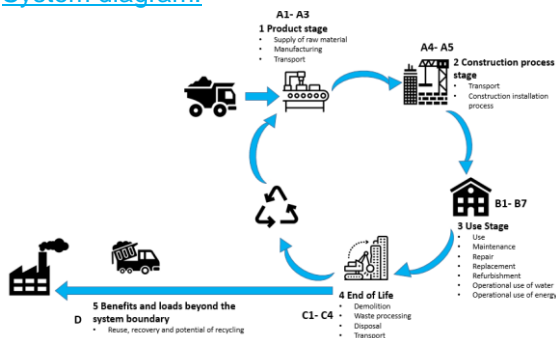
Plant production data for the complete year 2019. The reference product groups considered in this EPD are produced in two different sites with the weight proportional to their annual sales.

The data which is used to carry out the LCA calculations contains >90 % specific data and less 10 % generic data.

### Database(s) and LCA software used:

The LCA model, the data aggregation and environmental impacts are calculated with the software GaBi 10.6 and its Service Pack 40 databases. The impact models used are those indicated in EN 15804:2012+A2:2019.

### System diagram:



### Description of system boundaries:

The system boundary of the EPD follows the modularity approach defined by the EN 15804:2012+A2:2019.

### **The type of EPD is cradle-to-grave.**

List and explanation of the modules declared in the EPD.

**The product stage (A1-A3) includes:**

- A1 - raw material extraction and processing, processing of secondary material input (e.g. recycling processes),
- A2 - transport to the manufacturer and
- A3 - manufacturing.

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage.

The LCA results are given in an aggregated form for the product stage, meaning that the modules A1, A2 and A3 are considered as a unique module A1-A3.

| Product Parameters        | Value                           |
|---------------------------|---------------------------------|
| Declared density          | 16.8 kg/m <sup>3</sup> (+/-10%) |
| Glass mineral wool weight | 0.84 kg                         |
| Surface                   | 1m <sup>2</sup>                 |
| Thickness                 | 50 mm                           |
| Volume                    | 0.05 m <sup>3</sup>             |
| Packaging Plastic sheet   | 0.01 kg                         |
| Packaging Wooden pallet   | 0.03 kg                         |

### **The construction process stage includes:**

- A4 - transport to the construction site and
- A5 - installation into the building.

The transport to the building site (A4) and installation (A5) included in this LCA use the following parameters:

| Parameter   | Value  |
|---|--|
| Average transport distance  | 600 km   |
| Type of fuel and vehicle consumption or type of vehicle used for transport. | Truck Euro 6 (28 – 32 t / 22 t payload). 140 L for 100 km. |
| Truck capacity utilization (including 30% of empty returns)                 | 37.75 % of the weight capacity                             |
| Loss of materials in construction site                                      | 2%   |
| Packaging Wooden pallet   | 40% recycled, 60% incinerated                              |
| Packaging Plastic sheet   | 40% recycled, 60% incinerated                              |

The treatment of the packaging waste after the installation of the product (A5) has been considered.

### **The Use stage (B1-B7) includes:**

- B1: Use
- B2: Maintenance
- B3: Repair



- B4: Replacement
- B5: Refurbishment
- B6: Operational Energy Use
- B7: Operational Water Use

Once installation is complete, no actions or technical operations are required during the use stages until the end of life. Therefore, the mineral wool has no impact (excluding potential energy savings) on this stage.

**The end-of-life stage** includes:

- C1 - de-construction, demolition,
- C2 - transport to waste processing,
- C3 - waste processing for reuse, recovery and/or recycling and
- C4 - disposal.

This includes provision of all transports, materials, products and related energy and water use. The common manual dismantling impact of insulation is considered as very small and can be neglected in C1.

Although Glass Mineral Wool products from Knauf Insulation are partly recycled at their end-of-life, an established collection system does not yet exist. Therefore, the assumption chosen in this study, 100% landfill (C4) after the use phase, is the most conservative approach.

| Parameter   | Value   |
|---|---|
| Disposal type (mineral wool)  | 100% landfill   |
| Average transport distance waste (C2)                                       | 50 km   |
| Type of fuel and vehicle consumption or type of vehicle used for transport. | Truck-trailer, Euro 3, 34 - 40t gross weight / 27t payload capacity/ 40 L for 100 km. (if 100 % utilization). |
| Truck capacity utilization  | 50 % of the weight capacity   |

**Module D** includes reuse, recovery and/or recycling potentials. According to EN 15804:2012+A2:2019 any declared benefits and loads from net flows leaving the product system not allocated as co-products and having passed the end-of waste state shall be included in module D. Benefits considered in module D originate from packaging recycling or incineration.

## Recycled material

The mineral wool waste that is originating from the manufacturing process in the cutting lines is recycled internally and reinjected into the mineral wool production mattress.

Recycled content average for the considered plants for this product was calculated at 73% in 2019 according to the cullet market availability.

## Additional information:

All raw materials for the manufacturing of the declared product, the required energy, water consumption and the resulting emissions are considered into the LCA. Consecutively, the recipe components with a share even less than 1% are included. All neglected processes contribute less than 5% to the total mass or less than 5% to the total energy consumption. For information, the impact of the Glass Mineral Wool plant construction or machines is not taken into account in the life cycle assessment. Allocation criteria with by-products (mineral wool for ceiling tiles) are based on cost.

Materials for fixation and installation are not included into this LCA scope. Regarding installation this EPD only includes the environmental impact related to the product itself like material losses and packaging end of life. This may lead to the need of additional construction products or materials for which the impact is not included in this EPD, and which shall be taken into account at building level.

Knauf Insulation adopts a “worst case” approach into its EPDs.

Conversion factor for this EPD is to multiply all results by 1.19 in order to get impacts for 1 kg. In principal, an insulation product should always be characterized by its thickness and an R value, only taking into account the product's weight could lead to wrong interpretation.

## More information:

[www.knaufinsulation.com](http://www.knaufinsulation.com)

## Name and contact information of LCA practitioner:

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 Knauf Insulation Sprl  
 Rue de Maestricht 95  
 4600 Visé  
 Belgium  
 Contact : sustainability@knaufinsulation.com

Content Declaration

The product does not contain substances on the "Candidate List of Substances of Very High Concern for Authorisation" under the REACH regulation (if above 0.1% of the mass).

| Product components  | Weight %             | Pre-consumer material, weight - % | Post- consumer | Renewable material, weight- % |
|---------------------|----------------------|-----------------------------------|----------------|-------------------------------|
| Mineral Materials   | 20 – 60 %            | 0                                 | 0              | 0                             |
| Recycled Glass      | 40 - 80              | 50                                | 50             | 0                             |
| Bio - based binder  | 2 - 15               | 0                                 | 0              | 85                            |
| Additives           | < 1                  | 0                                 | 0              | 0                             |
| Packaging Materials | Weight, kg/ DU or FU | Weight -% (versus the product)    |                |                               |
| Wooden Pallet       | 0.03                 | 3.97                              |                |                               |
| Polyethylene film   | 0.01                 | 1.32                              |                |                               |
| TOTAL               | 0.04                 | 5.29                              |                |                               |

Declared Modules

Life cycle stages as defined in the European standard EN 15978 :2011 and the description of the system boundaries for the reference product LCA (X = included in the LCA, MND = module is not declared)

| Product stage |           |               | Construction process stage |                           | Use stage |             |        |             |               |                        |                       |                            | End of life stage |                  |          |  | Resource recovery stage |
|---------------|-----------|---------------|----------------------------|---------------------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-------------------|------------------|----------|--|-------------------------|
| Raw materials | 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 |                         |
| A1            | A2        | A3            | A4                         | A5                        | B1        | B2          | B3     | B4          | B5            | B6                     | B7                    | C1                         | C2                | C3               | C4       | D                                      |                         |
| X             | X         | X             | X                          | X                         | X         | X           | X      | X           | X             | X                      | X                     | X                          | X                 | X                | X        | X                                      |                         |

## Environmental performance

**Potential environmental impacts:** 1m<sup>2</sup> of Glass Mineral Wool TI 140 T with a thickness of 50mm and the R value of 1.39m<sup>2</sup>K/W.

| ENVIRONMENTAL IMPACTS |  |           |          |          |          |          |           |          |          |           |
|-----------------------|--|-----------|----------|----------|----------|----------|-----------|----------|----------|-----------|
| Parameter             | Unit   | A1-3***   | A4       | A5       | B1-B7    | C1       | C2        | C3       | C4       | D**       |
| GWP-fossil            | kg CO <sub>2</sub> eq.   | 1.10E+00  | 6.64E-02 | 4.34E-02 | 0.00E+00 | 0.00E+00 | 3.29E-03  | 0.00E+00 | 1.38E-02 | -3.11E-02 |
| GWP-biogenic          | kg CO <sub>2</sub> eq.   | -1.31E-01 | 0.00E+00 | 3.56E-02 | 0.00E+00 | 0.00E+00 | -3.90E-06 | 0.00E+00 | 1.06E-01 | 2.48E-02  |
| GWP-luluc             | kg CO <sub>2</sub> eq.   | 1.30E-03  | 5.41E-04 | 4.12E-05 | 0.00E+00 | 0.00E+00 | 2.68E-05  | 0.00E+00 | 5.89E-05 | -2.20E-05 |
| GWP-total             | kg CO <sub>2</sub> eq.   | 9.70E-01  | 6.69E-02 | 7.91E-02 | 0.00E+00 | 0.00E+00 | 3.31E-03  | 0.00E+00 | 1.19E-01 | -6.35E-03 |
| ODP                   | kg CFC 11 eq.  | 2.82E-14  | 1.31E-17 | 7.67E-16 | 0.00E+00 | 0.00E+00 | 6.47E-19  | 0.00E+00 | 7.75E-15 | -2.07E-14 |
| AP                    | mol H <sup>+</sup> eq.   | 6.55E-03  | 6.84E-05 | 1.47E-04 | 0.00E+00 | 0.00E+00 | 3.30E-06  | 0.00E+00 | 1.00E-04 | -4.46E-05 |
| EP-freshwater         | kg P eq.   | 9.71E-06  | 1.97E-07 | 2.26E-07 | 0.00E+00 | 0.00E+00 | 9.73E-09  | 0.00E+00 | 2.89E-07 | -1.10E-07 |
| EP-marine             | kg N eq.   | 1.16E-03  | 2.14E-05 | 2.77E-05 | 0.00E+00 | 0.00E+00 | 1.01E-06  | 0.00E+00 | 2.77E-05 | -1.35E-05 |
| EP-terrestrial        | mol N eq.  | 2.40E-02  | 2.56E-04 | 5.42E-04 | 0.00E+00 | 0.00E+00 | 1.21E-05  | 0.00E+00 | 2.95E-04 | -1.45E-04 |
| POCP                  | kg NMVOC eq.   | 2.59E-03  | 6.71E-05 | 6.41E-05 | 0.00E+00 | 0.00E+00 | 3.19E-06  | 0.00E+00 | 8.08E-05 | -3.94E-05 |
| ADP-minerals&metals*  | kg Sb eq.  | 2.95E-07  | 5.87E-09 | 6.63E-09 | 0.00E+00 | 0.00E+00 | 2.90E-10  | 0.00E+00 | 1.42E-09 | -5.51E-09 |
| ADP-fossil*           | MJ   | 1.67E+01  | 8.82E-01 | 4.03E-01 | 0.00E+00 | 0.00E+00 | 4.36E-02  | 0.00E+00 | 1.81E-01 | -6.81E-01 |
| WDP                   | m <sup>3</sup>   | 3.93E-02  | 6.14E-04 | 6.62E-03 | 0.00E+00 | 0.00E+00 | 3.04E-05  | 0.00E+00 | 1.04E-03 | -1.66E-03 |
| Acronyms              | <p>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&amp;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</p> |           |          |          |          |          |           |          |          |           |

\*\* : [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

\* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

\*\*\*: The indicators results are calculated with a reference product based on annual production volume (following the dedicated market share). The indicators results span between the reference product and the 100% sourced product from each dedicated plant may vary more than 10% (concerning A1- A3).



## Potential environmental impact – additional mandatory and voluntary indicators

| Indicator   | Unit                   | Tot.A1-A3 | A4       | A5       | B1-B7    | C1       | C2       | C3       | C4       | D         |
|-------------|------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| GWP-GHG [2] | kg CO <sub>2</sub> eq. | 1.10E+00  | 6.65E-02 | 4.35E-02 | 0.00E+00 | 0.00E+00 | 3.29E-03 | 0.00E+00 | 1.37E-02 | -3.12E-02 |

[2] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

**Use of resources:** 1m<sup>2</sup> of Glass Mineral Wool TI 140 T with a thickness of 50mm and the R value of 1.39m<sup>2</sup>K/W.

| RESOURCES USE |  |          |          |          |          |          |          |          |          |           |
|---------------|--|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Parameter     | Unit   | A1-3***  | A4       | A5       | B1-B7    | C1       | C2       | C3       | C4       | D*        |
| PERE [MJ]     | MJ   | 2.33E+00 | 5.07E-02 | 7.04E-02 | 0.00E+00 | 0.00E+00 | 2.51E-03 | 0.00E+00 | 2.12E-02 | -2.29E-01 |
| PERM [MJ]     | MJ   | 1.61E+00 | 0.00E+00 | 2.22E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |
| PERT [MJ]     | MJ   | 3.94E+00 | 5.07E-02 | 9.26E-02 | 0.00E+00 | 0.00E+00 | 2.51E-03 | 0.00E+00 | 2.12E-02 | -2.29E-01 |
| PENRE [MJ]    | MJ   | 1.62E+01 | 8.85E-01 | 4.03E-01 | 0.00E+00 | 0.00E+00 | 4.38E-02 | 0.00E+00 | 1.82E-01 | -6.81E-01 |
| PENRM [MJ]    | MJ.  | 4.78E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |
| PENRT [MJ]    | MJ   | 1.67E+01 | 8.85E-01 | 4.03E-01 | 0.00E+00 | 0.00E+00 | 4.38E-02 | 0.00E+00 | 1.82E-01 | -6.81E-01 |
| SM            | kg   | 6.01E-01 | 0.00E+00 | 1.23E-02 | 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 | 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 | 0.00E+00 | 0.00E+00  |
| FW            | m <sup>3</sup>   | 3.90E-03 | 5.81E-05 | 2.22E-04 | 0.00E+00 | 0.00E+00 | 2.88E-06 | 0.00E+00 | 3.45E-05 | -1.15E-04 |
| 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 |          |          |          |          |          |          |          |          |           |

\*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

\*\*\*: The indicators results are calculated with a reference product based on annual production volume (following the dedicated market share). The indicators results span between the reference product and the 100% sourced product from each dedicated plant may vary more than 10% (concerning A1- A3).

**Waste production and output flows:** 1m<sup>2</sup> of Glass Mineral Wool TI 140 T with a thickness of 50mm and the R value of 1.39m<sup>2</sup>K/W.

| OUTPUT FLOWS AND WASTE CATEGORIES |      |          |          |          |          |          |          |          |          |           |
|-----------------------------------|------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Parameter                         | Unit | A1-3***  | A4       | A5       | B1-B7    | C1       | C2       | C3       | C4       | D*        |
| Hazardous waste disposed          | kg   | 3.82E-09 | 4.66E-11 | 1.46E-10 | 0.00E+00 | 0.00E+00 | 2.31E-12 | 0.00E+00 | 2.87E-09 | -1.29E-10 |
| Non-hazardous waste disposed      | kg   | 3.69E-02 | 1.39E-04 | 2.03E-02 | 0.00E+00 | 0.00E+00 | 6.87E-06 | 0.00E+00 | 8.41E-01 | -2.57E-04 |
| Radioactive waste disposed        | kg   | 8.51E-04 | 1.61E-06 | 2.07E-05 | 0.00E+00 | 0.00E+00 | 7.94E-08 | 0.00E+00 | 2.48E-06 | -2.86E-05 |
| 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 | 0.00E+00 | 0.00E+00  |
| Material for recycling            | kg   | 0.00E+00 | 0.00E+00 | 1.81E-02 | 0.00E+00 | 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 | 2.72E-02 | 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 | 0.00E+00 | 9.11E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |
| Exported energy, thermal          | MJ   | 0.00E+00 | 0.00E+00 | 1.64E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |

\*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

\*\*\*: The indicators results are calculated with a reference product based on annual production volume (following the dedicated market share). The indicators results span between the reference product and the 100% sourced product from each dedicated plant may vary more than 10% (concerning A1- A3).

| ADDITIONAL IMPACT CATEROGIES AND INDICATORS |   |          |          |          |          |          |          |          |          |           |
|---|---|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Parameter                                   | Unit  | A1-3***  | A4       | A5       | B1-B7    | C1       | C2       | C3       | C4       | D*        |
| PM  | Disease Incidence   | 6.76E-08 | 5.00E-10 | 1.49E-09 | 0.00E+00 | 0.00E+00 | 2.44E-11 | 0.00E+00 | 1.22E-09 | -3.47E-10 |
| IRP   | kBq U235 eq.  | 6.04E-02 | 2.35E-04 | 1.76E-03 | 0.00E+00 | 0.00E+00 | 1.16E-05 | 0.00E+00 | 2.39E-04 | -4.47E-03 |
| ETP- fw                                     | CTUe  | 2.06E+01 | 6.54E-01 | 4.53E-01 | 0.00E+00 | 0.00E+00 | 3.24E-02 | 0.00E+00 | 1.11E-01 | -2.43E-01 |
| HTP-c                                       | CTUh  | 2.79E-10 | 1.32E-11 | 7.06E-12 | 0.00E+00 | 0.00E+00 | 6.55E-13 | 0.00E+00 | 1.39E-11 | -7.38E-12 |
| HTP- nc                                     | CTUh  | 3.26E-08 | 6.89E-10 | 7.63E-10 | 0.00E+00 | 0.00E+00 | 3.40E-11 | 0.00E+00 | 1.55E-09 | -3.36E-10 |
| SQP   | dimensionless   | 1.72E+01 | 3.03E-01 | 3.67E-01 | 0.00E+00 | 0.00E+00 | 1.50E-02 | 0.00E+00 | 4.26E-02 | -7.36E-02 |
| Acronyms                                    | PM = Particulate matter emissions; IRP= Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality |          |          |          |          |          |          |          |          |           |

[Information on biogenic carbon content](#)

| Results per functional or declared unit |      |          |
|---|------|----------|
| BIOGENIC CARBON CONTENT                 | Unit | QUANTITY |
| Biogenic carbon content in product      | kg C | 9.26E-05 |
| Biogenic carbon content in packaging    | kg C | 1.67E-02 |

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO<sub>2</sub>.

\*\*\*: The indicators results are calculated with a reference product based on annual production volume (following the dedicated market share). The indicators results span between the reference product and the 100% sourced product from each dedicated plant may vary more than 10% (concerning A1- A3). \*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

## LCA interpretation

### ENVIRONMENTAL IMPACTS

All impact categories except the Abiotic Depletion Potential for Non-Fossil Resources (ADP- minerals & metals) and the Depletion Potential of the Stratospheric Ozone layer (ODP) are dominated by the production. This is mainly due to the consumption of energy (electricity and natural gas) during the production of glass mineral wool.

**The Global Warming Potential (GWP-total)** is clearly dominated by the production, mostly due to energy consumption (electricity and natural gas).

**The Depletion Potential of the Stratospheric Ozone layer (ODP)** seems highly influenced by the production.

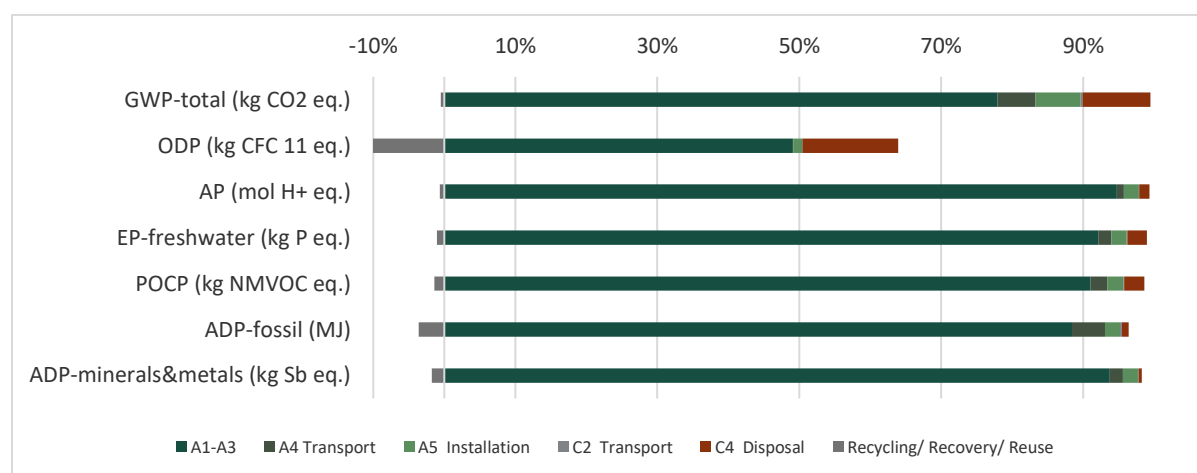
**The Acidification Potential (AP)** is also dominated by the production due to the process's emissions and the electricity consumption. Most of impact is by emissions of sulphur dioxide, ammonia and nitrogen oxides.

**The Eutrophication Potential Fresh Water (all EP indicators in total)** is significantly influenced by production due to emissions from curing oven, furnace and other unit processes. The glucose for the binder production also has an impact because of crops fertilizers use.

**The Formation Potential of Tropospheric Ozone (POCP)** is dominated by the production due to emissions in the curing oven and in other unit processes but also energy consumption.

**The Abiotic Depletion Potential for Non-Fossil Resources (ADP- minerals & metals)** is dominated by the raw materials production.

**The Abiotic Depletion Potential for Fossil Resources Potential (ADP-fossil)** is dominated by natural gas use and the electricity consumption for the production. The packaging and the binder have also a non-negligible impact. The installation stage has a "positive" contribution thanks to energy recovery from incineration of a percentage of plastic packaging and the avoidance production of new plastic production thanks to a percentage of recycling plastic packaging.



## RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the production of glass mineral wool products (especially due to the energy consumption) and with the little influence of raw materials, binder and packaging.

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the binder (bio-based), the production, (electricity mix) and the packaging (wooden pallets).

For the Use of Secondary Material (SM), there is a lot of external cullet used into the batch process (recycled glass from windows and bottles) up to 80% depending on plants.

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