

**Knauf Insulation unfaced rolls with a density of  $16\text{kg/m}^3$  and a thermal conductivity of:**

**-  $0.038\text{W/mK}$  at  $23^\circ\text{C}$  (JP)**

**-  $0.037\text{W/mK}$  at  $20^\circ\text{C}$  (MY & SG)**



*In accordance with: ISO 14025, ISO 21930, EN15804+A2:2019/AC:2021*

Program:	The International EPD® System <a href="http://www.environdec.com">www.environdec.com</a>
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com).

Knauf Insulation EPDs could cover one or several products (multi-products). In the case the EPD cover multiple products, the results are based on worst-case results.

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

<b>Programme:</b>	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden <a href="http://www.environdec.com">www.environdec.com</a> <a href="mailto:info@environdec.com">info@environdec.com</a>
<b>EPD registration number:</b>	S-P-11439
<b>Published:</b>	2024-05-29
<b>Valid until:</b>	2029-05-29
<b>EPD owner</b>	Knauf Insulation Sprl Rue de Maestricht 95 4600 Visé (Belgium)
<b>Product Category Rules:</b>	PCR 2019:14. Construction products (EN 15804+A2) Version 1.3.2 Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20
<b>Product group classification:</b>	UN CPC 37
<b>Reference year for plant data:</b>	2023
<b>Geographical application scope:</b>	Asia Pacific (APAC)

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 1.3.2 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.

☒ EPD verification by EPD Process Certification\*

Third-party verification: *Viktor Hakkarainen, Bureau Veritas (Certificate number: SE008541-1)* an approved certification body accountable for third-party verification.

Third-party verifier is accredited by: *SWEDAC - Sverige AB 1236*

\*For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see the GPI.

Procedure for follow-up of data during EPD validity involves third party verifier:

☒ Yes      ☐ No

## General information

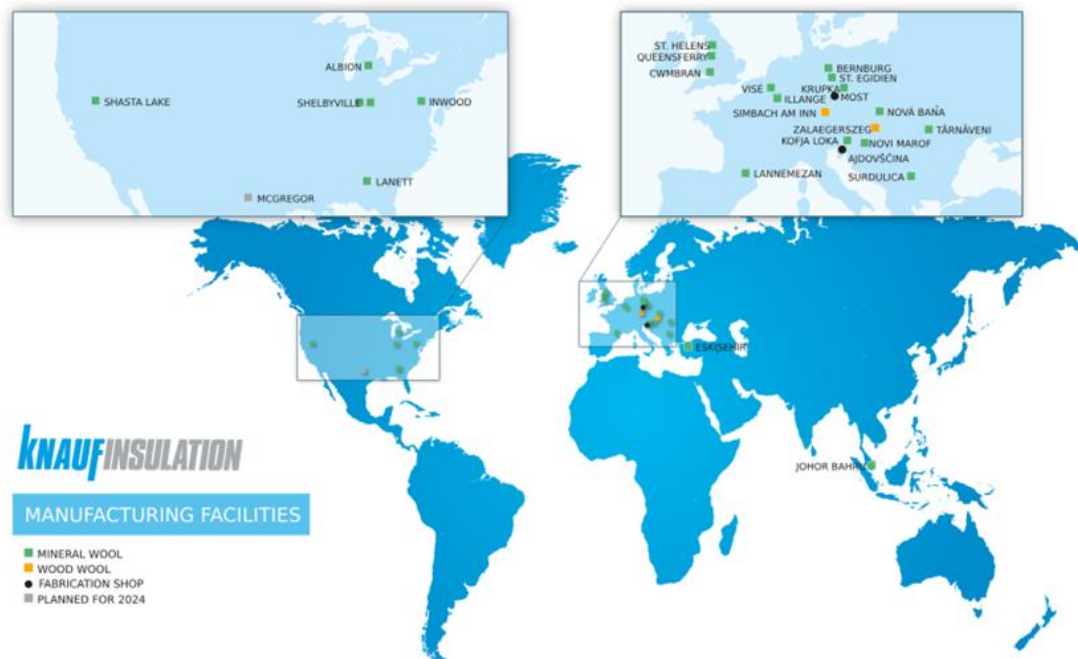
### Information about the company

#### Description of the organisation:

Knauf Insulation is a leading provider of glass and rock mineral wool, as well as wood wool insulation solutions. With more than 40 years of experience in the insulation industry, it is one of the most respected names in insulation worldwide.

As part of the Knauf Group, a €15.4bn turnover family-owned global manufacturer of building materials and construction systems, Knauf Insulation employs more than 6,000 employees and has 28 manufacturing sites in 15 countries, with a turnover of €2.5bn.

Knauf Insulation's mission is to challenge conventional thinking and create innovative insulation solutions that shape the way we live and build in the future, with care for the people who make them, the people who use them and the world we all depend on. Its vision is to lead the change in smarter insulation solutions for a better world.



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 sites considered 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 intended application of this product in the construction industry is within the Asia Pacific region. The data utilized for the production stage life cycle assessment is related to the Knauf Insulation production plant located in Johor Bahru (Malaysia).

Address: Jln Teruntum 4, Kawasan Perindustrian Tanjung Langsat, 81700 Pasir Gudang, Johor Bahru, Malaysia

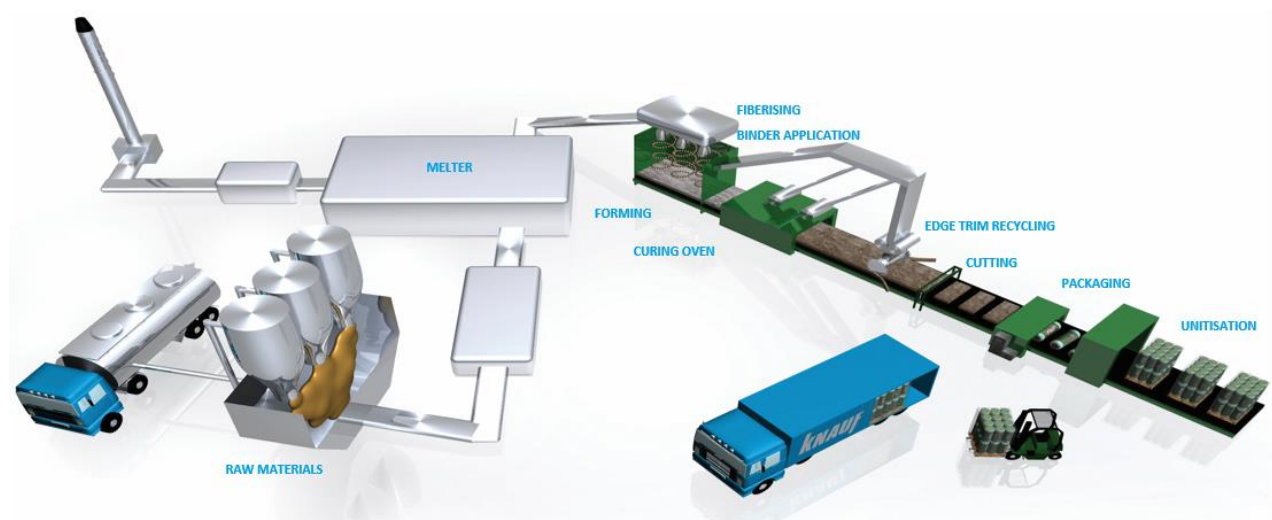
## Information about Glass Mineral Wool production

Knauf Insulation glass mineral wool products (GMW) are available in the form of rolls, slabs/batts and blowing wool.

Typically, the density of glass mineral wool falls within the range of 7.5 to 85 kg/m<sup>3</sup>, and it comprises a minimum of 92% inert materials. The inert part primarily comprises recycled glass (external cullet), which constitutes up to 80% of the composition. Sand and dolomite are introduced to the mix, and the entire blend is melted together in a furnace.

For slabs/batts and rolls, the residual fraction, which accounts for up to 8%, is composed of bio-based binder components. At Knauf Insulation, the binder used for the glass mineral wool products is ECOSE® Technology binder. ECOSE® Technology is unique to Knauf Insulation and contains no added formaldehyde or phenol. Additionally, this binder is derived from rapidly renewable natural raw materials, specifically plant starch.

Blowing wool insulation is a non-bonded, virgin fibrous insulation material, manufactured as a loose-fill product without the use of binders. In contrast, rolls and slabs/batts of insulation are bonded and cured in an oven.





## Product information

**Product name:** Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP - Japan) | 0.037W/mK at 20°C (MY - Malaysia & SG - Singapore) covers the following product range: Earthwool Ceiling and Wall Roll and Knauf Insulation Metal Roofing Roll (unfaced).

**Product identification:** The declared insulation consists of Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) | 0.037W/mK at 20°C (MY & SG), glasswool, unfaced rolls of 1m<sup>2</sup> (considered for this EPD). Thermal conductivity is tested at varying temperatures in various countries dependent on local industry standards.

**Product description:** The main application for Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) | 0.037W/mK at 20°C (MY & SG) is all construction applications excluding floorings and linear pipe thermal insulation.

**Geographical scope:** The manufacturing is in Johor Bahru (Malaysia). Energy-related information is described in the next section. Regarding the market area, the product is mainly marketed in the Asia Pacific region.

### Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN 12667	0.038W/mK at 23°C (JP) 0.037W/mK at 20°C (MY & SG)
Water vapor diffusion resistance (EN 12086)	1
Thermal Resistance (ISO 8301)	1.30 m <sup>2</sup> K/W at 23°C (JP) 1.35 m <sup>2</sup> K/W at 20°C (MY & SG)
Declared density range/ EN 1602	16 kg/m <sup>3</sup> (+/-10%)

### 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).

## LCA information

### Functional unit / declared unit:

The declared unit is 1m<sup>2</sup> of glasswool Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> (for a thickness of 50 mm, a declared thermal conductivity of 0.038W/mK at 23°C (JP) and R-value of 1.30 m<sup>2</sup>K/W | 0.037W/mK at 20°C (MY & SG) and R-value of 1.35 m<sup>2</sup>K/W).

**Reference service life (RSL):** The RSL or durability of Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) | 0.037W/mK at 20°C (MY & SG) is as long as the lifetime of the building equipment in which it is used (at least 60 years).

### Time representativeness & Information on Specific Data:

Plant production data for the year 2023 is used. The product considered in this EPD is produced in one single manufacturing plant; therefore, variations issue for sites is not relevant.

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

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

The LCA model, the data aggregation and environmental impacts are calculated with the software LCA for Experts (GaBi) 10.7 and its content version 2023.2. The impact models used are those indicated in EN 15804:2012+A2:2019.

### Gas information

Gas input (reference year: 2019) from Malaysia is selected for Johor Bahru (Malaysia).

### Electricity information

Plants (countries)	Electricity mixes	Locations (electricity)	Dataset Reference Year	Impact (kg CO <sub>2</sub> /kwh)
Johor Bahru (Malaysia)	Renewable Energy Certificates	Malaysia	2019	0.053

## 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.

For a comprehensive assessment, it is strongly recommended to consider the results from all the modules. Relying exclusively on Modules A1-A3 may lead to incomplete conclusions.

A comprehensive list and detailed explanations of each stage within the EPD are available as follows.

### 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 presented in an aggregated format for the product stage, where modules A1, A2, and A3 are consolidated into a single module, denoted as A1-A3.

Product Parameters	Value
Glass mineral wool weight	0.80 kg
Area	1m <sup>2</sup>
Thickness	50 mm
Volume	0.05 m <sup>3</sup>
Packaging – PE film	0.001 kg
Packaging – PP masterbag	0.003 kg
Packaging – Wooden Pallets	0.11 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 (truck)	300 km
Type of fuel and vehicle used for transport (truck)	Truck Euro 6 (28 – 32 t / 22 t payload).
Truck capacity utilisation (including 30% of empty returns)	24.82 % of the weight capacity
Average transport distance (ship)	7000 km
Type of ship used for transport	Container ship (5000 to 200000 dwt payload capacity)
Loss of materials on site	2%
Packaging – PE film, PP masterbag	15% recycled, 85% incinerated
Packaging – Wooden Pallets	15% recycled, 85% incinerated

The treatment and the transport 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 transport, 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 in all countries. 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 6, 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. The benefits considered in module D originate from packaging recycling or incineration.

#### Recycled material

The mineral wool waste generated during the manufacturing process is recycled internally and fed back into the mineral wool production process at multiple stages.

Recycled content average for the considered plants for this product was calculated at 66% in 2023 according to the cullet market availability. The calculation is taking into account the % of secondary materials from external supply input into the batch against virgin raw materials supply. The external waste considerations are also following the ISO 14021 standard.

#### Additional information:

All raw materials used in the manufacture of the declared product, the required energy, water consumption and the resulting emissions are considered in the LCA. As a result, recipe components with a share of 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 manufacturing equipment 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 required for fixing and installation are not included in the scope of this LCA. The impact of any additional construction products or materials not included in this EPD should be accounted for at building level. Regarding installation, this EPD only includes the environmental impacts relating to the product itself, such as material losses and packaging disposal.

Knauf Insulation adopts a conservative approach in its EPDs.

The conversion factor used in this EPD involves multiplying the results by 1.25 to obtain Environmental Impact Indicator results for 1 kg. An insulation product should always be characterized by its thickness and R-value. Solely considering the product's weight could potentially lead to misinterpretations.

#### Differences versus previous versions:

In the previous version of this EPD, wooden pallets were not included in the calculation. However, due to a change in supply chain logistics, this product will now be distributed with pallets. As a result, the calculations have been updated to include them.

#### 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](mailto: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 - % (out of total)	Post- consumer % (out of total)	Renewable material, weight- % (out of total)
Mineral Materials	20 – 60	0	0	0
Recycled Glass	40 – 80	0-25	75-100	0
Bio - based binder	2 - 15	0	0	80
Additives	< 1	0	0	0
Packaging Materials	Weight, kg/ DU or FU	Weight -% (versus the product)		
Packaging - PE film (0-50% recycled content)	0.004	0.44%		
Packaging - PP Masterbags	0.003	0.33%		
Packaging Wooden Pallet	0.11	13.92%		
Total	0.12	14.68%		

## Declared Modules, geography, share of specific data (in GWP-GHG indicator) & data variation

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  Reuse-Recovery-Recycling-potential
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-constitution demolition	Transport	Waste processing	Disposal		
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Geography	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	APAC	
Share of specific data	> 90 %																	
Variation* – products	<10 %																	
Variation** – Sites	0%																	

\*Variation regarding the average EPD result in terms of GWP-GHG indicator amongst products covered with this EPD

\*\*Variation regarding the average EPD result in terms of GWP-GHG indicator

According to PCR 2019:14 v1.3.2 infrastructure should be outside of the system boundary. However, infrastructure impacts could have been considered in some GaBi background datasets.

## Environmental performance

**Potential environmental impacts:** 1m<sup>2</sup> of glasswool Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) and R-value of 1.30 m<sup>2</sup>K/W | 0.037W/mK at 20°C (MY & SG) with a thickness of 50 mm and the R-value of 1.35 m<sup>2</sup>K/W.

*These results are representative of all the products mentioned in this EPD. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.*

ENVIRONMENTAL IMPACTS										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D**
GWP-fossil	kg CO <sub>2</sub> eq.	1.03E+00	1.16E-01	3.97E-02	0.00E+00	0.00E+00	2.45E-03	0.00E+00	1.29E-02	-1.11E-01
GWP-biogenic	kg CO <sub>2</sub> eq.	-2.76E-01	0.00E+00	2.26E-01	0.00E+00	0.00E+00	1.34E-04	0.00E+00	8.02E-02	0.00E+00
GWP-luluc	kg CO <sub>2</sub> eq.	4.73E-04	1.37E-06	1.16E-05	0.00E+00	0.00E+00	3.28E-08	0.00E+00	5.61E-05	-2.79E-06
GWP-total	kg CO <sub>2</sub> eq.	7.53E-01	1.16E-01	2.66E-01	0.00E+00	0.00E+00	2.58E-03	0.00E+00	9.31E-02	-1.11E-01
ODP	kg CFC 11 eq.	9.32E-13	5.61E-15	3.97E-14	0.00E+00	0.00E+00	2.14E-16	0.00E+00	7.38E-15	-4.79E-13
AP	mol H <sup>+</sup> eq.	3.92E-03	2.43E-03	1.67E-04	0.00E+00	0.00E+00	2.75E-06	0.00E+00	9.57E-05	-4.37E-04
EP-freshwater	kg P eq.	6.89E-06	1.94E-08	1.53E-07	0.00E+00	0.00E+00	4.12E-10	0.00E+00	2.75E-07	1.33E-08
EP-marine	kg N eq.	1.29E-03	6.05E-04	4.94E-05	0.00E+00	0.00E+00	1.01E-06	0.00E+00	2.64E-05	-1.20E-04
EP-terrestrial	mol N eq.	1.45E-02	6.63E-03	5.83E-04	0.00E+00	0.00E+00	1.11E-05	0.00E+00	2.81E-04	-1.32E-03
POCP	kg NMVOC eq.	3.14E-03	1.72E-03	1.29E-04	0.00E+00	0.00E+00	3.06E-06	0.00E+00	7.69E-05	-3.31E-04
ADP-minerals&metals*	kg Sb eq.	2.49E-07	3.78E-10	5.31E-09	0.00E+00	0.00E+00	9.17E-12	0.00E+00	1.33E-09	-2.53E-09
ADP-fossil*	MJ	1.41E+01	1.51E+00	3.95E-01	0.00E+00	0.00E+00	3.43E-02	0.00E+00	1.73E-01	-1.47E+00
WDP*	m <sup>3</sup>	4.54E-02	3.04E-04	2.36E-02	0.00E+00	0.00E+00	1.01E-05	0.00E+00	9.89E-04	-2.69E-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									

\* 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.

\*\* : [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 indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.

## 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.	1.05E+00	1.17E-01	4.04E-02	0.00E+00	0.00E+00	2.47E-03	0.00E+00	1.30E-02	-1.12E-01

[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 Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) and R-value of 1.30 m<sup>2</sup>K/W | 0.037W/mK at 20°C (MY & SG) with a thickness of 50 mm and the R-value of 1.35 m<sup>2</sup>K/W.

*These results are representative of all the products mentioned in this EPD. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.*

RESOURCES USE										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D*
PERE [MJ]	MJ	3.65E+00	3.21E-03	-5.96E-01	0.00E+00	0.00E+00	1.25E-04	0.00E+00	2.01E-02	0.00E+00
PERM [MJ]	MJ	2.55E+00	0.00E+00	5.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	MJ	6.20E+00	3.21E-03	-5.45E-01	0.00E+00	0.00E+00	1.25E-04	0.00E+00	2.01E-02	0.00E+00
PENRE [MJ]	MJ	1.40E+01	1.51E+00	1.45E+01	0.00E+00	0.00E+00	3.43E-02	0.00E+00	1.73E-01	0.00E+00
PENRM [MJ]	MJ	1.50E-01	0.00E+00	2.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	MJ	1.41E+01	1.51E+00	1.45E+01	0.00E+00	0.00E+00	3.43E-02	0.00E+00	1.73E-01	0.00E+00
SM	kg	5.24E-01	0.00E+00	1.07E-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>	4.70E-03	5.93E-06	6.29E-04	0.00E+00	0.00E+00	2.01E-07	0.00E+00	3.29E-05	-3.81E-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 indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.

**Waste production and output flows:** 1m<sup>2</sup> of glass mineral wool Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) and R-value of 1.30 m<sup>2</sup>K/W | 0.037W/mK at 20°C (MY & SG) with a thickness of 50 mm and the R-value of 1.35 m<sup>2</sup>K/W.

*These results are representative of all the products mentioned in this EPD. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.*

OUTPUT FLOWS AND WASTE CATEGORIES										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D*
Hazardous waste disposed	kg	1.13E-09	1.03E-12	8.01E-11	0.00E+00	0.00E+00	2.48E-14	0.00E+00	2.73E-09	-3.99E-11
Non-hazardous waste disposed	kg	8.72E-02	2.41E-05	2.22E-02	0.00E+00	0.00E+00	7.41E-07	0.00E+00	8.01E-01	-2.94E-04
Radioactive waste disposed	kg	7.79E-05	1.24E-07	4.53E-06	0.00E+00	0.00E+00	5.00E-09	0.00E+00	2.36E-06	-1.86E-06
Components for reuse	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	2.20E-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	1.25E-01	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	2.97E-01	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	5.34E-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 indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.

**Additional impact categories and indicators:** 1m<sup>2</sup> of glass mineral wool Knauf Insulation unfaced rolls with a density of 16kg/m<sup>3</sup> and a thermal conductivity of 0.038W/mK at 23°C (JP) and R-value of 1.30 m<sup>2</sup>K/W | 0.037W/mK at 20°C (MY & SG) with a thickness of 50 mm and the R-value of 1.35 m<sup>2</sup>K/W.

*These results are representative of all the products mentioned in this EPD. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.*

ADDITIONAL IMPACT CATEGORIES AND INDICATORS										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D*
PM	Disease Incidence	8.21E-08	4.30E-08	2.82E-09	0.00E+00	0.00E+00	2.37E-11	0.00E+00	1.16E-09	-4.34E-09
IRP	kBq U235 eq.	1.01E-02	1.50E-05	6.72E-04	0.00E+00	0.00E+00	6.24E-07	0.00E+00	2.28E-04	-3.00E-04
ETP-fw	CTUe	1.85E+01	4.91E-01	4.21E-01	0.00E+00	0.00E+00	1.49E-02	0.00E+00	1.04E-01	-3.95E-01
HTP-c	CTUh	4.71E-10	8.09E-12	1.24E-11	0.00E+00	0.00E+00	2.45E-13	0.00E+00	1.32E-11	-1.30E-11
HTP-nc	CTUh	2.08E-08	1.77E-10	5.78E-10	0.00E+00	0.00E+00	5.20E-12	0.00E+00	1.40E-09	-1.78E-10
SQP	dimensionless	3.71E+01	1.97E-03	7.73E-01	0.00E+00	0.00E+00	6.31E-05	0.00E+00	4.06E-02	-3.56E-01
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	kg C	kg CO <sub>2</sub> eq.
Biogenic carbon content in product	1.33E-02	4.89E-02
Biogenic carbon content in packaging	5.57E-02	2.04E-01

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

\*: [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 indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.



## LCA interpretation

### ENVIRONMENTAL IMPACTS

All impact categories 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 but significantly reduced through the use of electricity from renewable sources.

**The Depletion Potential of the Stratospheric Ozone layer (ODP)** is mostly influenced by the manufacturing phase (module A1-A3) and significantly influenced using electricity.

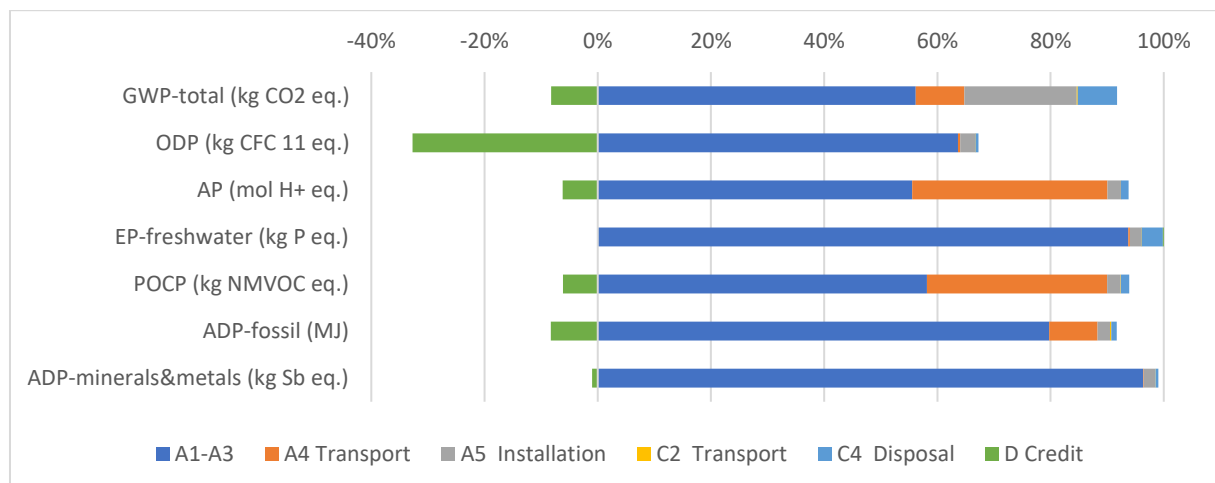
**The Acidification Potential (AP)** is also dominated by the production due to the process's emissions and the electricity consumption. Most of the impact is by emissions of sulphur dioxide, ammonia and nitrogen oxides.

**The Eutrophication Potential (all EP indicators in total)** is mainly influenced by production due to emissions from the 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 emissions from the manufacturing processes (including energy use) and raw materials.

**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 energy consumption for the production. The packaging (plastic) and the binder have also a non-negligible impact.



## 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 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 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, bottles and jars) depending on plants.

## References

### **International EPD® System**

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### **EN 12086**

EN 12086: 2013 Thermal insulating products for building applications –determination of water vapour transmission properties.

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EN 15978: 2011 Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method.

### **ISO 21930:2017**

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### **ISO 14021**

ISO 14021:2016 Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)

### **ISO 14025**

DIN EN ISO 14025:2011-10: Environmental labels and declarations – Type III environmental declarations – Principles and procedures

### **EN 15804:2012+A2:2019/AC:2021**

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### **EN 1602:**

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### **EN 12667**

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### **EN 13162**

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**EN 12086**

EN 12086: 2013 Thermal insulating products for building applications –determination of water vapour transmission properties.

**ISO 8301:1991**

Thermal insulation – Determination of steady-state thermal resistance and related properties – Heat flow meter apparatus.






**2024\_04\_22 KI 16 Kg m3 UF (01) RL - JB (full year) (I-report)**

I-report is an interactive report created with GaBi based on the scenario. More details on the product characteristics, plant allocation and scenario can be found in the i-report.

**JB\_GMW\_2023 (Background Report)**

Calculation rules for the Life Cycle Assessment and Requirements and more details about the production on the Background Report.

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