ENVIRONMENTAL PRODUCT DECLARATION

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

Knauf Flame Barrier 150

From

KNAUF INSULATION

Program:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
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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 from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804+A2:2019. For further information about comparability, see EN 15804+A2:2019 and ISO 14025.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number:	S-P-04017
Published:	2021-06-11
Valid until:	2026-06-11
EPD owner	Knauf Insulation Sprl Rue de Maestricht 95 4600 Visé Belgium
Product Category Rules:	PCR 2019:14. Construction products (EN 15804:A2) Version 1.1 c-PCR005 Thermal insulation products (EN 16783: 2017)
Product group classification:	UN CPC 37
Reference year for plant data:	2019
Geographical application scope:	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+A2:2019) Version 1.1 c-PCR005 Thermal insulation products (EN 16783: 2017)
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 process certification ☐ EPD verification
Certified by: Bureau Veritas certification Sverige AB SE006629-3
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ 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.

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, 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. UK- Queensferry Plant holds BES 6001 Responsible Sourcing of Construction Products Certificate.

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 Queensferry.

2 Chemistry Ln, Queensferry, Deeside CH5 2DA, United Kingdom

Information about Rock Mineral Wool production

The Rock Mineral Wool Products for Building Construction are available in the form of slabs, boards, lamellas and rolls. RMW slabs are used as a thermal, acoustical and fire insulation product.

In general, Rock Mineral Wool products ranges from 20 to 200 kg/m^3. In terms of composition, the inorganic part (92-98%) is composed of volcanic rocks, typically basalt, and some dolomite and with an increasing proportion of recycled material in the form of briquettes, a mix of stone wool scrap, other secondary materials and cement.

The remaining fraction is the thermo set resin binder.

Product information

Product name: Knauf Flame Barrier 150

Product identification: The declared insulation Knauf Flame Barrier 150 is a compact Rock Mineral Wool, uncoated and unfaced of 1m^2 (considered for this EPD).

For the placing on the market in the EU/EFTA (with exception of Switzerland), the regulation (EU) N°305/2011 of the Construction Product Regulation (CPR) applies.

For the UK market (England, Wales and Scotland), the UK Regulation SI 2019 No. 4651 applies. Besides, the SI 2020 No. 1359 amendment allows the usage of EU CPR in Northern Ireland. The concerned products have Declarations of Performance (DoP) O4208IPCPR, OU4208IPCPR.

Product description: The main application for Knauf Flame Barrier 150 is fire protection.

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 Queensferry with United Kingdom (UK) energy mix for electricity. Regarding the market area, the product is mainly marketed in Europe.

Energy:
Electricity mix and gas inputs are taken from UK (United Kingdom) with reference year 2016 (the latest available in GaBi database). 0.339 kg of CO_2 is released for 1 kwh of Electricity consumption from UK.

Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN 12667	0.038 W/(mK) at 10°C
Water vapor diffusion resistance (EN 12086)	1
Thermal Resistance (ISO 8301)	1.32 m^{2}K/W
Reaction to fire (EN 13501-1)	A1
Declared density range/ EN 1602	150 kg/m^3 (+/-10%)
Melting point of fibers DIN 4102-17	≥ 1000°C

LCA information

Functional unit / declared unit

The declared unit is 1m² of unfaced, uncoated Rock Mineral Wool Knauf Flame Barrier 150 with a thickness of 50 mm. The declared lambda is 0.038 W/mK. The density used for the calculation of this specific LCA is 150 kg/m³.

Reference service life: The RSL or durability of Knauf Flame Barrier 150 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:

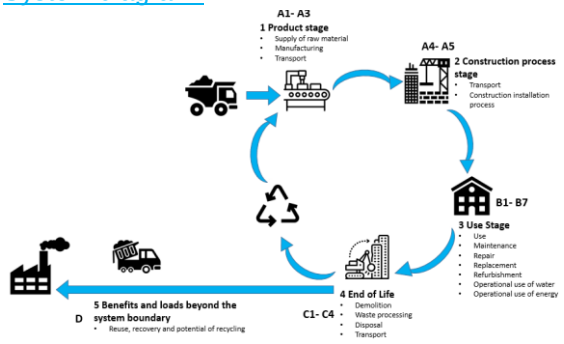
Plant production data for the complete year 2019. The reference product groups considered in this EPD are produced in one single manufacturing plant; therefore, variations issue for sites is not relevant.

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

Database(s) and LCA software used:

The LCA model, the data aggregation and environmental impacts are calculated with the software GaBi 10.0 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	150 kg/m³ (+/-10%)
Rock mineral wool weight	7.5 kg
Surface	1 m²
Thickness	50 mm
Volume	0.05 m³
Packaging Plastic sheet	0.02 kg
Packaging Wooden pallet	0.44 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)	57 % 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 Rock 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

For 2019 year, the external recycled waste as raw material is 31.28% originating (mainly) from slags.

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 Rock Mineral Wool plant construction or machines, are not taken into account in the life cycle assessment. No allocation is carried out for this specific product.

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

Conversion factor for this EPD is 0.13 for 1 kg. In principal, an insulation product should always be characterized with its thickness and an R value, only taking into account the product's weight could lead to wrong interpretation.

More information:

www.knaufinsulation.com

Name and contact information of LCA practitioner:

Yaprak Nayir
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 compotents	Weight %	Pre-consumer material, weight - %	Renewable material, weight- %
Basalt	55 - 60	0	0
Dolomitic - Limestone	15 - 20	0	0
Recovered metallurgical slags	15 -35	100	0
Thermo set resin binder	2 - 5	0	0
Additives	< 1	0	0
Packaging Materials	Weight, kg/ DU or FU	Weight -% (versus the product)	
Wooden Pallet	0.44	5.93	
Polyethylene film	0.02	0.26	
TOTAL	0.46	6.19	

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: 1m² of Rock Mineral Wool Knauf Flame Barrier 150 with a thickness of 50 mm with R value of 1.32 m²K/W.

ENVIRONMENTAL IMPACTS										
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D****
GWP-fossil	kg CO_2 eq.	1.15E+01	3.50E-01	2.88E-01	0.00E+00	0.00E+00	2.67E-02	0.00E+00	1.14E-01	-2.05E-01
GWP-biogenic	kg CO_2 eq.	-6.07E-01	-5.83E-04	4.66E-01	0.00E+00	0.00E+00	-4.52E-05	0.00E+00	-9.02E-03	-4.77E-04
GWP-luluc	kg CO_2 eq.	8.32E-03	2.81E-03	2.36E-04	0.00E+00	0.00E+00	2.18E-04	0.00E+00	3.27E-04	-1.25E-04
GWP-total	kg CO_2 eq.	1.09E+01	3.52E-01	7.54E-01	0.00E+00	0.00E+00	2.69E-02	0.00E+00	1.05E-01	-2.06E-01
ODP	kg CFC 11 eq.	4.51E-14	6.37E-17	2.48E-11	0.00E+00	0.00E+00	4.94E-18	0.00E+00	4.22E-16	-2.68E-13
AP	mol H^+ eq.	8.01E-02	8.80E-04	1.71E-03	0.00E+00	0.00E+00	1.64E-04	0.00E+00	8.16E-04	-3.31E-04
EP-freshwater	kg PO_4^{3-} eq.	4.49E-05	3.25E-06	1.06E-06	0.00E+00	0.00E+00	2.51E-07	0.00E+00	5.97E-07	-3.37E-06
EP-freshwater [1]	kg P eq.	1.46E-05	1.06E-06	3.45E-07	0.00E+00	0.00E+00	8.20E-08	0.00E+00	1.95E-07	-1.10E-06
EP-marine	kg N eq.	6.66E-03	3.75E-04	1.69E-04	0.00E+00	0.00E+00	7.93E-05	0.00E+00	2.10E-04	-9.66E-05
EP-terrestrial	mol N eq.	2.58E-01	4.22E-03	5.65E-03	0.00E+00	0.00E+00	8.77E-04	0.00E+00	2.31E-03	-1.04E-03
POCP	kg NMVOC eq.	1.72E-02	1.05E-03	4.44E-04	0.00E+00	0.00E+00	2.18E-04	0.00E+00	6.36E-04	-2.79E-04
ADP-minerals&metals*	kg Sb eq.	9.75E-07	2.81E-08	2.16E-08	0.00E+00	0.00E+00	2.18E-09	0.00E+00	1.02E-08	-3.02E-08
ADP-fossil*	MJ	1.55E+02	4.63E+00	3.37E+00	0.00E+00	0.00E+00	3.59E-01	0.00E+00	1.49E+00	-3.56E+00
WDP	m^3	4.75E-01	3.38E-03	6.37E-02	0.00E+00	0.00E+00	2.63E-04	0.00E+00	1.19E-02	-1.78E-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									

**: *[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.*

[1] EN 15804:2012+A2:2019 specifies that the unit for the indicator for Eutrophication aquatic freshwater shall be kg PO4 eq, although the reference given ("EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe") uses the unit kg P eq, until this has been corrected, results shall be given in both kg PO4 eq and kg P eq. in the EPD.

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_2 eq.	1.14E+01	3.46E-01	2.86E-01	0.00E+00	0.00E+00	2.64E-02	0.00E+00	1.12E-01	-2.03E-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.

Additional environmental impact indicators like PM [Disease incidences], IR [kBq U235 eq.], ETF-fw [CTUe], HTP-c [CTUh], HTP-nc [CTUh] and SQP [Pt] are not declared (ND) but were calculated and can be provided on request.

Use of resources: 1m² of Rock Mineral Wool Knauf Flame Barrier 150 with a thickness of 50 mm with R value of 1.32 m²K/W.

RESOURCES USE										
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
PERE [MJ]	MJ	1.65E+01	2.68E-01	5.02E-01	0.00E+00	0.00E+00	2.08E-02	0.00E+00	1.95E-01	-2.27E+00
PERM [MJ]	MJ	6.67E+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
PERT [MJ]	MJ	2.32E+01	2.68E-01	5.02E-01	0.00E+00	0.00E+00	2.08E-02	0.00E+00	1.95E-01	-2.27E+00
PENRE [MJ]	MJ.	1.49E+02	4.65E+00	3.26E+00	0.00E+00	0.00E+00	3.61E-01	0.00E+00	1.49E+00	-3.56E+00
PENRM [MJ]	MJ	6.87E+00	0.00E+00	1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	MJ	1.55E+02	4.65E+00	3.38E+00	0.00E+00	0.00E+00	3.61E-01	0.00E+00	1.49E+00	-3.56E+00
SM	kg	2.30E+00	0.00E+00	4.60E-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^3	3.20E-02	3.12E-04	1.92E-03	0.00E+00	0.00E+00	2.42E-05	0.00E+00	3.76E-04	-7.61E-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].*

Waste production and output flows: 1m² of Rock Mineral Wool Knauf Flame Barrier 150 with a thickness of 50 mm with R value of 1.32 m²K/W.

OUTPUT FLOWS AND WASTE CATEGORIES										
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
Hazardous waste disposed	kg	2.80E-07	2.15E-07	1.05E-08	0.00E+00	0.00E+00	1.67E-08	0.00E+00	2.28E-08	-1.35E-09
Non-hazardous waste disposed	kg	9.46E-01	7.37E-04	1.82E-01	0.00E+00	0.00E+00	5.72E-05	0.00E+00	7.51E+00	-1.44E-03
Radioactive waste disposed	kg	3.83E-03	8.57E-06	8.64E-05	0.00E+00	0.00E+00	6.65E-07	0.00E+00	1.70E-05	-2.14E-04
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	1.86E-01	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	2.78E-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	7.59E-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	1.46E+00	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].*

Information on biogenic carbon content

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	**Unit**	**QUANTITY**
Biogenic carbon content in product	**kg C**	0.00E+00
Biogenic carbon content in packaging	**kg C**	2.22E-01

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories, except the Abiotic Depletion Potential Element and the Ozone Depletion Potential, are dominated by the manufacturing processes. This can be explained by the huge impact of the energy use (electricity, natural gas and coke) for Rock Mineral Wool production.

The Global Warming Potential (GWP) is dominated by the manufacturing in the cupola, mostly due to CO_2 emissions from raw materials and energy consumption (50%). The production of the binder represents more than 15% of the impact.

The Ozone layer Depletion Potential (ODP) results are under the high influence of the selected scenario for plastic sheets packaging incineration.

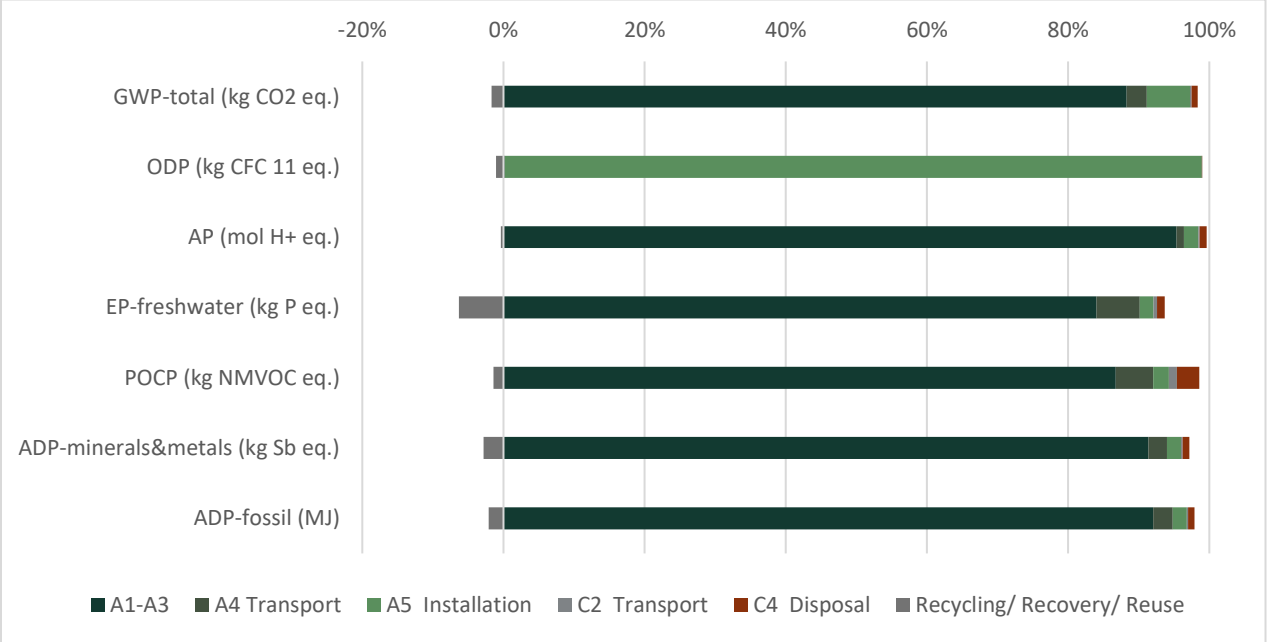
The Acidification Potential (AP) is also dominated by the manufacturing due to the emissions related to the processes and the energy consumption.

The Eutrophication Potential (EP) is significantly influenced by the manufacturing due to emissions from cupola furnace, curing oven and other unit processes.

The Photochemical Ozone Creation Potential (POCP) is particularly dominated by the manufacturing (emissions in the cupola furnace and other unit processes).

The Abiotic Depletion Potential Element (ADPe) impact mainly comes from the manufacturing of the product.

The Abiotic Depletion Potential Fossil (ADPf) is dominated by the use of coke as energy carrier. Next to the coke, we have also the impact of natural gas and upstream the electricity energy mix.



RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the manufacturing of Rock Mineral Wool products (especially due to the energy carrier, coke) and the binder.

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the manufacturing, mostly due to electricity consumption and packaging.

For the Use of Secondary Material (SM), it consists of slags.

References

International EPD® System

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DIN 4102 / T17
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Contact information:

EPD owner:	Knauf Insulation Rue de Maestricht 95 4600 Visé Belgium www.knaufinsulation.com Contact: sustainability@knaufinsulation.com
LCA support:	Université de Liège – Laboratory of Chemical Engineering PEPs - Products, Environment and Processes Allée du 6 août 15, Bat B6 4000 Liège Belgium Sphera Hauptstraße 111-113 70771 Leinfelden-Echterdingen Germany
Programme operator:	EPD International AB info@environdec.com