DEUTSCHE ROCKWOOL GmbH & Co. KG

ENVIRONMENTAL PRODUCT DECLARATION

ROCKWOOL stone wool insulation materials in the high bulk density range

PLANTS: Gladbeck, Neuburg, Flechtingen

in compliance with ISO 14025 + EN 15804

Program Operator	IBU – Institut Bauen und Umwelt e.V.
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ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**DEUTSCHE ROCKWOOL GmbH & Co. KG**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
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www.ibu-epd.com / https://epd-online.com

ECO PLATFORM EPD VERIFIED

1. General Information

DEUTSCHE ROCKWOOL GmbH & Co. KG

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-DRW-20180119-IBC2-EN

This declaration is based on the product category rules:
Mineral insulating materials, 12.2018
(PCR checked and approved by the SVR)

Issue date
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Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

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(Managing Director IBU)

ROCKWOOL stone wool insulation materials in the high bulk density range

Owner of the declaration
DEUTSCHE ROCKWOOL GmbH & Co. KG
Rockwool Straße 37-41
45966 Gladbeck
Germany

Declared product / declared unit
1 m^3 unfaced and/or uncoated synthetic resin-bonded stone wool insulating material in the high bulk density range (over 120 kg/m^3) produced by ROCKWOOL. In addition, the environmental impacts of seven facings based on 1 m^2 are shown in Appendix 1.

Scope:
The lifecycle assessment shown in the EPD relates to the lifecycle of unfaced or uncoated synthetic resin-bonded stone wool insulating material in the high bulk density range from ROCKWOOL. The stone wool is produced in the Gladbeck, Neuburg and Flechtingen works in which the production data for 2016 was recorded. The key LCA results for the facings are to be found in Appendix 1. This was produced and verified in 2015. The LCA thus represents 100% of the stone wool produced by ROCKWOOL. The products covered by this EPD are listed in Annex 2.

This document is a translation from the German Environmental Product Declaration into English. It is based on the German original version EPD-DRW-20180119-IBC2-DE.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/
☐ internally ☒ externally

Dr. Frank Werner
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

The definition of mineral wool (stone or glass wool) in accordance with German hazardous substances law (Chemicals Prohibition Order, Hazardous Substances Ordinance) is as follows: "Artificial vitreous (silicate) fibres with random orientation and a mass content of more than 18 % of sodium, potassium, calcium, magnesium and barium oxides".
Stone wool insulation is a fibre insulation material. A major component is stone wool insulation fibres. These are monofilament artificial mineral fibres of a non-crystalline structure which are obtained from a silica-based molten mass. The mean fibre diameter is 3-6 µm. The fibres can be several centimetres in length. The artificial resin-bonded stone wool insulation described in this declaration is manufactured in the form of high-density sheets, mats or rolls (over 120 kg/m^3). The products are supplied in thicknesses of between 20 mm and 350 mm, for example as compression-proof sheets, treadable two-layer sheets or felting and rolls.
For certain application areas, the insulation is provided with a functional facing on one or both sides.

/EU Regulation no. 305/2011/CPR/ (with the exception of Switzerland) applies for placing the product on the market in the EU/EFTA. The product requires a Declaration of Performance taking into account /DIN EN 13162/ (Thermal insulation products for buildings) and /DIN EN 14303/ (Thermal insulation products for building equipment and industrial installations) and CE-labelling. The respective national regulations apply to its use.

2.2 Application

- All applications according to /DIN 4108-10/ for application areas of walls, ceilings and roofs with the requirements set out therein with regard to heat and noise insulation and mechanical properties
- Domestic technology (insulation of heating and hot water pipes)
- Technical insulation (insulation of pipes, district heating piping, boilers and equipment)
- Industrial further processing (air conditioning ducts, fire protection doors, prefabricated house elements and chimney systems)
- Fire protection elements (cable insulation and elements for steel constructions)

2.3 Technical Data

Constructional Data

Name	Value	Unit
Thermal conductivity /DIN EN 13162/ /DIN EN 14303/	0.032 - 0.05	W/(mK)
Calculation value for thermal conductivity according to /DIN 4108-4/	0.033 - 0.049	W/(mK)
Water vapour diffusion resistance factor µ according to /DIN EN 12086/	1	-
Water vapor diffusion equivalent air layer thickness µ x component thickness [m]	µ x d	m
Sound absorption coefficient αS depending on the frequency is to be found in the data sheets for the relevant products.	-	%
Gross density according to /DIN EN 1602/	>120	kg/m³
Formaldehyde emissions acc. to EN 717-1	-	µg/m³
Compressive stress (at 10 % deformation) according to /DIN EN 826/	5 to 70	kPa

Performance data for the product in accordance with the declaration of performance in relation to its essential characteristics in accordance with:

- /DIN EN 13162:2015-04/, Thermal insulation products for buildings – Factory-made mineral wool (MW) products – Specification; German version, and
- /DIN EN 14303:2016-08/, Thermal insulation products for building equipment and industrial installations – Factory-made mineral wool (MW) products – Specification; German version EN 14303:2015.

2.4 Delivery status

The artificial resin-bonded stone wool insulation described in this declaration is manufactured in the form of high-density sheets, mats or rolls (over 120 kg/m³). The products are supplied in thicknesses of between 20 mm and 350 mm, for example as compression-proof sheets, treadable two-layer sheets or felting and rolls.

2.5 Base materials / Ancillary materials

The raw materials are the naturally occurring rocks diabase and basalt (27-50 mass %) and cement-bonded bricks (50-73 mass %). These are supplemented by up to 3-5 % binding agent (urea-modified phenol formaldehyde resin with glucose) and also a maximum of 0.2 % mineral oil and max. 0.1 % of bonding agent.

The basic and ancillary materials for the facings are:

facing	g/m² (one-sided)	components
glass fleece	100 g	glass fibres, binder
glass silk	102 g	glass fibres, binder
mineral fleece	346 g	glass fibres, mineral based primer, binder
mineral based primer	250 g	silicious emulsion
aluminium sandwich foil	94.8 g	aluminium foil, glass fabrics, PE foil
anorganic fiber-reinforced coating based on magnesium oxide	5450 g	magnesium cement, glass fibres
RockTect facing	145 g	PP fibres, thermoplastic elastomer ether ester (TEEE)

The secondary material content of the product is 24.7%, of which 24.6% are pre-consumer and 0.1% post-consumer recycled content. This secondary material content was calculated according to EN ISO 14021 considering all relevant flows of inputs and outputs in the production process and does not consider any fuels used.
No Substances of Very High Concern (SVHC), biocides or carcinogenic, mutagenic or reproduction-toxic substances (CMR substances) are used in production or in the facings:

1) This product/article/at least one partial article contains substances listed in the candidate list (status: 06/08/2018) exceeding 0.1 percentage by mass: no.

2) This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no.

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): no.

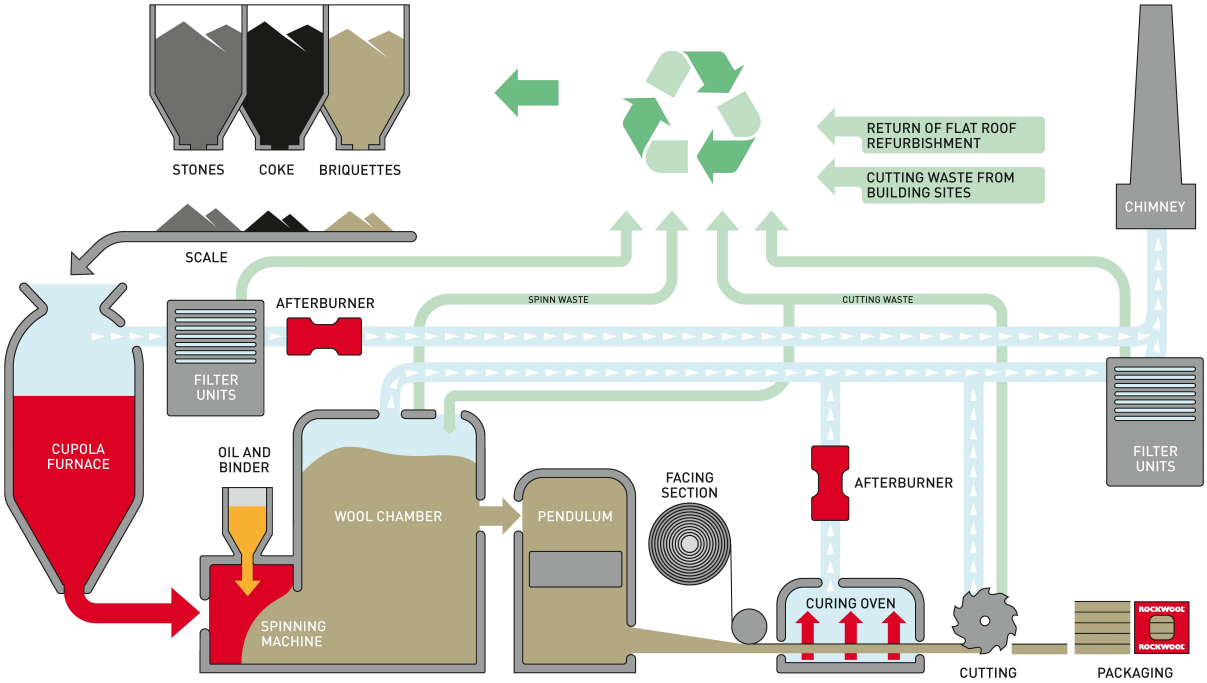
2.6 Manufacture

Diabase or basalt as well as cement-bonded bricks are melted using coke as the energy carrier in a cupola furnace at approximately 1,400-1,500°C and frayed out by means of roller spinning. Immediately afterwards, mineral oil and binding agent are sprayed on as a

watery solution. The binding agent serves to guarantee binding and dimensional stability and the mineral oil to reduce dust and to increase hydrophobisation. The bonding agent also contained in the watery solution supports the adhesion of the binding agent to the fibres.
In the collecting chamber, the raw wool is placed on transport conveyors under negative pressure. Optionally, facings can then be applied. (The corresponding environmental impacts for this are specified in the Appendix.). The possibly faced raw fleece is fed into hardening furnaces in which hot air at 200-300°C is sucked through the wool mass whilst the binding agents link to thermosets. Finally, the product is shaped using saws.

Quality control:

- Internal and external monitoring in accordance with CE labelling in accordance with European regulations.
- KEYMARK in accordance with insulation KEYMARK Scheme Rules 2.0/; for technical insulation products in accordance with VDI 2055 equivalent to Keymark Scheme rules and /AGI Q 132/.
- All products in accordance with /RAL-GZ 388/.
- Quality management system in accordance with /DIN EN ISO 9001/.



2.7 Environment and health during manufacturing

Since 01/06/2000, a ban on the manufacture, putting on the market and use of stone wool insulating materials which do not fulfil the exemption criteria of Appendix II of Section 16 of the Hazardous Substances Ordinance and Appendix 1 of Section 3 of the Chemicals Prohibition Order has been in force in Germany.

The prescriptions in Section 5.4.5.2.1 of /TA Luft/, the German Technical Regulations on Emissions, apply in addition (regulations for total dust and phenol/formaldehyde for old facilities).

ROCKWOOL has an environmental management system which is certified to /DIN EN ISO 14001/ and places great value on the environmental friendliness of its production facilities:

- Exhaust air produced during manufacture is mechanically filtered and most of it thermally combusted. The heat released is used to pre-heat the blast air via heat exchangers. The separated dust is reused as a raw material.
- Waste water produced during manufacturing is mainly processed internally and returned to production.
- Noise protection measurements have shown that all values recorded inside and outside the production facilities are below the requirements which apply in Germany. Noise-intensive parts of the facility such as defibration are encapsulated accordingly with constructional measures.

2.8 Product processing/Installation

The recommendations on product processing depend on the product and system and are described in the brochures and data sheets (www.rockwool.de). Health and safety measures in accordance with Section 3 of the instruction manual "handling stone wool insulation materials – glass wool, stone wool" /BG BAU/ must be observed:

- Favour pre-prepared stone wool insulation. This can be either supplied by the manufacturer or cut to size centrally on the building site.
- Unpack packaged insulation only at the workplace.

- Do not throw the materials.
- Do not use fast-running motor-driven saws without dust extraction.
- Cut on a solid surface with a knife or scissors. Do not tear.
- Ensure good ventilation at the workplace. Avoid raising dust.
- Do not blow off dust and dust deposits with compressed air or sweep them up dry but pick them up with an industry standard (category M) vacuum cleaner or wet-clean them.
- Keep the workplace clean and clean it regularly. Collect offcuts and waste immediately in suitable containers such as bins or plastic sacks.
- Wear loose-fitting closed work clothing and leather protective gloves or nitrite-coated cotton gloves.
- Rinse off building dust with water on finishing work.
- Work with your back to the wind and ensure that no employee stands in the dust trail during outdoor activities which create dust, for example during tipping processes.

2.9 Packaging

Wooden pallets, cardboard and paper and PE foil are used as packaging material. The packaging is disposed of via Interseroh AG, Cologne.

2.10 Condition of use

No changes occur to the material composition during the use phase except in the case of extraordinary effects (see 2.13).

2.11 Environment and health during use

Stone wool fibre dust indoors:
As with all dust, stone wool dust can cause irritations to the skin, eyes and respiratory tract and trigger allergic reactions.
Some general work hygiene principles which apply to handling all kinds of dust should be observed in order to prevent such temporary, reversable phenomena. ROCKWOOL insulating materials do not fall into the area of application of Appendix II of Section 16 Paragraph 2 of the Hazardous Substances Ordinance and Appendix 1 of Section 3 of the Chemicals Prohibition Order. They are therefore not subject to the manufacturing and use ban for fibre dust classified as carcinogenic in the workplace. According to the Federal Environmental Agency's text 30/94 ‘Investigations into indoor contamination through fibrous fine dust from installed stone wool’ ,the concentration of fibre dust indoors is

- Generally not increased in the use phase if it is properly installed heat insulation; this requires the insulation to be clearly separated from the interior (e.g. insulation on exterior walls or insulation behind an impervious moisture barrier and cladding consisting of gypsum board, wooden panels or the like
- Generally only moderately increased if the stone wool products are installed in such a manner that there is a direct exchange of air with the interior; this occurs mainly in rooms with suspended (acoustic) ceilings without a functional trickle protection
- Significantly increased (up to several thousand fibres per m^3 room air) in isolated cases e.g. with structural deficiencies or with constructions which no longer reflect the current state of technology, or temporarily during construction measures being performed on components which contain stone wool products

Release of formaldehyde and VOC:
Formaldehyde and VOC emissions can cause health problems such as headaches and nausea or the irritation of mucous membranes which is why low-emission building materials should be used. The formaldehyde and VOC emissions recorded for the declared stone wool products lie below the detection and assessment thresholds. No carcinogenic substances were detected. Use is therefore to be classified as safe (see Chapter 7.4).

2.12 Reference service life

No reference service life (RSL) in accordance with /ISO 15686/ was determined.
Details of average service life in accordance with /BBSR 2017/ are to be found in Chapter 4 in the section on use (B1-B7).

The service life of ROCKWOOL stone wool is unlimited if used correctly and is exclusively limited by the service life of the building components and the entire building. Insulation performance is sustained without limitations throughout the service life. The thermal insulation function can be impaired by extraordinary effects and damage to the construction (see Chapter 2.13).
The thermal performance characteristics of heat insulation is normally based on a minimum period of 50 years in accordance with /DIN EN 16783/.

2.13 Extraordinary effects

Fire

Name	Value
Building material class acc. /DIN EN 13501-1/	A1 (not flammable)

Water
Moisture impairs the insulation properties. Stone wool insulating materials are breathable and dry out of their own accord in case of minor moisture penetration. The insulation material should be replaced following the long-term influence of water (e.g. flooding).

Mechanical destruction

Not relevant.

2.14 Re-use phase
Stone wool insulation is not re-usable. It can be returned to the manufacturing process if it is homogenous. Ground stone wool can also be used as an additive in brick manufacture.

2.15 Disposal
The waste key for stone wool insulation building site waste is 17 06 04.

2.16 Further information
Further information on ROCKWOOL stone wool insulation can be found online at www.rockwool.de.

3. LCA: Calculation rules

3.1 Declared Unit
The declaration relates to the lifecycle of 1 m^3 stone wool insulation material produced by DEUTSCHE ROCKWOOL GmbH & Co. KG . The products are manufactured in three factories which exhibit no technology differences for stone wool manufacture. The average was formed on the basis of production quantities. The bulk density of the declared products can be over 120 kg/m^3. An average bulk density of 155 kg/m^3 is determined for the high-density stone wool insulation for which the LCA results are shown below. The transfer of the results to other bulk densities is possible via a linear scale.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	155	kg/m^3
Conversion factor to 1 kg	0.00645	-

In addition, the environmental profiles of seven facings which are based on the specifications mentioned in Chapter 2.5 are shown in the Appendix. To apply the facing data, the results based on the results for 1 m^3 for the stone wool must first be converted to the desired thickness. The results for the facings for 1m^2 are then to be added. The environmental profiles of the facings were calculated for one-sided application. In case of both-sided application, the environmental effects of the facings have to be doubled or added in case of different facings. Additional adhesive is not needed for the facing process.

3.2 System boundary
EPD type: Cradle to grave with options
The LCA includes the lifecycle phases of stone wool manufacture (A1-A3), transport to the building site (A4), the recycling and disposal of packaging and offcuts which accrue during installation (Module A5) and the end of life phase of the stone wool (Modules C1 to C4). Benefits as a result of thermal recycling of packaging were assigned to Module D.
Specifically, the following processes were included in the production stage (A1-A3):

- Provisioning processes of pre-production and energy
- Transport of raw materials and pre-products to the works
- Manufacturing process in the factory including energy-related uses, disposal of accruing residual materials and emissions
- Manufacture of packaging

Secondary materials which enter the system which have already reached the end of the waste characteristic before they are delivered were included free of loads but including the transports necessary for delivery. Waste used as alternative fuel also enters the system without loads. In accordance with the polluter-pays principle, the transport of this waste to the factory has to be added to the preceding product lifecycle and was not included in the LCA.
The quantities of packaging material included are annual usage or purchase quantities in which pallet rotations are already included. When selecting recycling processes for the calculation it was ensured that CO_2 stored in den packaging materials is released as an emission during the recovery process.
Emissions and loads as a result of the recycling of packaging are allocated to Module A5 and resultant benefits were added to Module D.
The recycling and disposal of the stone wool at end of life include truck transport back to the factory of manufacture or a dumping ground (C2) and also the final disposal of the corresponding share (C4). The quantity of stone wool waste delivered from building sites which was deployed in the relevant year was included as the recycling quantity at end of life which is why no net quantities for recycling result and thus no benefits can be included in Module D.
The scope of investigation of the facings covers Modules A1-A3, A4, A5, C1 to C4 and D. Since no additional packaging is included for the facing, no environmental loads or benefits ensue for facings in Modules A5 and D.

3.3 Estimates and assumptions
As far as possible, all data from the collection of operating data was included. However, no works-specific figures were available for some emission figures and waste so that these had to be estimated on the basis of the data from other ROCKWOOL factories in Germany and abroad.
There was no record for diabase in the background database used so that the diabase quantity used was calculated with the data for basalt.
ROCKWOOL produces its binder in one of its factories but uses pre-made binder in the other two factories. ROCKWOOL is not familiar with the formulae for this bought-in binders in detail which is why the composition was estimated based on the data sheets and formulae of the internal formulae.

3.4 Cut-off criteria
All mass, volume or energy-based data from the collection of operating data, i.e. all initial materials deployed as per the formula, the thermal energy used, internal fuel consumption and electricity consumption, all direct production waste and all available emission measurements were included in the assessment.
Assumptions for transport impacts for all relevant inputs and outputs were made. This means that material and energy flows with a share of less than 1% were also included.
It can be assumed that the neglected processes would

have contributed less than 5% respectively to the declared impact categories.

3.5 Background data

Programme version 8.5.0.79 and database version 8.7 including Service Pack 35 of the /GaBi/ software system for integrated life cycle assessments developed by THINKSTEP AG was used to model the lifecycle of the declared stone wool products (/GaBi/). All /GaBi/ records which were used to model the stone wool lifecycle can be viewed online in the /GaBi documentation/.
In order to guarantee the comparability of the results only background data from the GaBi database was used in the LCA. Since the production locations are in Germany, records for Germany were selected insofar as they existed. European or international records were used insofar as there was no data for Germany. Corresponding or sufficiently suitable equivalent records were available in the GaBi database for almost all relevant pre-products and ancillary materials used.

3.6 Data quality

According to THINKSTEP, the programme developer, the data for the pre-chains is based on industry data which was collected under consistent temporal and methodical framework conditions and was revised less than ten years ago. Records which were no longer valid according to the /GaBi documentation/ only had to be used for the plastic manufacturing and incineration processes. Since the packaging quantities are low compared to the raw materials and fuel used for manufacturing, the database can be seen as good to excellent overall with regard to its time-related, technological and geographical representativeness.

3.7 Period under review

The database for this LCA is based on data recordings for stone wool manufacture from 2016 at ROCKWOOL. The quantities of raw materials, energy and ancillary and operating materials used are included as mean values from 12 successive months in the factories reviewed.

3.8 Allocation

Various forms of waste, secondary raw materials and co-products are deployed in this product system. These were treated differently depending on their allocation:

- Waste is included in the product system without loads and without transports as the effects thereof are to be allocated to the previous lifecycle according to the polluter-pays principle.
- Secondary materials which have already reached the end of the waste characteristic are also included in the system free of loads. The transport of these materials to the factory were, however, included in the LCA.
- Steelworks slag is regarded as a co-product of the steel industry and is to be included with accordingly allocated loads. Since the contribution of this slag to the operating income of the steel producers is, however, extremely low, the environmental effects they cause can be neglected. The transport of the co-products to the factory was, however, included in Module A2.

Pig iron is produced whilst the raw materials and pre-products are being melted in the cupola furnace. Pig iron as a co-product fulfils the *End-of-waste* criteria in accordance with Chapter 5.5.5 of the PCR Part A and should therefore be included as a co-product. No allocation was made due to the low contribution of the iron ore to operating income.
Multi-input processes occurred especially in the recycling of materials in waste incineration plant. However, corresponding recovery processes were available in /GaBi/ for individual types of waste so that a realistic calculation of the resulting environmental effects was possible.
As described above, energetic recovery was assumed for some production waste (A3) and also the packaging materials (A5). Both electricity and heat are produced by combustion. In the model, these recovery processes are modelled in the modules in which the waste occurs. Since the resulting benefits in A3 lay below the energy requirement necessary for production they were modelled as a *closed loop* and there were no benefits here for Module D. The recycling of the packaging (A5), on the other hand, led to excess thermal and electrical energy which is used in other product systems and is therefore shown as a benefit in Module D.
Stone wool waste which accrues during the individual production steps is collected by the manufacturer and returned to production. This brings economic advantages and savings potential in relation to primary material. Furthermore, stone wool waste accrues during installation and after dismantling which is partly returned to the factory and is also recycled there. Since no reliable scenarios for the future return of this waste were available it was assumed that cutting waste is completely disposed of in landfill sites. The tonnage used in the period under review was assumed as the quantity of waste recycled after dismantling so that no net quantities accrue and thus also no benefits can be offset in Module D.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

Version 8.5.0.79 of the /GaBi/ software for integrated LCAs and database version 8.7 including Service Pack 35 were used to calculate the LCA. .

4. LCA: Scenarios and additional technical information

The scenarios on which the assumptions in Modules A4, A5, C1-C4 and D are based are described below. The information on modules B1-B7 which are not declared can be used to develop specific scenarios in the context of a building assessment.

Transport to building site (A4)

No material losses occur during transport, i.e. only the transport process is declared in Module A4. The average transport distance calculated by ROCKWOOL for 2016, the year under review, was 315 km.

Name	Value	Unit
Transport distance	315	km
Gross density of products transported	155	kg/m^3

Installation into building (A5)
Generally, no or only an extremely small amount of energy is required for installing the stone wool products. The products are normally wedged in (e.g. sloping roof) or laid out (e.g. flat roof). The products are partly secured with screws, for example with ETIC-systems. The amount of equipment and energy necessary for this is, however, extremely small so that it can be neglected.
The transport packaging specified is recycled to a large extent according to the waste disposal company, Interseroh. Since no adequate data was available to model the necessary treatment processes, energetic recovery had to be assumed for the calculation of the benefits from recycling (see assumptions for Module D).
The accruing cutting waste (approx. 2 %) is partly recycled in the manufacturing works. Due to the low percentage and a lack of data on precise recycling quantities this recycling was not modelled and it was assumed that the cutting waste was disposed of completely in landfill sites.

Name	Value	Unit
Material loss through cutting	2	%
Transport distance to landfill	50	km
Output substances following waste treatment on site - PE-foil	1.03695	kg
Output materials as a consequence of waste treatment on the building site - wooden pallets	4.7275	kg
Output materials as a consequence of waste treatment on the building site - paper cardboards	0.36735	kg
Transport distance to recycling plant	100	km

Use phase (B1-B7)
The use phase of the stone wool insulating materials depends on the respective use and was not declared. No inspection, servicing, maintenance, repair or replacement are necessary during the use phase. The following table shows the service life in accordance with /BBSR 2017/.

service life in accordance with BBSR 2017

Name	Value	Unit
Code 335.611: insulation layer as core insulation	≥ 50	a
Code 335.641: ETIC-system	40	a
Code 345.316: Special cladding: thermal insulation (Interior insulation)	≥ 50	a
Code 352.121: Footfall sound insulation	≥ 50	a
Code 352.122: Floor insulation including insulation of ceiling of the topmost storey	≥ 50	a
Code 353.421: cellar ceiling insulation	≥ 50	a
Code 363.531: Insulation layer as on-rafter and between-rafter insulation	≥ 50	a
Code 364.211: between-, on- and under-rafter insulation	≥ 50	a

End of life (C1-C4)
Normally, only a very small amount of energy or no energy at all is required to dismantle the stone wool products. The normally clamped-in or laid-out products can be removed manually without problems. The products are partly also fixed with screws. The amount of equipment and energy required to loosen the screws is, however, extremely small so that it can be neglected.
It was assumed that the stone wool waste is sorted on the building site. In this case no further treatment is necessary for recycling or disposal.
In the year under review, approximately 0.3 percent of cutting and dismantling waste was recycled in the assumed disposal scenario.
The environmental effects of depositing the stone wool waste accruing after dismantling on an inert material dump are declared in Module C4.

Name	Value	Unit
Recycling	0.44	kg
Landfilling	154.56	kg
Transport distance to landfill	50	km
Transport distance to recycling facility	315	km
Collected and sorted stone wool waste	100	%

Reuse, recovery and recycling potential (D), relevant scenario information
Benefits from the energetic recovery of the packaging materials are offset in Module D. Thermal energy from a natural gas and electricity mix were substituted for the calculation of the amount of benefits in the GaBi model.

Name	Value	Unit
Transport distance to energetic recovery	100	km

5. LCA: Results

The following tables contain the depiction of the environmental effects for 1 m³ unfaced stone wool with an average bulk density of 155 kg/m³, manufactured by DEUTSCHE ROCKWOOL GmbH & Co. KG. The following table shows the results of impact assessment indicators, resource use and waste and other output flows relating to 1 m³ stone wool insulating material. The modules marked with an x in accordance with /DIN EN 15804/ are thus addressed. The environmental effects and LCA indicators for the different facings are to be found in the appendix.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m³ ROCKWOOL stone wool, 155 kg/m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	196.64	3.16	16.49	0.00	0.51	0.00	2.46	-5.42
ODP	[kg CFC11-Eq.]	2.52E-10	1.31E-13	5.18E-12	0.00E+0	2.11E-14	0.00E+0	5.57E-13	-4.14E-12
AP	[kg SO_2-Eq.]	9.44E-1	2.74E-3	2.07E-2	0.00E+0	4.42E-4	0.00E+0	1.46E-2	-5.81E-3
EP	[kg $(PO_4)^{3-}$-Eq.]	1.05E-1	6.37E-4	2.48E-3	0.00E+0	1.03E-4	0.00E+0	2.01E-3	-9.74E-4
POCP	[kg ethene-Eq.]	4.66E-2	-2.21E-5	1.05E-3	0.00E+0	-3.56E-6	0.00E+0	1.13E-3	-4.96E-4
ADPE	[kg Sb-Eq.]	4.07E-5	2.80E-7	9.96E-7	0.00E+0	4.50E-8	0.00E+0	9.45E-7	-2.06E-6
ADPF	[MJ]	1724.91	42.92	39.20	0.00	6.91	0.00	31.80	-69.77

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m³ ROCKWOOL stone wool, 155 kg/m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	160.32	2.25	95.03	0.00	0.36	0.00	4.09	-17.09
PERM	[MJ]	118.27	0.00	-88.82	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	283.61	2.25	6.31	0.00	0.36	0.00	4.09	-17.09
PENRE	[MJ]	1448.77	43.15	82.91	0.00	6.95	0.00	33.01	-78.87
PENRM	[MJ]	231.78	0.00	-44.23	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	1836.01	43.15	41.72	0.00	6.95	0.00	33.01	-78.87
SM	[kg]	37.11	0.00	0.74	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m³]	4.59E-1	4.15E-3	3.87E-2	0.00E+0	6.68E-4	0.00E+0	6.30E-3	-1.09E-2

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ ROCKWOOL stone wool, 155 kg/m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	3.46E-6	2.28E-6	1.72E-7	0.00E+0	3.66E-7	0.00E+0	5.68E-7	-4.47E-8
NHWD	[kg]	1.21E+1	3.46E-3	3.38E+0	0.00E+0	5.58E-4	0.00E+0	1.55E+2	-4.32E-2
RWD	[kg]	4.14E-2	9.02E-5	9.44E-4	0.00E+0	1.45E-5	0.00E+0	4.78E-4	-3.60E-3
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	17.16	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	39.57	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

6. LCA: Interpretation

Interpretation of the environmental impact
The product stage (Modules A1-A3) dominates all environmental impacts. Module A5 is only noticeable because of its global warming potential (**GWP**). The release of formerly bonded carbon appears here as a result of the energetic recovery of the packaging (wooden pallets).

Module D appears proportionately to the greatest extent in the potential for depletion of non-fossil resources (**ADPE**) and in the potential for depletion of fossil fuels (**ADPF**) which are significantly reduced as a result of the benefits for packaging materials.

The global warming potential of stone wool manufacture results largely from the CO2 emissions during production. A further third is attributable to energy provision (electricity, coke and natural gas). The cement used to manufacture the cement-bonded bricks also influences the result. The carbon bound in the wooden pallets, on the other hand, leads to a slight reduction of the **GWP** in Modules A1-A3.

The ozone depletion potential (**ODP**) is mainly caused (approx. 78 %) by the incineration of plastic wastes accruing in the factory. A further 16 % originates from the electricity provision pre-chains. 84 % of the acidification potential (**AP**) of stone wool production (Modules A1-A3) is attributable to emissions in the factory. Major contributions to **AP** are caused specifically by ammonia, sulphur dioxide and hydrogen sulphide.

The emissions caused in the factory form 72 % of the eutrophication potential (**EP**). Here again, the ammonia emissions which occur during hardening of the bonding agent play a significant role. Furthermore, the **EP** is influenced by the provision of coke and electricity.

The emissions caused in the factory are also the main contributor to the potential for formation of tropospheric ozone (**POCP**). Formaldehyde released from the bonding agent and other NMVOC emissions make a decisive contribution here. In addition, SO2 produced during coke burning causes a high **POCP** value. When examining the **ADPE** it is noticeable that the pre-chains for cement production (41 %) and the use of electricity (46 %) constitute some 87 % of this indicator.

The **ADPF** values are mainly attributable to electricity, coke and natural gas.

Interpretation of primary energy use
A differentiation is made between renewable and non-renewable and also energetically and materially used shares in the depiction of primary energy use:

Of the renewable primary energy used (**PERT**) in production some 43 % is used materially, whereby a large proportion of this materially bound primary energy (**PERM**) is stored in the packaging materials. Only a small proportion is attributable to the stone wool or the (glucose-containing) binding agent contained in the stone wool.

The largest proportion of renewable energetically used primary energy (**PERE**) in the manufacturing phase comes from the German electricity mix. The energetic recovery of packaging in Module D also causes the reclassification of the primary energy used materially up to that point as an energetically used share.

The use of non-renewable primary energy (**PENRT**) dominates the overall use of energy. It is also dominated by the energy needs of production. The coke and natural gas used for melting dominate here. These two energy carriers influence some 55 % of the **PENRT** in Modules A1-A3. The non-regenerative share of the German electricity mix contributes a further 19 %. A large contribution (approx. 15 %) is also made by the binding agent, although it constitutes just 3-4 % of the weight of the end product. Primary energy use to extract and prepare the further raw materials, for example basalt, is comparably low.

It must, however, be remembered that the load-free waste and secondary materials included in the calculation make up a significant proportion of the raw materials used (recycled content of around 25%). Considerable quantities of raw materials are saved due to these materials being included load-free in the production process.

Interpretation of further indicators
Approximately 2.96 litres of fresh water resources (**FW**) are used for the manufacture of one kilogram of stone wool. Thereof, the proportion of drinking water used in the factories is on average 38 %. Considerable amounts of water are also required in the provision of electricity and packaging materials and in the bonding agent pre-chains.

Waste production is assessed separately for the three fractions of hazardous waste disposed, non-hazardous waste disposed and radioactive waste disposed:
Half of the hazardous waste accruing in the stone wool lifecycle (**HWD**) is attributed to the production process. The main influencing factor here is the provision of diesel for production and raw material transports. Further relevant quantities of hazardous waste accrue in the pre-chains for electricity, basalt and coke.

The non-hazardous waste (**NHWD**) represents the largest proportion in the lifecycle of stone wool. The disposal of insulating materials at the end of their service life dominates here. Less than 10% of the **NHWD** occurs during the production phase (A1-A3), of which in turn a large proportion is attributable to pre-chains for basalt. In addition, the disposal of waste accruing in the factory also has an effect on this indicator.

Radioactive waste (**RWD**) accrues exclusively in the pre-chains of raw materials and energy provision, above all in electricity production. The production of cement also has a visible effect on the result but is of secondary importance compared to electricity production.

7. Requisite evidence

7.1 Biopersistence:

Measurement agency / Date: RCC Ltd, Wölferstrasse 4, CH-4414 Füllinsdorf, Switzerland, May-Dec. 1999
Procedure: Test of the biopersistence of artificial mineral fibres through endotracheal instillation in accordance with the German Hazardous Substances Ordinance.
Result: Award certificate for the /RAL GZ-388/ quality mark dated 26th April 2017.
Verification of conformity with quality and test regulations from the Gütegemeinschaft Mineralwolle e. V. dated July 2017 (see www.mineralwolle.de)

7.2 Radioactivity

Measurement agency / Date: North Rhine-Westphalia Material Testing Authority, 21/09/1999
Procedure: Gamma spectroscope analysis of three stone wool samples.
Result: Radium 226 = 26-70 Bq/kg, Radium 228 = 25-65 Bq/kg, Thorium 228 = 29-70 Bq/kg. The nuclides are naturally occurring radioactive substances. No artificial radioactive substances were found.

7.3 Leaching

Measurement agency / Date: ACB GmbH environmental laboratory, 13/03/2014
Procedure: Determination of eluate values in accordance with /DIN EN 12457-4/
result: On the basis of the results stone wool insulation is to be classified as disposal class II in accordance with the Disposal Directive of 27/09/2017. In individual cases it can be classified as Class I waste with the approval of the competent authorities.

Name	Value	Unit
Conductivity	116	µS/cm
pH-value	9.9	-
Total dissolved substance content	12	mg/l
Ignition loss	3.89	%
Dry matter	99.7	%
Non-volatile lipophilic matter	<0.05	%
Antimony	<0.005	mg/l
Arsenic	<0.005	mg/l
Barium	0.010	mg/l
Lead	<0.005	mg/l
Cadmium	<0.0005	mg/l
Chloride	2.51	mg/l
Total chrome	<0.005	mg/l
Easily purgeable cyanide	<0.002	mg/l
Fluoride	2.38	mg/l
Dissolved organic carbon (DOC)	9.0	mg/l
Total organic carbon (TOC)	2.40	%
Copper	<0.005	mg/l
Molybdenum	<0.005	mg/l
Nickel	<0.01	mg/l
Phenol index	0.012	mg/l
Mercury	<0.0001	mg/l
Selenium	<0.005	mg/l
Sulphate	6.27	mg/l
Zinc	<0.02	mg/l

7.4 Formaldehyde and VOC emissions

Measurement agency / Date: Eurofins Product Testing A/S Smedeskovvej 38, DK-8464 Galten, Denmark, various tests
Procedure: Test of product emissions in accordance with the German Committee for Health-Related Evaluation of Building Products /AgBB/
Results:
No carcinogenic substances were detected after 3 and 28 days.
The total VOC (TVOC) after 3 days was below the assessment threshold of 10 mg/m³.
The total VOC (TVOC) after 28 days was below the assessment threshold of 1 mg/m³.
The total SVOC (TSVOC) after 28 days was below the assessment threshold of 0.1 mg/m³.
A rating figure R below the threshold of 1 resulted from the individual VOC substances with more than 5 µg/m³ detected after 28 days.
The total individual VOC substances without a NIK value after 28 days was below the assessment threshold of 0.1 mg/m³.
The formaldehyde concentration after 28 days was below the assessment threshold of 120 µg/m³.

VOC Emissionen

Name	Value	Unit
Overview of Results (28 Tage)	-	µg/m³
TVOC (C6 - C16)	-	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³
R (dimensionless)	-	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	nicht nachgewiesen	µg/m³

AgBB overview of results (3 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	-	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³
R (dimensionless)	-	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	-	µg/m³

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ANNEX 1 – LCA results of the facings

In the following the environmental impacts and life cycle inventory indicators of ROCKWOOL facings are shown. These serve as basis for the calculation of the environmental profiles of faced stone-wool insulation boards.
It is assumed that the facing will be landfilled after usage. This scenario corresponds to the disposal scenario of the unfaced stone-wool products.
After recalculating the volume-based values for the desired thickness, the environmental results for the stone-wool boards and their facings can be added together separately per module.

The environmental profiles of the facings are shown for one-sided attachment.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² glass fleece

Para-meter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	2.42E-01	2.34E-03	0.00E+00	0.00E+00	3.72E-04	0.00E+00	1.61E-03	0.00E+00
ODP	[kg CFC11-Eq.]	1.14E-11	2.89E-15	0.00E+00	0.00E+00	4.59E-16	0.00E+00	2.58E-14	0.00E+00
AP	[kg SO_2-Eq.]	1.03E-03	1.03E-05	0.00E+00	0.00E+00	1.63E-06	0.00E+00	9.79E-06	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	1.21E-04	2.81E-06	0.00E+00	0.00E+00	4.46E-07	0.00E+00	1.34E-06	0.00E+00
POCP	[kg ethene-Eq.]	8.75E-05	-3.53E-06	0.00E+00	0.00E+00	-5.61E-07	0.00E+00	9.18E-07	0.00E+00
ADPE	[kg Sb-Eq.]	8.26E-06	1.21E-10	0.00E+00	0.00E+00	1.92E-11	0.00E+00	5.99E-10	0.00E+00
ADPF	[MJ]	3.50E+00	3.19E-02	0.00E+00	0.00E+00	5.07E-03	0.00E+00	2.11E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² glass fleece

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	4.25E-01	2.44E-03	0.00E+00	0.00E+00	3.88E-04	0.00E+00	2.16E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	4.25E-01	2.44E-03	0.00E+00	0.00E+00	3.88E-04	0.00E+00	2.16E-03	0.00E+00
PENRE	[MJ]	3.90E+00	3.21E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	2.19E-02	0.00E+00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	3.90E+00	3.21E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	2.19E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m³]	1.51E-03	1.41E-06	0.00E+00	0.00E+00	2.24E-07	0.00E+00	4.15E-06	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² glass fleece

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	1.54E-06	2.58E-08	0.00E+00	0.00E+00	4.10E-09	0.00E+00	6.80E-09	0.00E+00
NHWD	[kg]	1.99E-02	8.00E-06	0.00E+00	0.00E+00	1.27E-06	0.00E+00	1.00E-01	0.00E+00
RWD	[kg]	1.57E-04	4.26E-08	0.00E+00	0.00E+00	6.76E-09	0.00E+00	3.49E-07	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² glass silk

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	2.05E-01	2.39E-03	0.00E+00	0.00E+00	3.80E-04	0.00E+00	1.65E-03	0.00E+00
ODP	[kg CFC11-Eq.]	9.86E-12	2.95E-15	0.00E+00	0.00E+00	4.68E-16	0.00E+00	2.63E-14	0.00E+00
AP	[kg SO_2-Eq.]	9.96E-04	1.05E-05	0.00E+00	0.00E+00	1.67E-06	0.00E+00	9.98E-06	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	1.08E-04	2.87E-06	0.00E+00	0.00E+00	4.55E-07	0.00E+00	1.37E-06	0.00E+00
POCP	[kg ethene-Eq.]	6.42E-05	-3.60E-06	0.00E+00	0.00E+00	-5.72E-07	0.00E+00	9.36E-07	0.00E+00
ADPE	[kg Sb-Eq.]	9.34E-06	1.23E-10	0.00E+00	0.00E+00	1.96E-11	0.00E+00	6.11E-10	0.00E+00
ADPF	[MJ]	2.65E+00	3.26E-02	0.00E+00	0.00E+00	5.17E-03	0.00E+00	2.15E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² glass silk

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	4.25E-01	2.44E-03	0.00E+00	0.00E+00	3.88E-04	0.00E+00	2.16E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	4.25E-01	2.44E-03	0.00E+00	0.00E+00	3.88E-04	0.00E+00	2.16E-03	0.00E+00
PENRE	[MJ]	3.90E+00	3.21E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	2.19E-02	0.00E+00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	3.90E+00	3.21E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	2.19E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	1.51E-03	1.41E-06	0.00E+00	0.00E+00	2.24E-07	0.00E+00	4.15E-06	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² glass silk

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	1.54E-06	2.58E-08	0.00E+00	0.00E+00	4.10E-09	0.00E+00	6.80E-09	0.00E+00
NHWD	[kg]	1.99E-02	8.00E-06	0.00E+00	0.00E+00	1.27E-06	0.00E+00	1.00E-01	0.00E+00
RWD	[kg]	1.57E-04	4.26E-08	0.00E+00	0.00E+00	6.76E-09	0.00E+00	3.49E-07	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² mineral fleece

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	5.88E-01	8.13E-03	0.00E+00	0.00E+00	1.29E-03	0.00E+00	5.58E-03	0.00E+00
ODP	[kg CFC11-Eq.]	2.17E-11	1.00E-14	0.00E+00	0.00E+00	1.59E-15	0.00E+00	8.92E-14	0.00E+00
AP	[kg SO_2-Eq.]	1.80E-03	3.56E-05	0.00E+00	0.00E+00	5.65E-06	0.00E+00	3.39E-05	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	1.90E-04	9.70E-06	0.00E+00	0.00E+00	1.54E-06	0.00E+00	4.65E-06	0.00E+00
POCP	[kg ethene-Eq.]	9.14E-05	-1.22E-05	0.00E+00	0.00E+00	-1.94E-06	0.00E+00	3.18E-06	0.00E+00
ADPE	[kg Sb-Eq.]	4.55E-06	4.19E-10	0.00E+00	0.00E+00	6.65E-11	0.00E+00	2.07E-09	0.00E+00
ADPF	[MJ]	1.35E+01	1.10E-01	0.00E+00	0.00E+00	1.75E-02	0.00E+00	7.28E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² mineral fleece

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	5.79E-01	8.44E-03	0.00E+00	0.00E+00	1.34E-03	0.00E+00	7.46E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	5.79E-01	8.44E-03	0.00E+00	0.00E+00	1.34E-03	0.00E+00	7.46E-03	0.00E+00
PENRE	[MJ]	1.41E+01	1.11E-01	0.00E+00	0.00E+00	1.76E-02	0.00E+00	7.59E-02	0.00E+00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	1.41E+01	1.11E-01	0.00E+00	0.00E+00	1.76E-02	0.00E+00	7.59E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	3.20E-03	4.88E-06	0.00E+00	0.00E+00	7.75E-07	0.00E+00	1.44E-05	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² mineral fleece

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	3.39E-04	8.95E-08	0.00E+00	0.00E+00	1.42E-08	0.00E+00	2.35E-08	0.00E+00
NHWD	[kg]	6.33E-02	2.77E-05	0.00E+00	0.00E+00	4.40E-06	0.00E+00	3.47E-01	0.00E+00
RWD	[kg]	2.56E-04	1.47E-07	0.00E+00	0.00E+00	2.34E-08	0.00E+00	1.21E-06	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² 1 m² mineral based primer

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	2.17E-01	5.87E-03	0.00E+00	0.00E+00	9.31E-04	0.00E+00	4.03E-03	0.00E+00
ODP	[kg CFC11-Eq.]	1.21E-11	7.25E-15	0.00E+00	0.00E+00	1.15E-15	0.00E+00	6.45E-14	0.00E+00
AP	[kg SO_2-Eq.]	8.86E-04	2.57E-05	0.00E+00	0.00E+00	4.08E-06	0.00E+00	2.45E-05	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	7.85E-05	7.06E-06	0.00E+00	0.00E+00	1.12E-06	0.00E+00	3.36E-06	0.00E+00
POCP	[kg ethene-Eq.]	8.83E-05	-8.82E-06	0.00E+00	0.00E+00	-1.40E-06	0.00E+00	2.30E-06	0.00E+00
ADPE	[kg Sb-Eq.]	2.63E-07	3.02E-10	0.00E+00	0.00E+00	4.80E-11	0.00E+00	1.50E-09	0.00E+00
ADPF	[MJ]	4.29E+00	8.00E-02	0.00E+00	0.00E+00	1.27E-02	0.00E+00	5.26E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² mineral based primer

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	2.76E-01	6.11E-03	0.00E+00	0.00E+00	9.70E-04	0.00E+00	5.39E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	2.76E-01	6.11E-03	0.00E+00	0.00E+00	9.70E-04	0.00E+00	5.39E-03	0.00E+00
PENRE	[MJ]	4.66E+00	8.00E-02	0.00E+00	0.00E+00	1.27E-02	0.00E+00	5.48E-02	0.00E+00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	4.66E+00	8.00E-02	0.00E+00	0.00E+00	1.27E-02	0.00E+00	5.48E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	1.11E-03	3.53E-06	0.00E+00	0.00E+00	5.60E-07	0.00E+00	1.04E-05	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² mineral based primer

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	3.43E-04	6.49E-08	0.00E+00	0.00E+00	1.03E-08	0.00E+00	1.70E-08	0.00E+00
NHWD	[kg]	5.28E-02	2.00E-05	0.00E+00	0.00E+00	3.18E-06	0.00E+00	2.50E-01	0.00E+00
RWD	[kg]	1.44E-04	1.06E-07	0.00E+00	0.00E+00	1.69E-08	0.00E+00	8.72E-07	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² aluminium sandwich foil

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	6.41E-01	2.22E-03	0.00E+00	0.00E+00	3.53E-04	0.00E+00	1.53E-03	0.00E+00
ODP	[kg CFC11-Eq.]	2.23E-10	2.74E-15	0.00E+00	0.00E+00	4.35E-16	0.00E+00	2.44E-14	0.00E+00
AP	[kg SO_2-Eq.]	2.34E-03	9.77E-06	0.00E+00	0.00E+00	1.55E-06	0.00E+00	9.28E-06	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	1.70E-04	2.66E-06	0.00E+00	0.00E+00	4.23E-07	0.00E+00	1.27E-06	0.00E+00
POCP	[kg ethene-Eq.]	1.70E-04	-3.35E-06	0.00E+00	0.00E+00	-5.32E-07	0.00E+00	8.70E-07	0.00E+00
ADPE	[kg Sb-Eq.]	1.46E-06	1.15E-10	0.00E+00	0.00E+00	1.82E-11	0.00E+00	5.68E-10	0.00E+00
ADPF	[MJ]	8.98E+00	3.03E-02	0.00E+00	0.00E+00	4.81E-03	0.00E+00	2.00E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² aluminium sandwich foil

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	2.37E+00	2.32E-03	0.00E+00	0.00E+00	3.68E-04	0.00E+00	2.05E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	2.37E+00	2.32E-03	0.00E+00	0.00E+00	3.68E-04	0.00E+00	2.05E-03	0.00E+00
PENRE	[MJ]	8.03E+00	3.04E-02	0.00E+00	0.00E+00	4.82E-03	0.00E+00	2.08E-02	0.00E+00
PENRM	[MJ]	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	1.07E+01	3.04E-02	0.00E+00	0.00E+00	4.82E-03	0.00E+00	2.08E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	5.11E-03	1.34E-06	0.00E+00	0.00E+00	2.12E-07	0.00E+00	3.93E-06	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² aluminium sandwich foil

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	2.79E-06	2.45E-08	0.00E+00	0.00E+00	3.89E-09	0.00E+00	6.45E-09	0.00E+00
NHWD	[kg]	1.12E-01	7.56E-06	0.00E+00	0.00E+00	1.20E-06	0.00E+00	9.50E-02	0.00E+00
RWD	[kg]	6.93E-04	4.04E-08	0.00E+00	0.00E+00	6.41E-09	0.00E+00	3.31E-07	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT:
1 m² anorganic fiber-reinforced coating based on magnesium oxide

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	6.66E+00	1.28E-01	0.00E+00	0.00E+00	2.03E-02	0.00E+00	8.79E-02	0.00E+00
ODP	[kg CFC11-Eq.]	2.18E-10	1.58E-13	0.00E+00	0.00E+00	2.50E-14	0.00E+00	1.41E-12	0.00E+00
AP	[kg SO_2-Eq.]	1.10E-02	5.61E-04	0.00E+00	0.00E+00	8.90E-05	0.00E+00	5.33E-04	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	1.68E-03	1.53E-04	0.00E+00	0.00E+00	2.43E-05	0.00E+00	7.32E-05	0.00E+00
POCP	[kg ethene-Eq.]	6.69E-04	-1.93E-04	0.00E+00	0.00E+00	-3.06E-05	0.00E+00	5.00E-05	0.00E+00
ADPE	[kg Sb-Eq.]	5.39E-05	6.62E-09	0.00E+00	0.00E+00	1.05E-09	0.00E+00	3.27E-08	0.00E+00
ADPF	[MJ]	5.35E+01	1.74E+00	0.00E+00	0.00E+00	2.76E-01	0.00E+00	1.15E+00	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE:
1 m² anorganic fiber-reinforced coating based on magnesium oxide

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	7.67E+00	1.34E-01	0.00E+00	0.00E+00	2.12E-02	0.00E+00	1.18E-01	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	7.67E+00	1.34E-01	0.00E+00	0.00E+00	2.12E-02	0.00E+00	1.18E-01	0.00E+00
PENRE	[MJ]	6.05E+01	1.75E+00	0.00E+00	0.00E+00	2.77E-01	0.00E+00	1.20E+00	0.00E+00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	6.05E+01	1.75E+00	0.00E+00	0.00E+00	2.77E-01	0.00E+00	1.20E+00	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	1.57E-02	7.69E-05	0.00E+00	0.00E+00	1.22E-05	0.00E+00	2.26E-04	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:
1 m² anorganic fiber-reinforced coating based on magnesium oxide

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	2,95E-05	1,40E-06	0,00E+00	0,00E+00	2,23E-07	0,00E+00	3,71E-07	0,00E+00
NHWD	[kg]	6,92E-01	4,36E-04	0,00E+00	0,00E+00	6,92E-05	0,00E+00	5,46E+00	0,00E+00
RWD	[kg]	2,77E-03	2,32E-06	0,00E+00	0,00E+00	3,69E-07	0,00E+00	1,90E-05	0,00E+00
CRU	[kg]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
MFR	[kg]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
MER	[kg]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
EEE	[MJ]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
EET	[MJ]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² RockTect facing

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	4.06E-01	3.40E-03	0.00E+00	0.00E+00	5.40E-04	0.00E+00	2.34E-03	0.00E+00
ODP	[kg CFC11-Eq.]	1.02E-11	4.19E-15	0.00E+00	0.00E+00	6.65E-16	0.00E+00	3.74E-14	0.00E+00
AP	[kg SO_2-Eq.]	6.77E-04	1.49E-05	0.00E+00	0.00E+00	2.37E-06	0.00E+00	1.42E-05	0.00E+00
EP	[kg $(PO_4)^{3-}$-Eq.]	6.96E-05	4.08E-06	0.00E+00	0.00E+00	6.47E-07	0.00E+00	1.95E-06	0.00E+00
POCP	[kg ethene-Eq.]	1.48E-04	-5.12E-06	0.00E+00	0.00E+00	-8.13E-07	0.00E+00	1.33E-06	0.00E+00
ADPE	[kg Sb-Eq.]	1.39E-07	1.76E-10	0.00E+00	0.00E+00	2.79E-11	0.00E+00	8.69E-10	0.00E+00
ADPF	[MJ]	1.18E+01	4.63E-02	0.00E+00	0.00E+00	7.35E-03	0.00E+00	3.05E-02	0.00E+00

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² RockTect facing

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	3.77E-01	3.55E-03	0.00E+00	0.00E+00	5.63E-04	0.00E+00	3.13E-03	0.00E+00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	3.77E-01	3.55E-03	0.00E+00	0.00E+00	5.63E-04	0.00E+00	3.13E-03	0.00E+00
PENRE	[MJ]	7.04E+00	4.65E-02	0.00E+00	0.00E+00	7.38E-03	0.00E+00	3.18E-02	0.00E+00
PENRM	[MJ]	5.13E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	1.22E+01	4.65E-02	0.00E+00	0.00E+00	7.38E-03	0.00E+00	3.18E-02	0.00E+00
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	1.61E-03	2.05E-06	0.00E+00	0.00E+00	3.25E-07	0.00E+00	6.02E-06	0.00E+00

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² RockTect facing

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	1.74E-06	3.75E-08	0.00E+00	0.00E+00	5.95E-09	0.00E+00	9.87E-09	0.00E+00
NHWD	[kg]	2.27E-03	1.16E-05	0.00E+00	0.00E+00	1.84E-06	0.00E+00	1.45E-01	0.00E+00
RWD	[kg]	1.41E-04	6.18E-08	0.00E+00	0.00E+00	9.81E-09	0.00E+00	5.06E-07	0.00E+00
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

ANNEX 2 – product list high bulk density range

The following products are covered by the IBU-EPD "ROCKWOOL rock wool insulation materials in the high bulk density range".

504
Alurock
Baserock 90
Bitrock
Bondrock 040 MV
Brandschutz-Profilfüller-150
Conlit 150 U
Conlit Duct Board 90
Conlit Fire Plug
Conlit Muffenrohrschale
Conlit Muffenrohrschale S
Conlit Penetration Board
Conlit PS 150 Sprinkler Bogen
Conlit PS 150 Sprinkler Cap
Conlit PS 150 Sprinkler Section
Conlit PS EIS 90
Conlit Steelprotect Board
Conlit Steelprotect Board Alu
Conlit Steelprotect Section
Conlit Steelprotect Section Alu
Conrock 12.5
Conrock 12.5 P
Conrock 15
Conrock Plus 12.5
Conrock Q7
Conrock Q9
Durock 037
Durock 038
Durock 040
Durock Austria 035
Durock Austria 038
Eurorock
Floorrock Acoustic CP2
Floorrock Acoustic CP3
Floorrock AP
Floorrock GP
Floorrock Heat
Floorrock HP
Floorrock TE
Floorrock Therm
Frontrock
Georock 037
Georock 038
Georock 040
Georock 040 MV
Hardrock 038
Hardrock 040
Interrock

Interrock 037
Keprock
Keprock MV
Lamellen W 12
Lamellen W 20
Lamellen W 50
Lolamat
Lolamat W12
Madeira
Masterrock 036
Masterrock 036 kaschiert
Megarock
Monorock Max
Panrock
Panrock 140
Panrock 140 LAM
Prima
Prorock 036
Raftrock
RDK
RFS 11063
RFS 30
RFS 60
RFS 5341
RFS 5833
RFS 6040
RFS 6053
RFS 6543
RFS 7260
RFS 7543
RFS 8643
RFS 9060
RFS 9060 G
RFS 11270
RFS 11460
RFS 18063
RFS LK 10357
RFS LK 11564
RFS LK 7564
Rhinoxx
Rhinoxx Afschot / Pente
RMZ 5240
Rockacier B Nu
Rockacier C NU
RockFloor Extra
RockFloor Solid
RockFloor Therm
Roofrock 038 Austria

RP-GF
RP-GF 70
RP-GF 90
RPI-12
RPI-12 T
RPI-13.5
RPI-15
RPI-17
RP-KGD
RP-PT
RP-PT 040
RP-PT/M
RP-SD
RP-SD GF
RP-TF
RP-XV
RSK
SeaRox SL 450
SeaRox SL 470
Silkrock 12 SE
Solarrock
Soundrock 12 NE
Soundrock 12 SE
Soundrock 15 SE
Spanrock YL
Spanrock YL LAM
Spanrock ZL
Splitrock Trennfugendämmplatte
Streetrock 140 SE
Taurox Duo NP
Taurox NP
Tauroxx
Teclit Dämmkappe
Teclit Hanger
Tegarock Plus
W20 OP RWD