ENVIRONMENTAL PRODUCT DECLARATION

In accordance with EN 15804 and ISO 14025

Glass Wool Insulation G3

Date of publication: 2018-06-26
Valid until: 2021-06-25
Based on PCR 2014:13 Insulation materials
Scope of the EPD®: Italia

Registration number
The International EPD® System:
S-P-01137

ISOVER SAINT-GOBAIN

General information

Manufacturer: Saint- Gobain PPC Italia S.p.A.
Programme used: The International EPD® System. More information at www.environdec.com
EPD® registration number: S-P-01137
PCR identification: PCR Multiple CPC codes Insulation materials version 1.2 (2014:13)
Product name and manufacturer represented: Glass Wool type 4+; Saint- Gobain PPC Italia S.p.A.
Owner of the declaration: Saint- Gobain PPC Italia S.p.A.
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Declaration issued: 2018-06-26, **valid until**: 2021-06-25

EPD program operator	The International EPD® System. Operated by EPD® International AB. www.environdec.com.
PCR review conducted by	The Technical Committee of the International EPD® System
EPD owner:	Saint-Gobain PPC Italia S.p.A.
LCA author:	Politecnico di Milano
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒	
Verifier Vito D'Incognito appointed by the International EPD System Committee	

Product description

Product description and description of use:

This Environmental Product Declaration (EPD®) describes the environmental impacts of 1 m² of mineral wool with a thermal resistance of 1.0 $K*m^2*W^{-1}$.
The declared unit is therefore is the amount of material necessary to achieve 1 m^2*K*W^{-1} of thermal resistance as requested by the applicable PCR.

The production site of Saint- Gobain PPC Italia SpA in Vidalengo di Caravaggio (BG) uses natural and abundant raw materials (sand), using fusion and fiberising techniques to produce glass wool. The products obtained come in the form of a "mineral wool mat" consisting of a soft, airy structure

On Earth, naturally, the best insulator is dry immobile air at 20°C: its thermal conductivity factor, expressed in λ, is 0.025 W/(m.K) (watts per meter Kelvin degree). The thermal conductivity of glass wool is close to immobile air as its lambda varies from 0.031 W/(m.K) for the most efficient to 0.043 W/(m.K) to the least.

With its entangled structure, glass wool is a porous material that traps the air, making it one of the best insulating materials. The porous and elastic structure of the wool also absorbs noise in the air, knocks and offers acoustic correction inside premises. Mineral wool containing incombustible materials does not fuel fire or propagate flames.

Glass wool insulation (glass wool) is used in buildings as well as industrial facilities. It ensures a high level of comfort, lowers energy costs, minimizes carbon dioxide (CO_2) emissions, prevents heat loss through pitched roofs, walls, floors, pipes and boilers, reduces noise pollution and protects homes and industrial facilities from the risk of fire.

Glass wool products last for the average building's lifetime (which is often set at 50 years as a default), or as long as the insulated building component is part of the building.
The glass wool products in this EPD are identified as products belonging to a family called "G3".
In this document the environmental impacts are described for three different configurations of the glass wool "G3":

- Insulating products without facing (the reference product assumed is "E60 S G3" with a density of 30 kg/m^3 and a thermal conductivity of 0,032 W/mK);
- Insulating products with facing (the facing is normally made up of paper and bitumen) (the reference product assumed is "E60 S rolled up G3 KAR" with a density of 30 kg/m^3 and a thermal conductivity of 0,032 W/mK);
- Insulating products with bitumen layer type BAC (the facing is a high thickness layer of bitumen) (the reference product assumed is "BAC CF Roofine G3" with a density of 90 kg/m^3 and a thermal conductivity of 0,037 W/mK).

Technical data/physical characteristics

Thermal resistance of the Product: **1.0** K.m².W^{-1} (EN 12667) according to the PCR.
The thermal conductivity of the Glass wool is: **0,032 W/(m·K)** (EN 12667) (product without facing)
The thermal conductivity of the Glass wool is: **0,037 W/(m·K)** (EN 12667) (product with facing type BAC)
The thermal conductivity of the Glass wool is: **0,032 W/(m·K)** (EN 12667) (product with facing)

Reaction to fire: **Euroclasses as follows:**
A1 (products without facing or with glass veil)
A2,s1-d0 (products without facing or with glass veil)
B,s1-d0 (Isover Climcover Roll Alu B G3)
F (bituminized facing)

PRODUCT WITHOUT FACING
(nominal values of density = 30 kg/m^3 and thermal conductivity = 0,032 W/mK)
Description of the main components and/or materials for 1 m^2 of product without facing with a thermal resistance of 1 K.m^2.W^{-1} for the calculation of the EPD®:

PARAMETER	VALUE
Quantity of wool for 1 m^2 of product	0,96 Kg
Thickness of wool	32 mm
Surfacing	No facing or glass mat
Packaging for the transportation and distribution	Polyethylene Wood pallet Paper for the label
Product used for the Installation	None

PRODUCT WITH FACING type BAC
(nominal values of density = 90 kg/m^3 and thermal conductivity = 0,037 W/mK)

Description of the main components and/or materials for 1 m^2 of product with facing type BAC with a thermal resistance of 1 K.m^2.W^{-1} for the calculation of the EPD®:

PARAMETER	VALUE
Quantity of wool for 1 m^2 of product	3,33 Kg
Thickness of wool	37 mm
Surfacing	bitumen
Packaging for the transportation and distribution	Polyethylene Wood pallet Paper for the label
Product used for the Installation	None

PRODUCT WITH FACING (nominal values of density = 30 kg/m^3 and thermal conductivity = 0,032 W/mK)

Description of the main components and/or materials for 1 m^2 of product with facing with a thermal resistance of 1 K.m^2.W^{-1} for the calculation of the EPD®:

PARAMETER	VALUE
Quantity of wool for 1 m^2 of product	0,960 Kg
Thickness of wool	32 mm
Surfacing	Paper, aluminum foil, bitumen
Packaging for the transportation and distribution	Polyethylene Wood pallet Paper for the label
Product used for the Installation	None

During the life cycle of the product any hazardous substance listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization[1]” has been used in a percentage higher than 0,1% of the weight of the product.

The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

1 http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

LCA calculation information

FUNCTIONAL UNIT	Providing a thermal insulation on 1 m² of product with a thermal resistance of 1 $K.m^2.W^{-1}$
SYSTEM BOUNDARIES	Cradle to Grave: Mandatory stages = A1-3, A4-5, B1-7, C1-4. Optional stage = D not taken into account
REFERENCE SERVICE LIFE (RSL)	50 years
CUT-OFF RULES	In the case that there is not enough information, the process energy and materials representing less than 1% of the whole energy and mass used can be excluded (if they do not cause significant impacts). The addition of all the inputs and outputs excluded cannot be bigger than the 5% of the whole mass and energy used, as well of the emissions to environment occurred. Flows related to human activities such as employee transport are excluded. The construction of plants, production of machines and transportation systems are excluded since the related flows are supposed to be negligible compared to the production of the building product when compared at these systems lifetime level.
ALLOCATIONS	Allocation criteria are based on mass
GEOGRAPHICAL COVERAGE AND TIME PERIOD	Italia production 2015 Italia transportation 2015

- “EPDs of construction products may be not comparable if they do not comply with EN 15804"
- “Environmental Product Declarations within the same product category from different programs may not be comparable”

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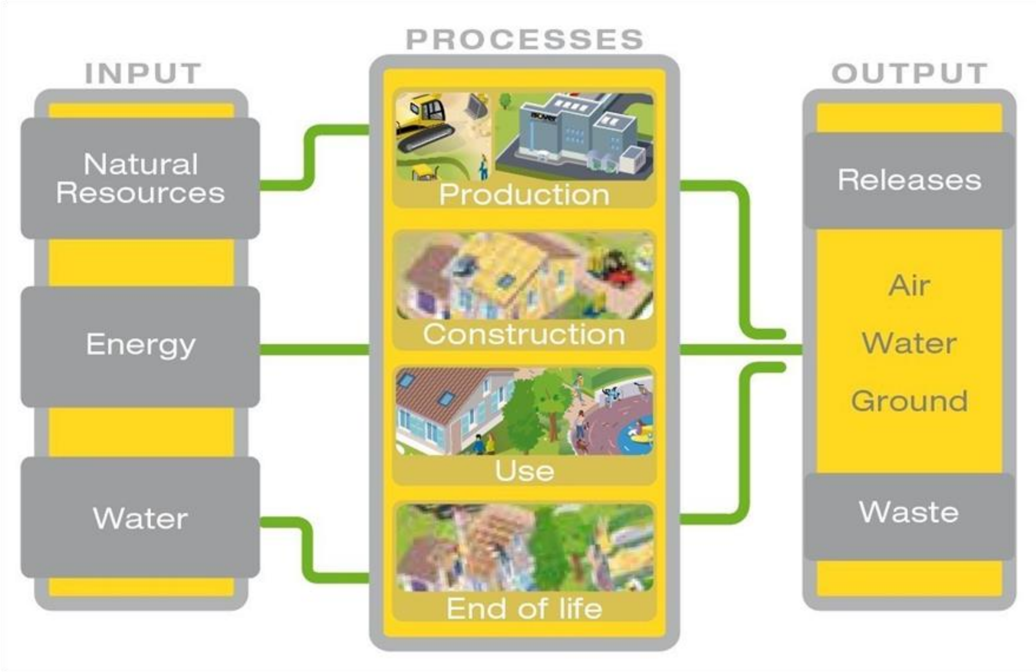
Life cycle stages

Flow diagram of the Life Cycle



Product stage, A1-A3

Description of the stage: the product stage of the glass wool products is subdivided into 3 modules A1, A2 and A3 respectively "Raw material supply", "transport" and "manufacturing".

The aggregation of the modules A1, A2 and A3 is a possibility considered by the EN 15804 standard. This rule is applied in this EPD.

Description of the scenarios and other additional technical information:

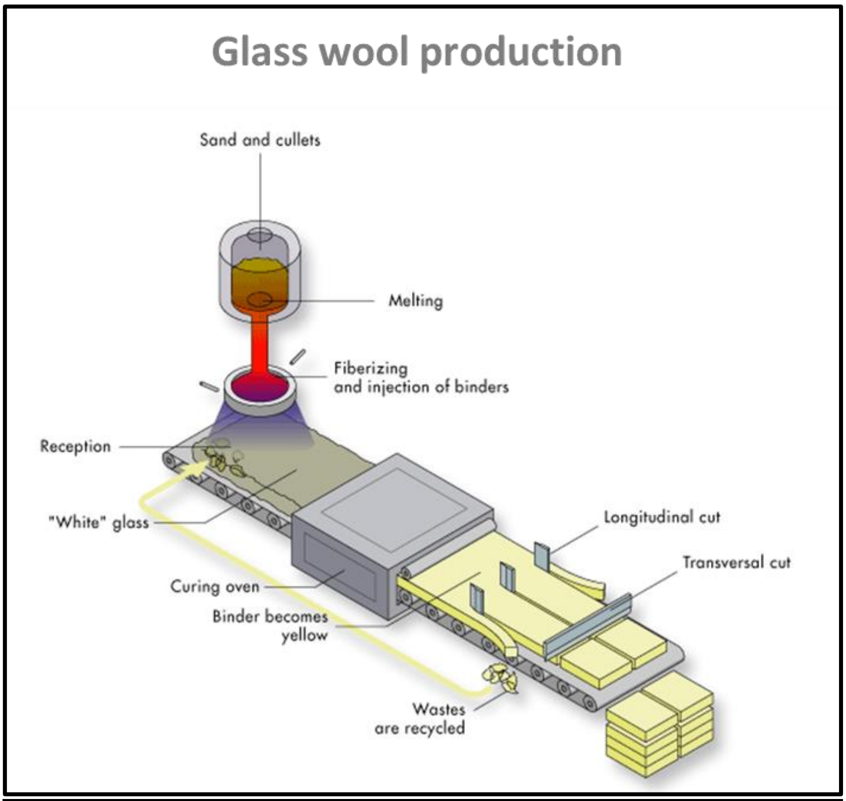
A1, Raw materials supply
This module takes into account the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process.

Specifically, the raw material supply covers production of binder components and sourcing (quarry) of raw materials for fiber production, e.g. sand and borax for glass wool. Besides these raw materials, recycled materials (glass cullet) are also used as input.

A2, Transport to the manufacturer
The raw materials are transported to the manufacturing site. In our case, the modeling include: road, rail and ship transportation (average values) of each raw material.

A3, Manufacturing
This module includes the manufacturing of the product and packaging. Specifically, it covers the manufacturing of glass, resin, glass wool (including the processes of fusion and fiberizing showed in the flow diagram), and the packaging.

Manufacturing process flow diagram



Construction process stage, A4-A5

Description of the stage: the construction process is divided into 2 modules: A4, transport to the building site and A5, installation in the building.

A4, Transport to the building site: this module includes transport from the production gate to the building site.
Transport is calculated on the basis of a scenario with the parameters described in the following table.

PARAMETER	VALUE/DESCRIPTION
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat, etc.	Average truck trailer with a 24t payload, diesel consumption 38 liters for 100 km
Distance	456 km
Capacity utilisation (including empty returns)	100 % of the capacity in volume
Bulk density of transported products*	20-100 kg/m^3
Volume capacity utilisation factor	1

*Isover products from Vidalengo factory present a compression factor between 4 and 8.

A5, Installation in the building: this module includes:

No additional accessory was taken into account for the implementation phase insulation product.

PARAMETER	VALUE/DESCRIPTION
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	5 %
Distance	25 km to landfill by truck
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovering, disposal (specified by route)	Packaging wastes are 100 % collected and modeled as recovered matter Glass wool losses are landfilled

Use stage (excluding potential savings), B1-B7

Description of the stage: the use stage is divided into the following modules:

- B1: Use
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational energy use
- B7: Operational water use

Description of the scenarios and additional technical information:
Once installation is complete, no actions or technical operations are required during the use stages until the end of life stage. Therefore glass wool insulation products have no impact (excluding potential energy savings) on this stage.

End of Life Stage, C1-C4

Description of the stage: this stage includes the next modules:

C1, Deconstruction, demolition
The de-construction and/or dismantling of insulation products take part of the demolition of the entire building. In our case, the environmental impact is assumed to be very small and can be neglected.

C2, Transport to waste processing
The model use for the transportation (see A4, transportation to the building site) is applied.

C3, Waste processing for reuse, recovery and/or recycling
The product is considered to be landfilled without reuse, recovery or recycling.

C4, Disposal
The glass wool is assumed to be 100% landfilled.

Description of the scenarios and additional technical information:

End of life:

PARAMETER	VALUE/DESCRIPTION
Collection process specified by type	The entire product, including any surfacing is collected alongside any mixed construction waste

Recovery system specified by type	There is no recovery, recycling or reuse of the product once it has reached its end of life phase.
Disposal specified by type	The product alongside the mixed construction waste from demolishing will go to landfill
Assumptions for scenario development (e.g. transportation)	We assume that the waste going to landfill will be transported by truck with 24 tons payload, using diesel as a fuel consuming 38 liters per 100km. Distance covered is 25 km

Reuse/recovery/recycling potential, D

Description of the stage: module D has not been taken into account.

LCA results

LCA model, aggregation of data and environmental impact are calculated from the LCA SimaPro 8.3 software together with Ecoinvent 3.3 databases to obtain the inventory of generic data.
The impacts have been assessed with a combination of the following methods: CML-IA baseline v. 4.1 (Global Warming Potential, Ozone Layer Depletion, Acidification, Eutrophication, Abiotic depletion non fossil, Abiotic depletion fossil), Cumulative Energy Demand V1.09 (Use of renewable primary energy excluding renewable primary energy resources used as raw materials, Total use of renewable primary energy resources, Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials, Total use of non-renewable primary energy resources), ReCiPe Midpoint (H) V1.13 (Photochemical Ozone Creation and Use of net fresh water) and EDIP 2003 V1.06 (Hazardous waste disposed, Non-hazardous waste disposed, Radioactive waste disposed).

Raw materials and energy consumption, as well as transport distances have been taken directly from the manufacturing plant (Production data according 2015 and transport data according 2015).

In the next pages the environmental impacts for the family G3 with no facing/facing BAC/facing are listed in the tables 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 3.4.

TABLE 1.1_ENVIRONMENTAL IMPACTS G3 without facing

Parameters	***Product stage***	***Construction stage***		***Use stage***							***End of life stage***				***D Reuse, recovery, recycling***
	A1 / A2 / A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operational energy use**	**B7 Operational water use**	**C1 Deconstruction / demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) - *kg CO_2 equiv/FU*	1,93 E+00	9,00 E-02	7,37 E-04	0	0	0	0	0	0	0	0	3,60 E-03	0	4,63 E-03	MND
	The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.														
Ozone Depletion (ODP) *kg CFC 11 equiv/FU*	2,20 E-07	1,75 E-08	1,82 E-10	0	0	0	0	0	0	0	0	7,03 E-10	0	1,64 E-09	MND
	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification potential (AP) *kg SO_2 equiv/FU*	1,49 E-02	3,61 E-04	3,91 E-06	0	0	0	0	0	0	0	0	1,45 E-05	0	3,67 E-05	MND
	Acid depositions have negative impacts on natural ecosystems and the man-made environment incl, buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication potential (EP) *kg $(PO_4)^3$- equiv/FU*	4,20 E-03	8,12 E-05	8,55 E-07	0	0	0	0	0	0	0	0	3,25 E-06	0	7,78 E-06	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.														
Photochemical ozone creation (POPC) *kg Ethene equiv/FU*	7,90 E-03	4,97 E-04	5,37 E-06	0	0	0	0	0	0	0	0	1,99 E-05	0	5,04 E-05	MND E-03
	Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Abiotic depletion potential for non-fossil resources (ADP-elements) - *kg Sb equiv/FU*	4,44 E-06	2,55 E-07	1,69 E-09	0	0	0	0	0	0	0	0	1,02 E-08	0	5,59 E-09	MND
Abiotic depletion potential for fossil resources (ADP-fossil fuels) - *MJ/FU*	3,97 E+01	1,39 E+00	1,48 E-02	0	0	0	0	0	0	0	0	5,56 E-02	0	1,37 E-01	MND
	Consumption of non-renewable resources, thereby lowering their availability for future generations.														

TABLE 1.2_RESOURCE USE G3 without facing

Parameters	Product stage	Construction process stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - *MJ/FU*	6,37 E+00	2,02 E-02	3,02 E-04	0	0	0	0	0	0	0	0	8,08 E-04	0	3,65 E-03	MND
Use of renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) *MJ/FU*	6,37 E+00	2,02 E-02	3,02 E-04	0	0	0	0	0	0	0	0	8,08 E-04	0	3,65 E-03	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - *MJ/FU*	4,21 E+01	1,52 E+00	1,61 E-02	0	0	0	0	0	0	0	0	6,10 E-02	0	1,48 E-01	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - *MJ/FU*	4,21 E+01	1,52 E+00	1,61 E-02	0	0	0	0	0	0	0	0	6,10 E-02	0	1,48 E-01	MND
Use of secondary material *kg/FU*	7,24 E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Use of renewable secondary fuels- *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of non-renewable secondary fuels - *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of net fresh water - *m3/FU*	9,29 E-02	2,70 E -04	9,62 E-06	0	0	0	0	0	0	0	0	1,08 E-05	0	1,55 E-04	MND

TABLE 1.3_WASTE CATEGORIES G3 without facing

Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed *kg/FU*	5,26 E-05	7,70 E-07	9,24 E-09	0	0	0	0	0	0	0	0	3,09 E-08	0	9,54 E-08	MND
Non-hazardous waste disposed *kg/FU*	2,26 E-01	6,75 E-02	4,84 E-02	0	0	0	0	0	0	0	0	2,70 E-03	0	9,12 E-01	MND
Radioactive waste disposed *kg/FU*	8,28 E-05	1,00 E-05	1,04 E-07	0	0	0	0	0	0	0	0	4,02 E-07	0	9,24 E-07	MND

TABLE 1.4_OTHER OUTPUT FLOWS G3 without facing															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for recycling *kg/FU*	0	0	7,72 E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for energy recovery *kg/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Exported energy *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND

TABLE 2.1_ENVIRONMENTAL IMPACTS family G3 with facing BAC

Parameters	Product stage	Construction stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Global Warming Potential (GWP) - *kg CO2 equiv/FU*	7,02 E+00	3,12 E-01	2,56 E-03	0	0	0	0	0	0	0	0	1,25 E-02	0	1,60 E-02	MND
	The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.														
Ozone Depletion (ODP) *kg CFC 11 equiv/FU*	1,22 E-06	6,09 E-08	6,32 E-10	0	0	0	0	0	0	0	0	2,44 E-09	0	5,67 E-09	MND
	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification potential (AP) *kg SO2 equiv/FU*	5,53 E-02	1,25 E-03	1,36 E-05	0	0	0	0	0	0	0	0	5,02 E-05	0	1,27 E-04	MND
	Acid depositions have negative impacts on natural ecosystems and the man-made environment incl, buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication potential (EP) *kg (PO4)3- equiv/FU*	1,51 E-02	2,82 E-04	2,96 E-06	0	0	0	0	0	0	0	0	1,13 E-05	0	2,70 E-05	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.														
Photochemical ozone creation (POPC) *kg Ethene equiv/FU*	3,09 E-02	1,72 E-03	1,86 E-05	0	0	0	0	0	0	0	0	6,91 E-05	0	1,75 E-04	MND
	Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Abiotic depletion potential for non-fossil resources (ADP-elements) - *kg Sb equiv/FU*	1,60 E-05	8,86 E-07	5,87 E-09	0	0	0	0	0	0	0	0	3,55 E-08	0	1,94 E-08	MND
Abiotic depletion potential for fossil resources (ADP-fossil fuels) - *MJ/FU*	1,73 E+02	4,81 E+00	5,13 E-02	0	0	0	0	0	0	0	0	1,93 E-01	0	4,74 E-01	MND
	Consumption of non-renewable resources, thereby lowering their availability for future generations.														

TABLE 2.2_RESOURCE USE family G3 with facing BAC

Parameters	Product stage	Construction process stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - *MJ/FU*	2,29 E+01	5,28 E+00	1,05 E-03	0	0	0	0	0	0	0	0	2,80 E-03	0	1,26 E-02	MND
Use of renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) *MJ/FU*	2,29 E+01	5,28 E+00	1,05 E-03	0	0	0	0	0	0	0	0	2,80 E-03	0	1,26 E-02	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - *MJ/FU*	1,84 E+02	7,00 E-02	5,60 E-02	0	0	0	0	0	0	0	0	2,12 E-01	0	5,13 E-01	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - *MJ/FU*	1,84 E+02	7,00 E-02	5,60 E-02	0	0	0	0	0	0	0	0	2,12 E-01	0	5,13 E-01	MND
Use of secondary material *kg/FU*	2,51 E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Use of renewable secondary fuels- *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of non-renewable secondary fuels - *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of net fresh water - *m3/FU*	3,27 E-01	9,38 E-04	3,34 E-05	0	0	0	0	0	0	0	0	3,75 E-05	0	5,36 E-04	MND

TABLE 2.3_WASTE CATEGORIES family G3 with facing BAC

Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed *kg/FU*	1,93 E-04	2,67 E-06	3,21 E-08	0	0	0	0	0	0	0	0	1,07 E-07	0	3,31 E-07	MND
Non-hazardous waste disposed *kg/FU*	8,15 E-01	2,34 E-01	1,68 E-01	0	0	0	0	0	0	0	0	9,38 E-03	0	3,16 E+00	MND
Radioactive waste disposed *kg/FU*	5,45 E-04	3,48 E-05	3,60 E-07	0	0	0	0	0	0	0	0	1,40 E-06	0	3,20 E-06	MND

TABLE 2.4_OTHER OUTPUT FLOWS family G3 with facing BAC

Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for recycling *kg/FU*	0	0	2,68 E-01	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for energy recovery *kg/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Exported energy *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND

TABLE 3.1_ENVIRONMENTAL IMPACTS family G3 with facing

Parameters	Product stage	Construction stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Global Warming Potential (GWP) - *kg CO_2 equiv/FU*	2,00 E+00	9,00 E-02	7,37 E-04	0	0	0	0	0	0	0	0	3,60 E-03	0	4,63 E-03	MND
	The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.														
Ozone Depletion (ODP) *kg CFC 11 equiv/FU*	2,55 E-07	1,75 E-08	1,82 E-10	0	0	0	0	0	0	0	0	7,03 E-10	0	1,64 E-09	MND
	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification potential (AP) *kg SO_2 equiv/FU*	1,55 E-02	3,61 E-04	3,91 E-06	0	0	0	0	0	0	0	0	1,45 E-05	0	3,67 E-05	MND
	Acid depositions have negative impacts on natural ecosystems and the man-made environment incl, buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication potential (EP) *kg $(PO_4)^{3-}$ equiv/FU*	4,34 E-03	8,12 E-05	8,55 E-07	0	0	0	0	0	0	0	0	3,25 E-06	0	7,78 E-06	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.														
Photochemical ozone creation (POPC) *kg Ethene equiv/FU*	8,35 E-03	4,97 E-04	5,37 E-06	0	0	0	0	0	0	0	0	1,99 E-05	0	5,04 E-05	MND
	Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Abiotic depletion potential for non-fossil resources (ADP-elements) - *kg Sb equiv/FU*	4,75 E-06	2,55 E-07	1,69 E-09	0	0	0	0	0	0	0	0	1,02 E-08	0	5,59 E-09	MND
Abiotic depletion potential for fossil resources (ADP-fossil fuels) - *MJ/FU*	4,29 E+01	1,39 E+00	1,48 E-02	0	0	0	0	0	0	0	0	5,56 E-02	0	1,37 E-01	MND
	Consumption of non-renewable resources, thereby lowering their availability for future generations.														

TABLE 3.2_RESOURCE USE family G3 with facing

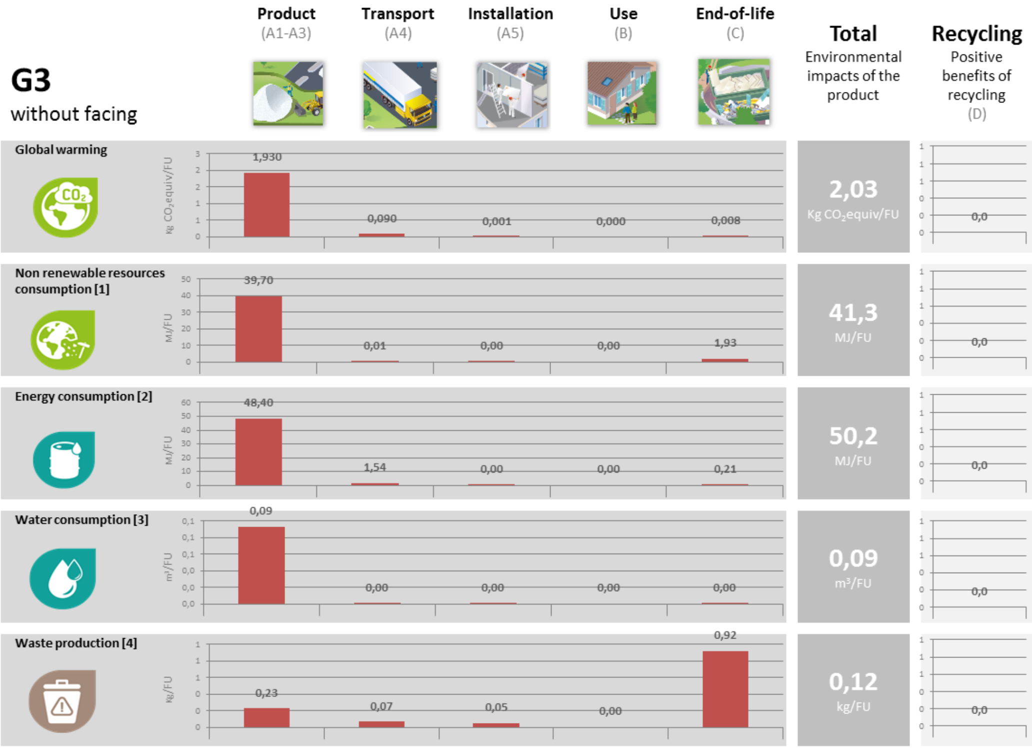
Parameters	Product stage	Construction process stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - *MJ/FU*	7,09 E+00	2,02 E-02	3,02 E-04	0	0	0	0	0	0	0	0	8,08 E-04	0	3,65 E-03	MND
Use of renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) *MJ/FU*	7,09 E+00	2,02 E-02	3,02 E-04	0	0	0	0	0	0	0	0	8,08 E-04	0	3,65 E-03	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - *MJ/FU*	4,57 E+01	1,52 E+00	1,61 E-02	0	0	0	0	0	0	0	0	6,10 E-02	0	1,48 E-01	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - *MJ/FU*	4,57 E+01	1,52 E+00	1,61 E-02	0	0	0	0	0	0	0	0	6,10 E-02	0	1,48 E-01	MND
Use of secondary material *kg/FU*	7,24 E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Use of renewable secondary fuels- *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of non-renewable secondary fuels - *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Use of net fresh water - *m3/FU*	9,47 E-02	2,70 E -04	9,62 E-06	0	0	0	0	0	0	0	0	1,08 E-05	0	1,55 E-04	MND

TABLE 3.3_WASTE CATEGORIES family G3 with facing

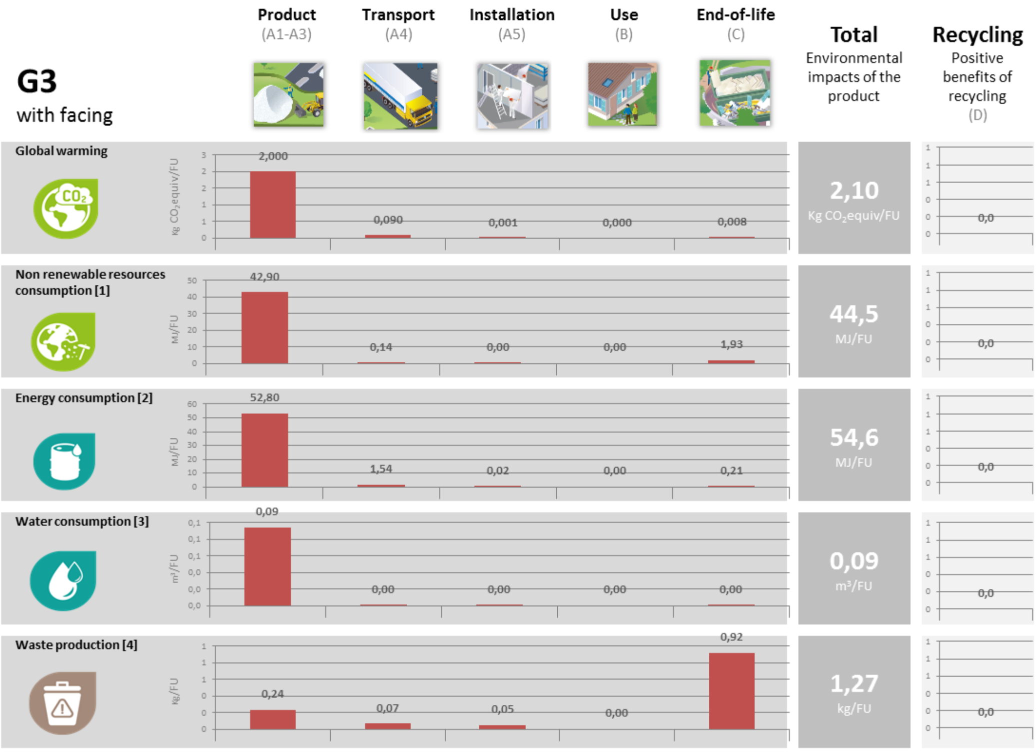
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed *kg/FU*	5,51 E-05	7,70 E-07	9,24 E-09	0	0	0	0	0	0	0	0	3,09 E-08	0	9,54 E-08	MND
Non-hazardous waste disposed *kg/FU*	2,35 E-01	6,75 E-02	4,84 E-02	0	0	0	0	0	0	0	0	2,70 E-03	0	9,12 E-01	MND
Radioactive waste disposed *kg/FU*	1,03 E-04	1,00 E-05	1,04 E-07	0	0	0	0	0	0	0	0	4,02 E-07	0	9,24 E-07	MND

TABLE 3.4_OTHER OUTPUT FLOWS family G3 with facing

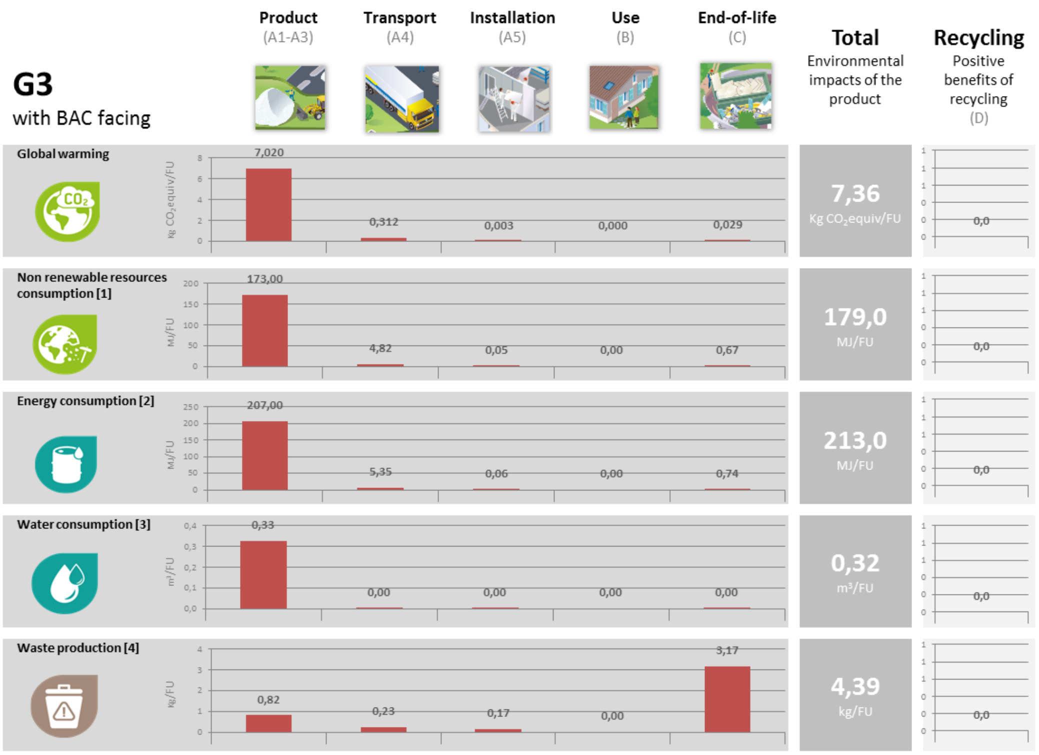
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for recycling *kg/FU*	0	0	7,72 E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for energy recovery *kg/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND
Exported energy *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MND



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the total use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the the sum of hazardous, non-hazardous and radioactive waste disposed.



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the total use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the the sum of hazardous, non-hazardous and radioactive waste disposed.



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the total use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the the sum of hazardous, non-hazardous and radioactive waste disposed.

Global Warming Potential (Climate Change) (GWP)

When analyzing the above figure for GWP, it can clearly be seen that the majority of contribution to this environmental impact is from the production modules (A1 – A3). This is primarily because the sources of greenhouse gas emissions are predominant in this part of the life cycle. CO_2 is generated upstream from the production of electricity and is also released on site by the combustion of natural gas. We can see that other sections of the life cycle also contribute to the GWP; however the production modules contribute to over 80% of the contribution. Combustion of fuel in transport vehicles will generate the second highest percentage of greenhouse gas emissions.

Non-renewable resources consumptions

We can see that the consumption of non – renewable resources is once more found to have the highest value in the production modules. This is because a large quantity of natural gas is consumed within the factory, and non – renewable fuels such as natural gas and coal are used to generate the large amount of electricity we use. The contribution to this impact from the other modules is very small and primarily due to the non – renewable resources consumed during transportation.

Energy Consumptions

As we can see, modules A1 – A3 have the highest contribution to total energy consumption. Energy in the form of electricity and natural gas is consumed in a vast quantity during the manufacture of glass mineral wool so we would expect the production modules to contribute the most to this impact category.

Water Consumption

As we don't use water in any of the other modules (A4 – A5, B1 – B7, C1 – C4), we can see that there is no contribution to water consumption. For the production phase, water is used within the manufacturing facility and therefore we see the highest contribution here. However, we recycle a lot of the water on site so the contribution is still relatively low.

Waste Production

Waste production does not follow the same trend as the above environmental impacts. The largest contributor is the end of life module. This is because the entire product is sent to landfill once it reaches the end of life state. However, there is a still an impact associated with the production module since we do generate waste on site. The very small impact associated with installation is due to the loss rate of product during implementation.

Environmental Positive Contribution

Recycled material content

Isover glass wool's recycled glass content is on the average 75,4 %. Recycled glass content calculation is based on the product weight and calculated according to the ISO 14021:2016 using the 2015 raw material and production data.

Health and safety

Isover glass wool is in accordance with Note Q of the Regulation (EC) n. 1272/2008 of the European Parliament and of the Council as currently in force and fulfills the Minimal Environmental Criteria as described in Italian Regulation.

Annex 1: Additional information

Influence of particular thicknesses

Products without facing

This EPD® covers - for the glass wool type G3 without facing – finished products in the range of density between 13 and 112,5 kg/m^3 and the range of thicknesses between 20 mm and 220 mm. Therefore for every specific product (characterized by its density and thickness) a multiplication factor may be determined in order to obtain its environmental performance starting from the environmental impacts of the reference product. The reference product for this family is the product named "E60 S G3" and the impacts listed in the following tables are determined for the functional unit : value of R= 1 m^2.K / W for 32 mm of product).
To determine the impacts associated to a generic products a conversion factor shall be calculated and the impacts given in this EPD must be multiplied by the conversion factor.

For a generic product belonging to the family "G3 without facing" the conversion factor CF can be determined as follows assuming **ρ** = density of the product [kg/m^3] under examination and S = product thickness [m].

$$\text{CF} = 1{,}041 * \boldsymbol{\rho} * S$$

As an example the conversion factor CF for a product with a density = 50 and a thickness of 40 mm is determined as follows:
CF = $1{,}041 * 50 * 0{,}04$ = 2,08

To determine for instance the environmental impact "Global Warming Potential (GWP) - kg CO_2 equiv/FU" in the stage A5 "installation", from table 1.1 the value of 7,37 E-04 is taken and multiplied by 2,08 to find the impact of 1,53 E-03 kg CO_2 equiv.

Products with facing type BAC

This EPD® covers - for the glass wool type G3 with facing type BAC – finished products in the range of density between 80 and 112,5 kg/m^3 and the range of thicknesses between 30 mm and 140 mm. Therefore for every specific product (characterized by its density and thickness) a multiplication factor may be determined in order to obtain its environmental performance starting from the environmental impacts of the reference product. The reference product for this family is the product named "BAC CF Roofine G3" with a density of 90 kg/m^3 and a thermal conductivity of 0,037 W/mK and the impacts listed in the following tables are determined for the functional unit : value of R= 1 m^2.K / W for 37 mm of product).
To determine the impacts associated to a generic products a conversion factor shall be calculated and the impacts given in this EPD must be multiplied by the conversion factor.

For a generic product belonging to the family "G3 with facing type BAC" the conversion factor CF can be determined as follows assuming **ρ** = density of the product [kg/m^3] under examination and S = product thickness [m].

$$\text{CF} = 0{,}300 * \boldsymbol{\rho} * S$$

As an example the conversion factor CF for a product with a density = 80 and a thickness of 40 mm is determined as follows:

CF = $0{,}300 * 80 \ * 0{,}04$ = 0,96

To determine for instance the environmental impact “Global Warming Potential (GWP) - kg CO_2 equiv/FU” in the stage A5 “installation”, from table 2.1 the value of 2,56 E-03 is taken and multiplied by 0,96 to find the impact of 2,45 E-03 kg CO_2 equiv.

Products with facing

This EPD® covers - for the glass wool type G3 with facing – finished products in the range of density between 15 and 50 kg/m^3 and the range of thicknesses between 25 mm and 50 mm. Therefore for every specific product (characterized by its density and thickness) a multiplication factor may be determined in order to obtain its environmental performance starting from the environmental impacts of the reference product. The reference product for this family is the product named “E60 S arrotolato G3 KAR” with a density of 30 kg/m^3 and a thermal conductivity of 0,032 W/mK” and the impacts listed in the following tables are determined for the functional unit : value of R= 1 m^2.K / W for 32 mm of product).
To determine the impacts associated to a generic products a conversion factor shall be calculated and the impacts given in this EPD must be multiplied by the conversion factor.

For a generic product belonging to the family “G3 with facing” the conversion factor can be determined as follows assuming **ρ** = density of the product [kg/m^3] under examination and S = product thickness [m].

$$\text{CF} = 1{,}041 * \boldsymbol{\rho} \ * S$$

As an example the conversion factor CF for a product with a density = 50 and a thickness of 40 mm is determined as follows:
CF = $1{,}041 * 50 \ * 0{,}04$ = 2,08

To determine for instance the environmental impact “Global Warming Potential (GWP) - kg CO_2 equiv/FU” in the stage A5 “installation”, from table 3.1 the value of 7,37 E-04 is taken and multiplied by 2,08 to find the impact of 1,53 E-03 kg CO_2 equiv.

Bibliography

- ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
- ISO 14025:2006: Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
- PCR Multiple UN CPC codes Insulation materials (2014:13) version 1.2
- UNE-EN 15804:2012+A1:2013: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- General Programme Instructions for the International EPD® System, version 2.5

Convalida EPD

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