ENVIRONMENTAL PRODUCT DECLARATION

In accordance with EN 15804+A1:2014 and EN 16783

Isover DOMO PLUS - 100 mm

Date of publication: 2018-10-30
Validity: 5 years
Valid until: 2023-10-29
Declaration number: 3015-EPD-030057508

EPD VERIFIED

he environmental impacts of this product ave been assessed over its whole life cycle. s Environmental Product Declaration has een verified by an independent third party.

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ISOVER SAINT-GOBAIN

General information

Manufacturer: Saint-Gobain Construction Products Poland – Division ISOVER;
Tel : (03) 360 2350; Fax : (03) 360 2351; e-mail : info@isover.be
Program used: Narodni program environmentalniho značeni (www.cenia.cz)
PCR identification: EN 16783
Product name and manufacturer represented: Isover DOMO PLUS 100 mm; Production site: Saint-Gobain Isover Gliwice (Poland)
Owner of the declaration: Saint-Gobain Construction Products Polska Sp. z o.o. – Division ISOVER
EPD® prepared by: Anna Gil (Saint-Gobain Construction Products Poland – Division ISOVER) and LCA central Team (Yves Coquelet)
Declaration issued: 2018-10-30, **valid until:** 2023-10-29

CEN standard EN 15804+A1 serves as the core PCR	
Independent verification of the declaration and data, according to EN ISO 14025:2010: ☐ Internal ☒ External	TECHNICKÝ A ZKUŠEBNÍ ÚSTAV STAVEBNÍ PRAHA, s.p. Akreditovaný Certifikační orgán č.3015 ZÚS
Third party verifier: Technický a zkušební ústav stavební Praha, s.p. Prosecká 811/76a, Praha 9, 190 00 Czech Republic Certification Body for EPD, accredited by CAI - Czech Accreditation Institute, under No. 440/2018	

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 2,60 K*m^2/W

The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

The production site of Saint-Gobain Isover Gliwice (Poland) 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 10°C: its thermal conductivity factor, expressed in λ , is 0.025 W/(m.K) (watts per meter Kelvin degree). The thermal conductivity of mineral wool is close to immobile air as its lambda varies from 0.030 W/(m.K) for the most efficient to 0.040 W/(m.K) to the least.

With its entangled structure, mineral 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.

Mineral 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.

Correctly installed glass wool products and solutions do not require maintenance and last throughout the lifetime of the building (which is set at 50 years as a default value in the model), or as long as the insulated building component is a part of the building.

Technical data/physical characteristics:

The thermal resistance of the product equals: 2,60 m²K/W
The thermal conductivity of mineral wool is: 0.038 W/(m.K)
Reaction to fire: A1 (Declaration according to EN 13501-1+A1)
Acoustic properties: Level of air flow resistivity ≥5 (kPa·s·m-2)

Description of the main components and/or materials for 1 m² of product with a thermal resistance of 2,60 K*m²*W^{-1} for the calculation of the EPD:

Main components
Glass wool **90-95 %** **(REACH registration number 01-2119472313-44-0041)**
Binder **0-10%**

PARAMETER	VALUE
Quantity of wool	1,30 Kg
Thickness of wool	100 mm
Surfacing	None
Packaging for the transportation and distribution	76,9 g/m² (62 g wood pallet + 14,9 g Polyethylene)
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 authorization1" has been used in a percentage higher than 0,1% of the weight of the product.

LCA calculation information

FUNCTIONAL UNIT	Providing a thermal insulation on 1 m² with a thermal resistance of equals 2,60 m²K/W.
SYSTEM BOUNDARIES	Cradle to Grave: Mandatory stages = A1-3, A4-5, B1-7, C1-4
REFERENCE SERVICE LIFE (RSL)	50 years
CUT-OFF RULES	See detailed explanation page 10
ELECTRICITY USED FOR THE MANUFACTORING PROCESS	See detailed explanation page 10
ALLOCATIONS	Allocation criteria are based on mass
GEOGRAPHICAL COVERAGE AND TIME PERIOD	Gliwice production data: 2017. Poland, Slovakia, Czech republic transport : 2017

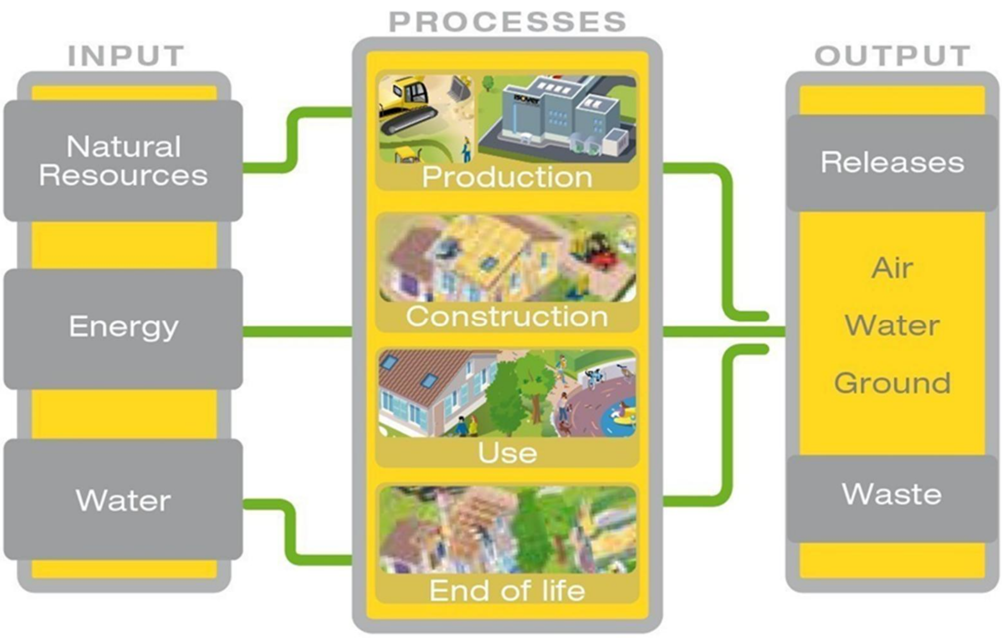
- "EPDs of construction products may be not comparable if they do not comply with EN 15804+A1:2014 and EN 16783 "
- "Environmental Product Declarations within the same product category from different programs may not be comparable"

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

Life cycle stages

System boundaries (X=included, MND=module not declared)																	
Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal		Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		MND

Flow diagram of the Life Cycle



Product stage, A1-A3

Description of the stage: The product stage of the mineral 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 15 804 standard. This rule is applied in this EPD.

Description of scenarios and additional technical information:

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

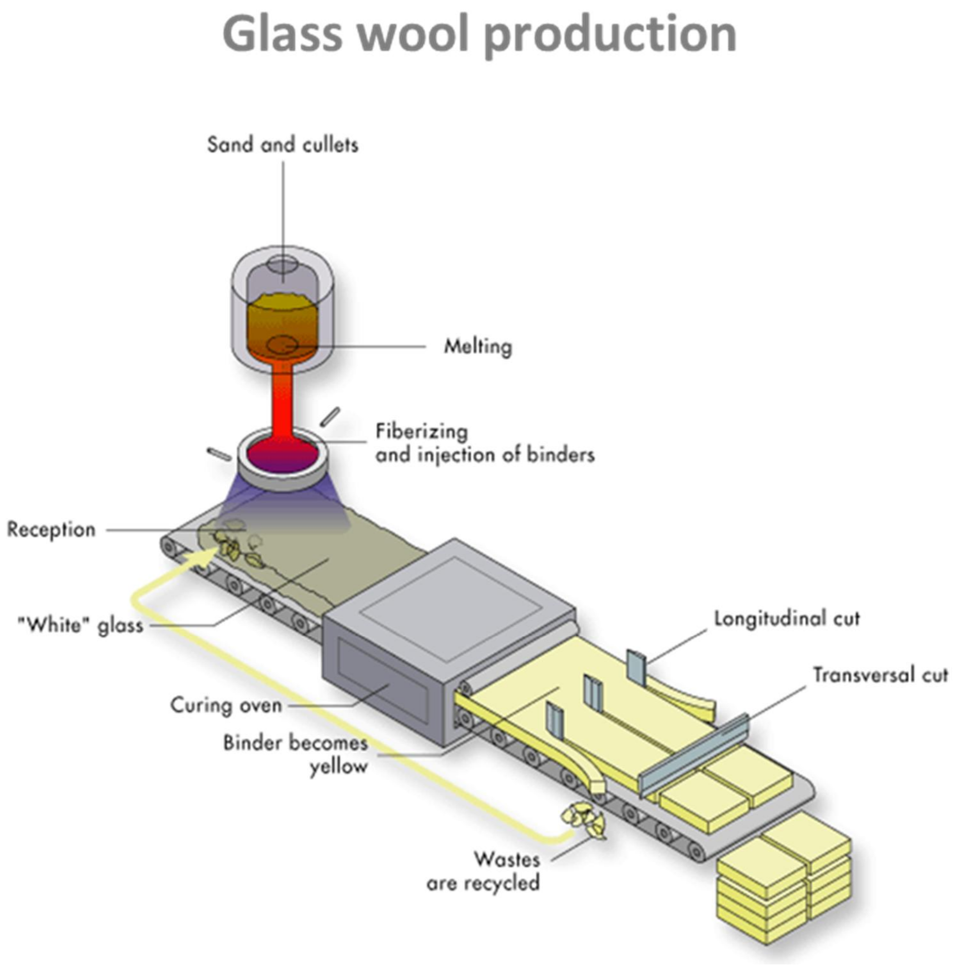
Specifically, the raw material supply covers production binder components and sourcing (quarry) of raw materials for fiber production, e.g. sand and borax for glass wool. Besides these raw materials, recycled materials (glass cullet) are also used as input.

A2, transport to the manufacturer
The raw materials are transported to the manufacturing site. In our case, the modeling includes: road transportations (average values) of each raw material.

A3, manufacturing

This module covers glass wool fabrication, including melting and fiberization (see process flow diagram). In addition, the production of packaging material is taking into account at this stage.

Manufacturing process flow diagram



Construction process stage, A4-A5

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

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
Fuel type and consumption of vehicle or vehicle type used for transport	Lorry 16-32 ton (EURO 5), with a 16t payload and diesel consumption 38 liters for 100 km
Distance	500 km
Capacity utilisation (including empty returns)	100 % of the capacity in volume 30 % of empty returns
Bulk density of transported products	13,0 kg/m3 (average)
Volume capacity utilisation factor	1 (by default)

A5, Installation in the building: This module includes.

- Wastage of products: see following table 5 %. These losses are landfilled (landfill model for glass see chapter End of life),
- Additional production processes to compensate for the loss
- Processing of packaging wastes: they are 100 % collected and modeled as recovered matter.

PARAMETER	VALUE
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

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

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 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, mineral wool insulation products have no impact (excluding potential energy savings) on this stage.

End-of-life stage C1-C4

Description of the stage: The stage includes next modules:

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

C2, transport to waste processing
Transport is included and calculated on the basis of a scenario with the parameters described in the End-of-life table.

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 scenarios and additional technical information: See below

End-of-life:

PARAMETER	VALUE/DESCRIPTION
Collection process specified by type	The entire product, including any surfacing is collected alongside any mixed construction waste 1300 g of glass wool (collected with 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	1300 g of glass wool are landfilled
Assumptions for scenario development (e.g. transportation)	We assume that the waste going to landfill will be transported by Lorry 16-32 ton (EURO 5), with a 16t payload, diesel consumption 38 liters for 100 km 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 potential environmental impact are calculated from the TEAM™ software 5.2. and CML impact method has been used, together with DEAM (2017) and Ecoinvent V3.3 (2016) databases to obtain the inventory of generic data.

Raw materials and energy consumption, as well as transport distances have been taken directly from the manufacturing plant of Saint-Gobain Isover Gliwice (Poland) (Production data according to 2017).

Resume of the LCA results detailed on the following tables.

Cut-off criteria

The cut-off criterion used in Saint-Gobain EPD will be the mass criterion with the following details:

- Taking into account all input and output flows in a unit process i.e. taking into account the value of all flows in the unit process and the corresponding LCI whenever available
- No simplification of the LCI by additional exclusions of material flows

Data collected at the manufacturing site was used. The inventory process in this LCA includes all data related to raw material, packaging material and consumable items, and the associated transport to the manufacturing site. Process energy and water use, direct production waste and emissions to air and water are included. Scenarios have been developed to account for downstream processes such as demolition and waste treatment in accordance with the requirements of EN 16783.

All inputs and outputs to the manufacturing plants have been included and made transparent. All assumptions regarding the materials and water balances have also been included.

All hazardous and toxic materials and substances are considered in the inventory even though they are below the cut off criteria

There are excluded processes in the inventory:

- Flows related to human activities such as employee transport and administration activity.

Allocation

Allocation criteria are based on mass.

The allocation of all the air emissions, wastes and energy usage are based on mass (kg). The reason we can use a mass basis is because we use the exact same manufacturing process shown for every product. We only produce glass mineral wool in the manufacturing plant of Saint-Gobain Isover Gliwice (Poland) using the same process and therefore all the factors can be allocated by a mass basis. The amount of binder varies for different products and is accounted for as well as if different surface layers are used.

A mass balance was conducted for the 2017 production year to ensure that we haven’t excluded any materials, emissions and hence potential environmental impacts. Regarding the mass balance, all the raw materials and corresponding production goods and wastes generated were taken into account.

Influence of particular thicknesses

All the results in the table of this EPD refer to an Isover DOMO PLUS with a 100 mm of thickness for a functional unit of 1 m² with a thermal resistance equals to 2,60 K*m²*W^{-1}

This EPD of Isover DOMO PLUS 100mm includes the range of thicknesses between 50 mm and 220 mm, for every thickness, using a multiplication factor in order to obtain the environmental performance of the thickness. In order to calculate the multiplication factors, a reference unit has been selected (value of R= 2,60 m^2*K / W for 100 mm).

The various multiplication factors are obtained by making the LCA calculations for all thicknesses (including the various facing and packaging). The tables below give an exact multiplication factor for GWP. Other indicators can vary more.

In the next table the multiplication factors are shown for every specific thickness of the product family. In order to obtain the environmental performance associated with every specific thickness, the results expressed in this EPD must be multiplied by its corresponding multiplication factor.

PRODUCT THICKNESS (mm)	MULTIPLICATION FACTOR
50	0,50
80	0,80
100	1,00
120	1,20
150	1,50
160	1,60
180	1,80
200	2,00
220	2,20

Parameters	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	D Reuse, recovery, recycling
	Product stage	**Construction process stage**		**Use stage**							**End-of-life stage**				
Global Warming Potential (GWP) - *kg CO2 equiv/FU*	2,59E+00	9,43E-02	1,06E-01	0	0	0	0	0	0	0	0	4,67E-03	0	6,94E-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*	7,15E-08	1,72E-08	5,70E-09	0	0	0	0	0	0	0	0	8,51E-10	0	2,33E-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 (chlorofluorocarbonsor halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification potential (AP) *kg SO2 equiv/FU*	2,58E-02	3,15E-04	7,20E-04	0	0	0	0	0	0	0	0	1,56E-05	0	5,23E-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 (PO4)3- equiv/FU*	2,30E-03	5,40E-05	1,14E-04	0	0	0	0	0	0	0	0	2,68E-06	0	9,42E-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*	6,84E-03	9,02E-05	3,19E-04	0	0	0	0	0	0	0	0	4,47E-06	0	1,46E-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 ressources (ADP-elements) - *kg Sb equiv/FU*	1,56E-06	1,78E-07	8,73E-08	0	0	0	0	0	0	0	0	8,83E-09	0	6,03E-09	MND
Abiotic depletion potential for fossil ressources (ADP-fossil fuels) - *MJ/FU*	5,04E+01	1,42E+00	2,13E+00	0	0	0	0	0	0	0	0	7,05E-02	0	1,98E-01	MND
	Consumption of non-renewable resources, thereby lowering their availability for future generations.														

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*	2,62E+00	1,76E-02	1,50E-01	0	0	0	0	0	0	0	0	8,70E-04	0	5,09E-03	MND
Use of renewable primary energy used as raw materials *MJ/FU*	1,19E+00	0	5,95E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) *MJ/FU*	3,81E+00	1,76E-02	2,09E-01	0	0	0	0	0	0	0	0	8,70E-04	0	5,09E-03	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - *MJ/FU*	3,98E+01	1,41E+00	1,96E+00	0	0	0	0	0	0	0	0	7,00E-02	0	1,97E-01	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	1,38E+00	0	6,90E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - *MJ/FU*	4,12E+01	1,41E+00	2,02E+00	0	0	0	0	0	0	0	0	7,00E-02	0	1,97E-01	MND
Use of secondary material *kg/FU*	7,31E-01	0	3,65E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Use of renewable secondary fuels- *MJ/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Use of non-renewable secondary fuels - *MJ/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Use of net fresh water - *m3/FU*	9,50E-03	2,73E-04	5,70E-04	0	0	0	0	0	0	0	0	1,35E-05	0	2,17E-04	MND

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*	1,00E-01	9,25E-04	3,57E-03	0	0	0	0	0	0	0	0	4,59E-05	0	1,02E-04	MND
Non-hazardous waste disposed *kg/FU*	4,97E-01	7,42E-02	9,10E-02	0	0	0	0	0	0	0	0	3,68E-03	0	1,30E+00	MND
Radioactive waste disposed *kg/FU*	3,31E-05	9,65E-06	3,25E-06	0	0	0	0	0	0	0	0	4,79E-07	0	1,32E-06	MND

OUTPUT FLOWS

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*	1,59E-01	0	8,86E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for energy recovery *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Exported energy *MJ/FU*	4,32E-06	0	1,19E-08	0	0	0	0	0	0	0	0	0	0	0	MND

LCA interpretation

[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 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. CO2 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 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

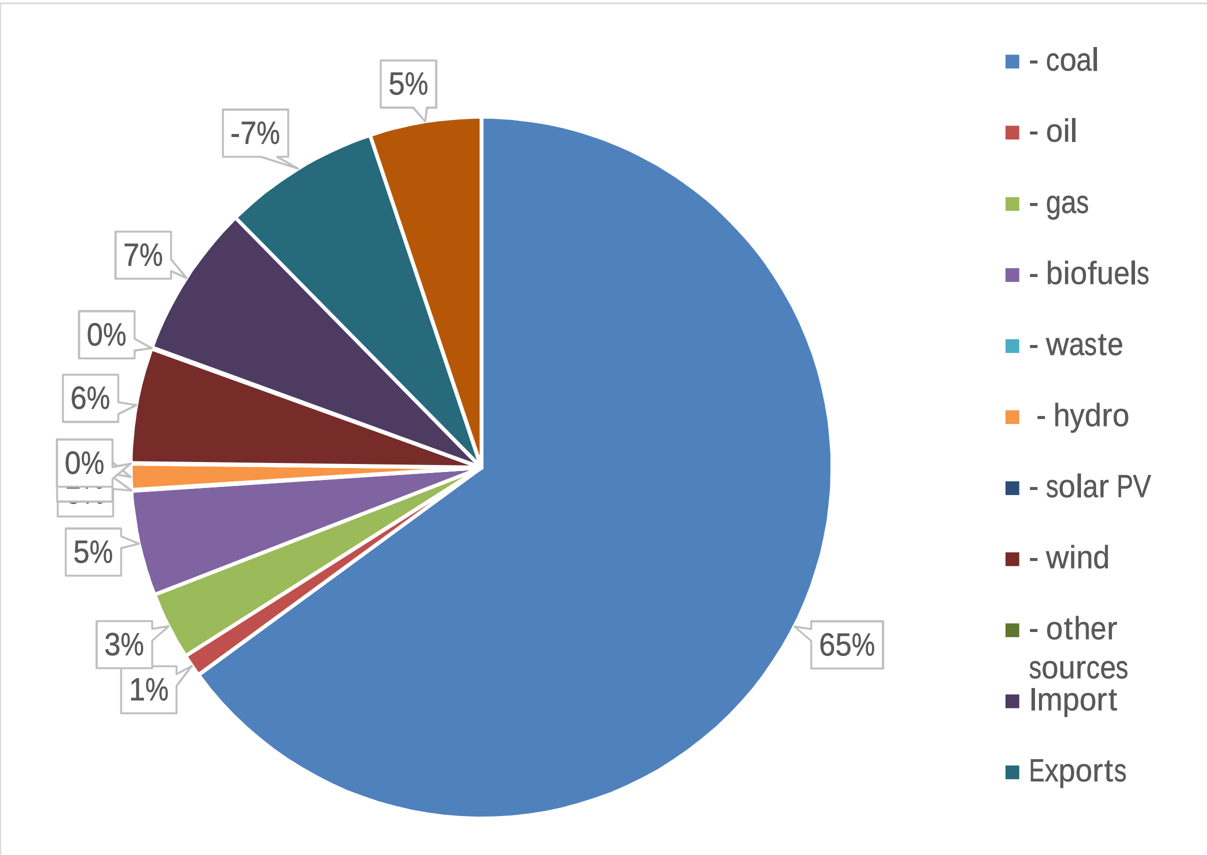
As we don’t use water in any of the other modules (A4 – A5, B1 – B7, C1 – C4), we can see that there is no contribution to water consumption. For the production phase, water is used within the manufacturing facility and therefore we see the highest contribution here. However, we recycle a lot of the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

Additional information

TYPE OF INFORMATION	DESCRIPTION
Location	Representative of average production in Poland (2015)
Geographical representativeness description	Breakdown of energy sources in Poland: - Coal and peat: 75.9% - Fuel oil: 1.2% - Gas: 3.6% - Biofuels : 5.7% - Nuclear: 0% - Hydro: 1.4% - Wind: 6.2% - Solar PV: 0.03% - Other sources: 0.1% Import: 8.3% Export: -8.4% Distribution losses: 6%
Reference year	**2015**
Type of data set	**Cradle to gate**
Source	**IEA 2017**



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.
- EN 15804+A1:2014
- EN 16783
- LCA report Saint -Gobain ISOVER April 2018
- Ecoinvent database V3.3 (2016) information about validation, calculation, and update are available via the various reports:
    - ecoinvent 2.2 translated reports_06_Energy Systems.zip 23 MB 08.08.2016
    - ecoinvent 3 report_Crop Production.zip 2.2 MB 08.08.2016
    - ecoinvent 3 report_Refrigerated Transport.pdf 845.2 KB 08.08.2016
    - ecoinvent 3 report_selected chapters_Energy.zip 293 KB 08.08.2016
    - ecoinvent 3 report_Transport Default Model_Global.pdf 464.9 KB 08.08.2016
    - ecoinvent 3 report_Transport Default Model_Switzerland.zip 636.5 KB 08.08.2016
    - ecoinvent 3.3 open access datasets_PDF documentation.zip

  All these report are available at: https://v33.ecoquery.ecoinvent.org/File/Reports
- Ecobilan DEAM database, information about validation, calculation, and update are available via the report:
    - DEAM™ User's Manual Version 2017 DEAMSTK 5.2.4
    - This user manual is only available with the license of the tool.