ENVIRONMENTAL PRODUCT DECLARATION

In accordance with EN 15804 and ISO 14025

PRISMA PLUS

Date of publication: 2016-11-10
Validity: 3 years
Valid until: 2019-11-10
Based on PCR 2014:13 Insulation materials
Scope of the EPD®: Brazil

Registration number The International System: S-P-00960

ISOVER SAINT-GOBAIN

General information

Manufacturer: ISOVER - Saint-Gobain do Brasil Produtos Industriais e para Construção Ltda.
Rua João Alfredo, 177 – 04747-000 São Paulo – SP
Programme used: The International EPD® System. More information at www.environdec.com
EPD® registration number: S-P-00960
PCR identification: PCR Multiple CPC codes Insulation materials version 1.0 (2014:13)
Product name and manufacturer represented: PRISMA PLUS; ISOVER - Saint-Gobain do Brasil
Owner of the declaration: ISOVER - Saint-Gobain do Brasil
CPC code: 371
EPD® prepared by: ISOVER - Saint-Gobain do Brasil
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Declaration issued: 2016-11-10, **valid until**: 2019-11-10

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
LCA and EPD® performed by ISOVER - Saint-Gobain do Brasil	
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒	
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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 production site of ISOVER - Saint-Gobain do Brasil in Santo Amaro (Brazil 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.

Mineral 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.

Technical data/physical characteristics (for a thickness of 32 mm):

Thermal resistance of the Product: **1.0** K.m².W^{-1} (IN-82372: Thermal Conductivity)
The thermal conductivity of the mineral wool is: **0.032 W/(m·K)** ((IN-82372: Thermal Conductivity)
Reaction to fire: **Class A – NBR 9442**
Acoustic properties: **- not applicable**

Description of the main components and/or materials for 1 m^2 of mineral wool 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	2.56 Kg
Thickness of wool	32 mm
Surfacing	Painted Glass Veil + Glass Veil + Adhesive : 228 g/m²
Packaging for the transportation and distribution	Cardboard: 48.57 g/m²
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 programme 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	Brazil production and transport : 2015

- “EPDs of construction products may be not comparable if they do not comply with EN 15804 or ISO 21930"
- “Environmental Product Declarations within the same product category from different programs may not be comparable”

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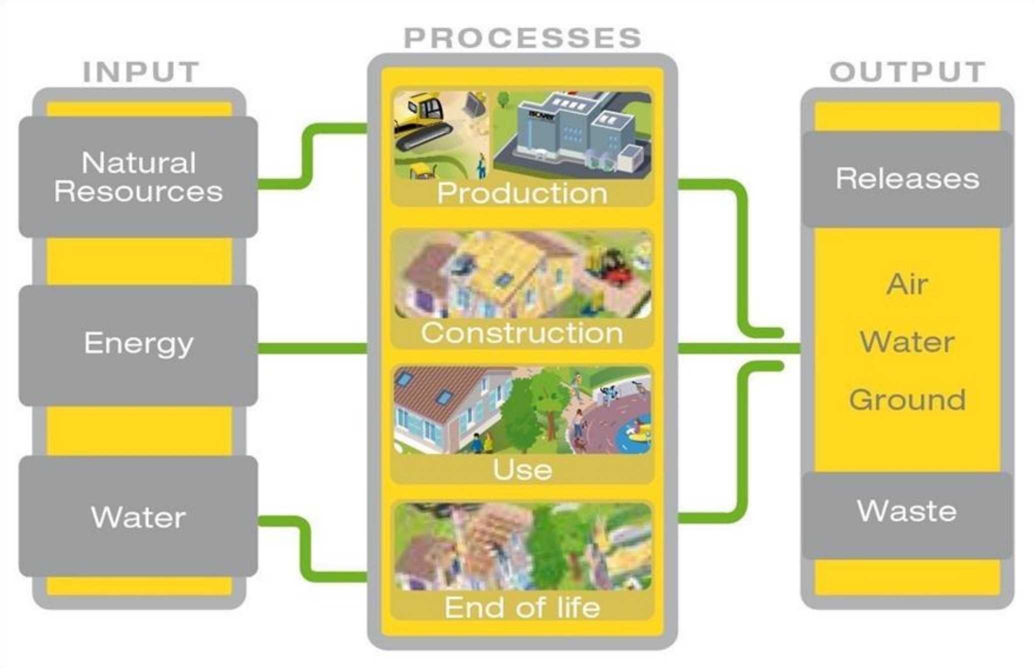
Life cycle stages

Flow diagram of the Life Cycle



Product stage, A1-A3

Description of the stage: the product stage of the 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 the scenarios and other additional technical information:

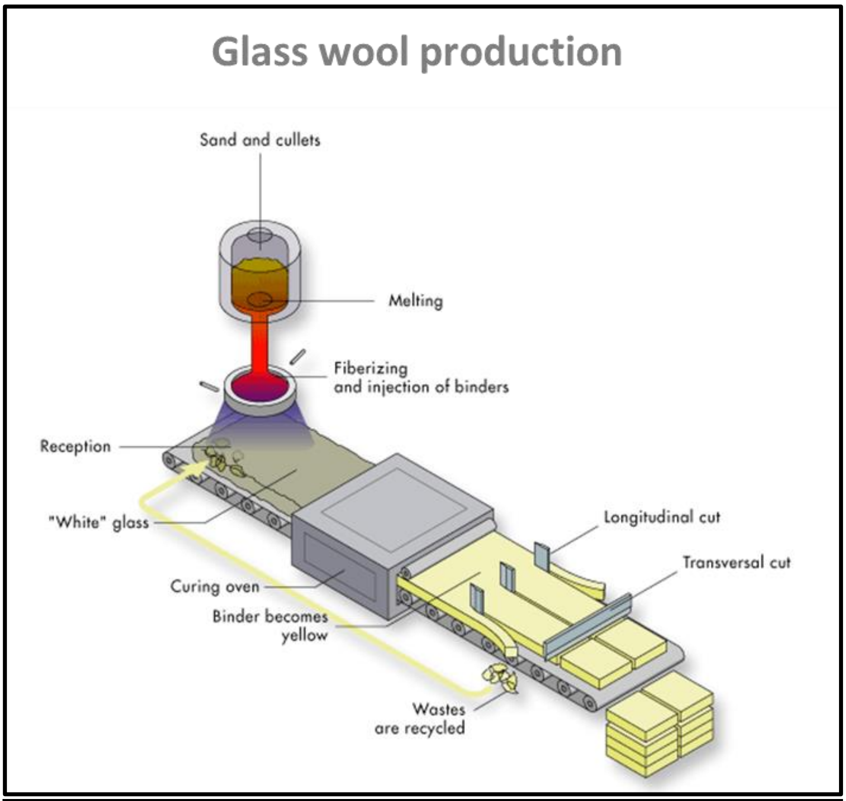
A1, Raw materials supply
This module takes into account the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process

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 (agglomerates) 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 (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, mineral 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	1046km
Capacity utilisation (including empty returns)	100 % of the capacity in volume 30 % of empty returns
Bulk density of transported products*	80 kg/m^3
Volume capacity utilisation factor	1

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 mineral 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 mineral 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 2788 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	The product alongside the mixed construction waste from demolishing will go to landfill 2788 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 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 TEAM™ software 5.2., CML 4.1 impact methods has been used, together with DEAM (2006) and Ecoinvent 2.2 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 (Production data according 2015 and transport data according 2015)

Influence of particular thicknesses

This EPD® includes the range of thicknesses between 25 mm and 32 mm, for every thickness, using a multiplication factor in order to obtain the environmental performance of every thickness. In order to calculate the multiplication factors, a reference unit has been selected (value of R= 1 m^2.K / W for 32 mm). All the results refer to 32 mm of thickness.

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
25	0.8
32	1

ENVIRONMENTAL IMPACTS

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*	4.3E+00	4.8E-01	2.4E-01	0	0	0	0	0	0	0	0	1.1E-02	0	2.7E-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*	2.4E-07	3.5E-07	3.0E-08	0	0	0	0	0	0	0	0	8.3E-09	0	2.3E-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*	1.8E-02	2.2E-03	1.0E-03	0	0	0	0	0	0	0	0	5.3E-05	0	2.3E-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*	3.3E-03	5.2E-04	1.9E-04	0	0	0	0	0	0	0	0	1.2E-05	0	1.5E-05	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.														
Photochemical ozone creation (POPC) *Ethene equiv/FU*	2.2E-03	3.5E-04	1.3E-04	0	0	0	0	0	0	0	0	8.2E-06	0	1.6E-06	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*	1.9E-06	1.3E-10	9.6E-08	0	0	0	0	0	0	0	0	3.1E-12	0	1.1E-12	MND
Abiotic depletion potential for fossil resources (ADP-fossil fuels) - *MJ/FU*	8.6E+01	6.2E+00	4.6E+00	0	0	0	0	0	0	0	0	1.5E-01	0	3.5E-02	MND
	Consumption of non-renewable resources, thereby lowering their availability for future generations.														

RESOURCE USE

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*	1.5E+01	3.0E-03	7.9E-01	0	0	0	0	0	0	0	0	7.2E-05	0	6.6E-05	MND
Use of renewable primary energy used as raw materials *MJ/FU*	9.3E-01	0	0	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*	1.6E+01	3.0E-03	7.9E-01	0	0	0	0	0	0	0	0	7.2E-05	0	6.6E-05	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - *MJ/FU*	7.6E+01	6.2E+00	4.2E+00	0	0	0	0	0	0	0	0	1.5E-01	0	3.5E-02	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	7.0E-01	0	0	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*	7.7E+01	6.2E+00	4.2E+00	0	0	0	0	0	0	0	0	1.5E-01	0	3.5E-02	MND
Use of secondary material *kg/FU*	1.6E+00	0	8.1E-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*	8.0E-03	5.9E-04	4.3E-04	0	0	0	0	0	0	0	0	1.4E-05	0	0	MND

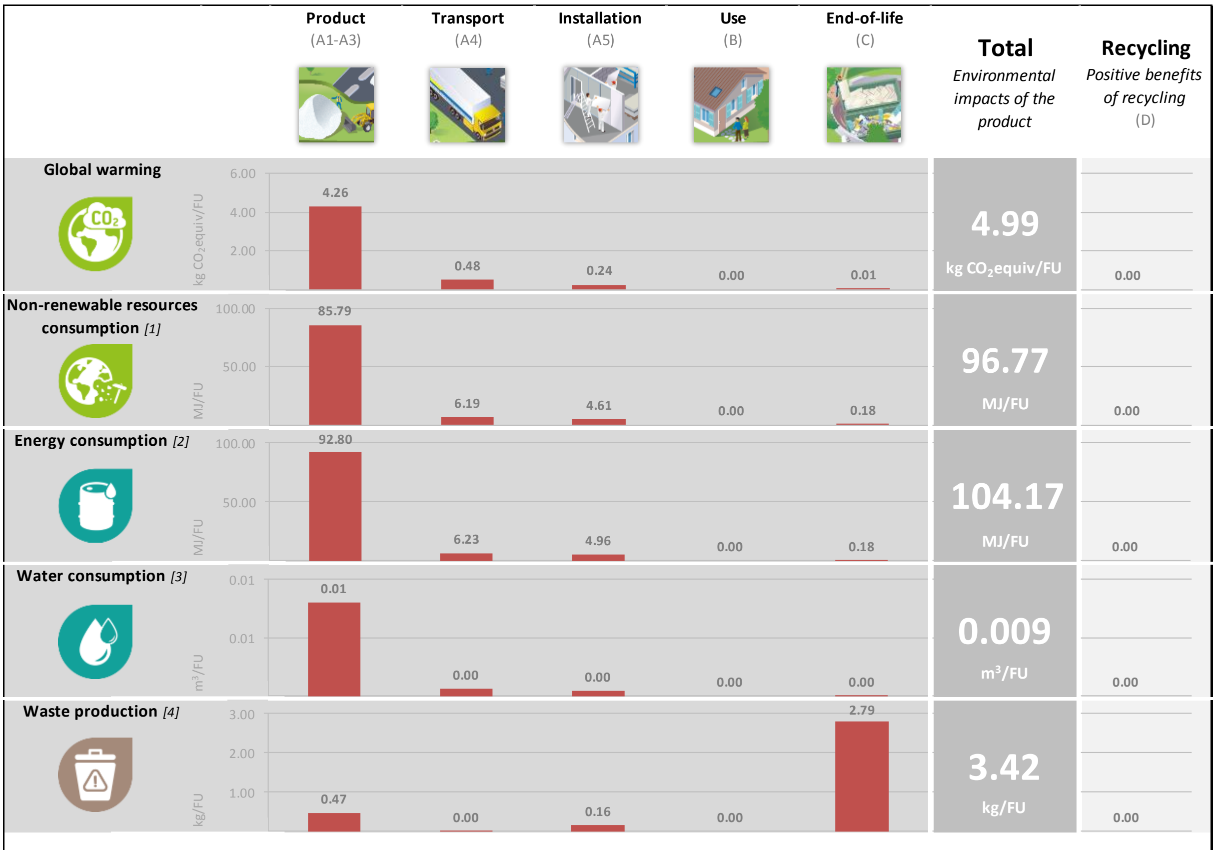
WASTE CATEGORIES

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*	3.6E-03	1.4E-04	1.9E-04	0	0	0	0	0	0	0	0	3.4E-06	0	0	MND
Non-hazardous waste disposed *kg/FU*	4.6E-01	5.6E-04	1.6E-01	0	0	0	0	0	0	0	0	1.3E-05	0	2.8E+00	MND
Radioactive waste disposed *kg/FU*	6.5E-05	9.9E-05	8.3E-06	0	0	0	0	0	0	0	0	2.4E-06	0	0	MND

OTHER 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*	7.9E-01	2.6E-06	9.1E-02	0	0	0	0	0	0	0	0	6.1E-08	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*	1.3E-06	0	6.5E-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 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.

Additional information

TYPE OF INFORMATION	DESCRIPTION
Location	Representative of average production in Brazil (2011)
Geographical representativeness description	Split of energy sources in Brazil (source: IEA 2011): - Coal and peat: 2.33% - Fuel oil: 2.78% - Gas: 4.72% - Nuclear: 2.94% - Hydro and Wind : 80% - Import: 7.23%
Reference year	2011
Type of data set	Cradle to gate
Source	IEA 2011

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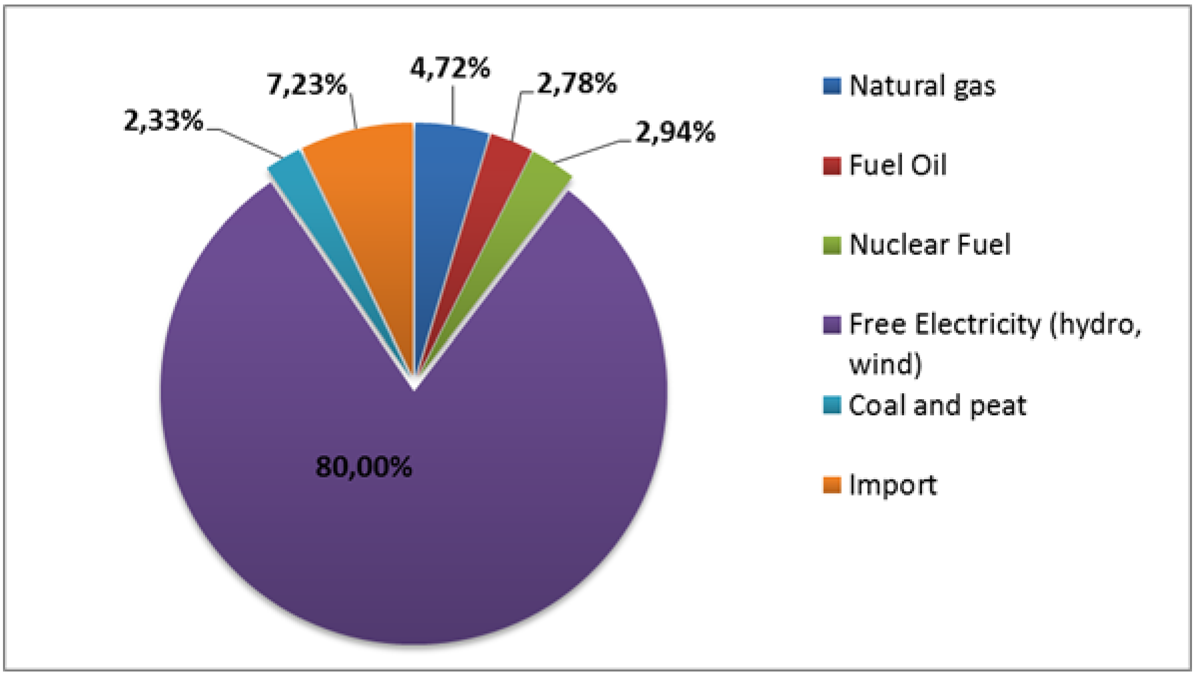

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- ISO 14025:2006: Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
- PCR Multiple UN CPC codes Insulation materials (2014:13) version 1.0
- UNE-EN 15804:2012: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
- General Programme Instructions for the International EPD® System, version 2.5