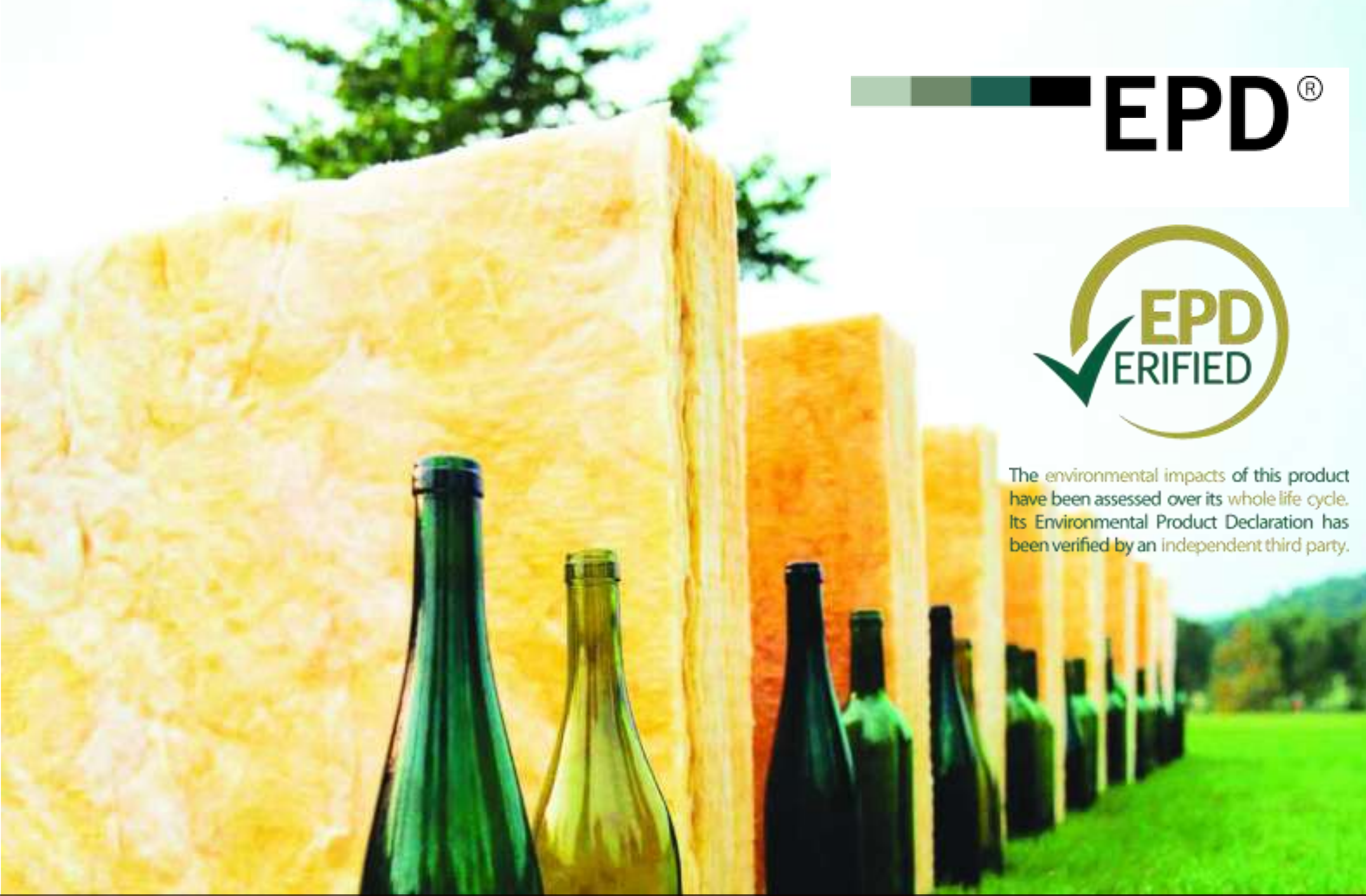


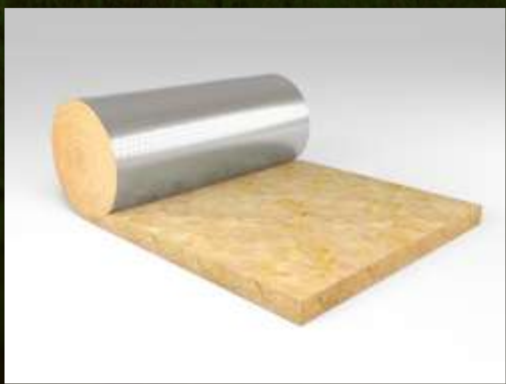
ENVIRONMENTAL PRODUCT DECLARATION

In accordance with EN 15804 and ISO 14025

ISOAIR

Realization data : 2015-08-17
Validity: 3 years
Valid until: 2018-08-17
Based on PCR 2014:13 Insulation materials v. 1.0

Scope of the EPD®: South America



REGISTRATION NUMBER
S-P-00733

ISOVER SAINT-GOBAIN

General information

Manufacturer: Saint- Gobain Argentina S.A. - Div. ISOVER
Programme used: The International EPD System. For more information see www.environdec.com
EPD registration number: S-P-00733
PCR identification: PCR Multiple CPC codes Insulation materials version 1.0 (2014:13)
Product name and manufacturer represented: ISOAIR; Saint- Gobain Argentina S.A. - Div. ISOVER / Llavallol
Owner of the declaration: Saint- Gobain Argentina S.A. - Div. ISOVER
EPD prepared by: Silvina Plante (Isover Saint Gobain Argentina) and Michaël Medard (Saint Gobain France)
Contact: Silvina Plante (Isover Saint Gobain Argentina). Email: silvina.lopez@saint-gobain.com
Declaration issued: 2015-08-17, **valid until**: 2018-08-17

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 Argentina	
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒	
Verifier: Marcel Gómez Ferrer. *Marcel Gómez Consultoria Ambiental* (www.marcelgomez.com).Individual verifier approved by The International EPD® System. Email: info@marcelgomez.com During the verification procedure, the approved individual verifier had support by Bureau Veritas Iberia SL. The individual verifier is, however, solely responsible for the EPD® verification.	

Product description

Product description and description of use:

This Environmental Product Declaration (EPD) describes the environmental impacts of 1 m² of glass wool with a thermal resistance of equals 1,0 K.m2.W-1

The production site of Saint- Gobain Argentina S.A. - Div. ISOVER / Llavallol 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 "glass 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 0.032 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. Glass 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.

Technical data/physical characteristics:

Thermal resistance of the product: 0.9 K.m2.W-1 (ISO 8302 / IRAM 11559 / ASTM C 177)
Reaction to fire: RE2 combustible - very low flame spread - Norma IRAM 11910 / M1 norma UNE 23727
Optical smoke density : Level 1 – Norm IRAM 11912
Acoustic properties: NRC:0.50

Description of the main product components and or materials for 1 m² of product with a thermal resistance of 1 K.m2.W-1 for EPD calculation:

PARAMETER	VALUE
Quantity of wool	533 g
Thickness of wool	41 mm
Surfacing	Alumino FSK 87 g
Packaging for the transportation and distribution	Polyethylene : 10 g
Product used for the Installation:	None

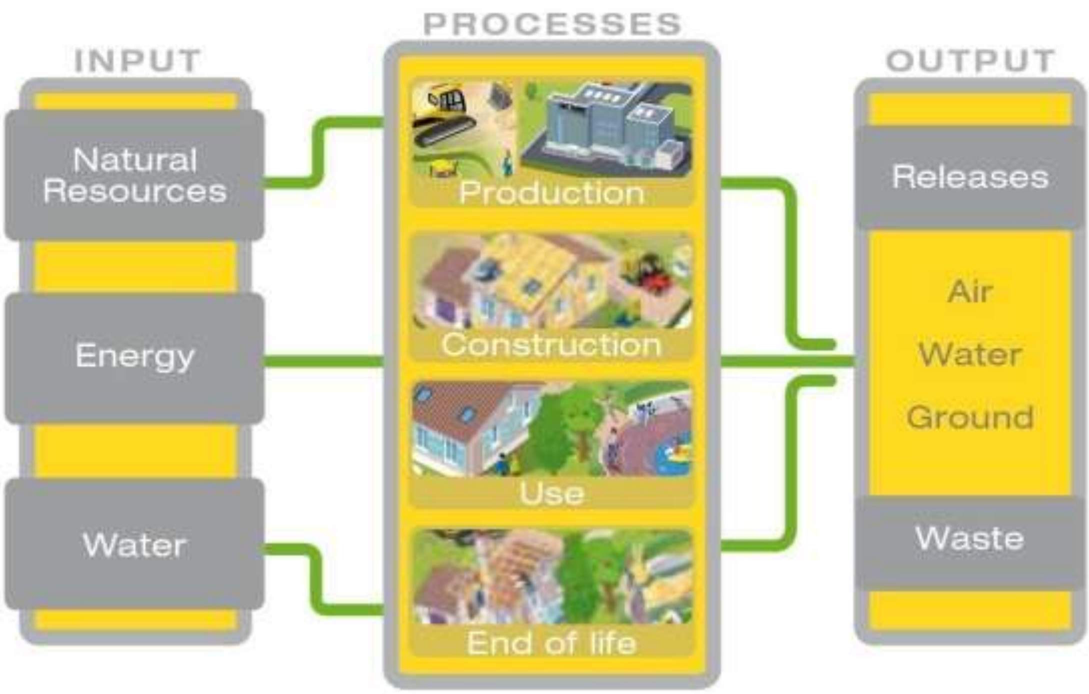
LCA calculation information

FUNCTIONAL UNIT	Providing a thermal insulation on 1 m² with a thermal resistance of equals 1.0 K.m^2.W^{-1}.
SYSTEM BOUNDARIES	Cradle to Grave: Mandatory stages = A1-3, A4-5, B1-7, C1-4 and Optional stage = D
REFERENCE SERVICE LIFE (RSL)	50 years
CUT-OFF RULES	The use of cut-off criterion on mass inputs and primary energy at the unit process level (1%) and at the information module level (5%); 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	Argentina 2013

- "EPD 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"

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 15 804 standard. This rule is applied in this EPD.

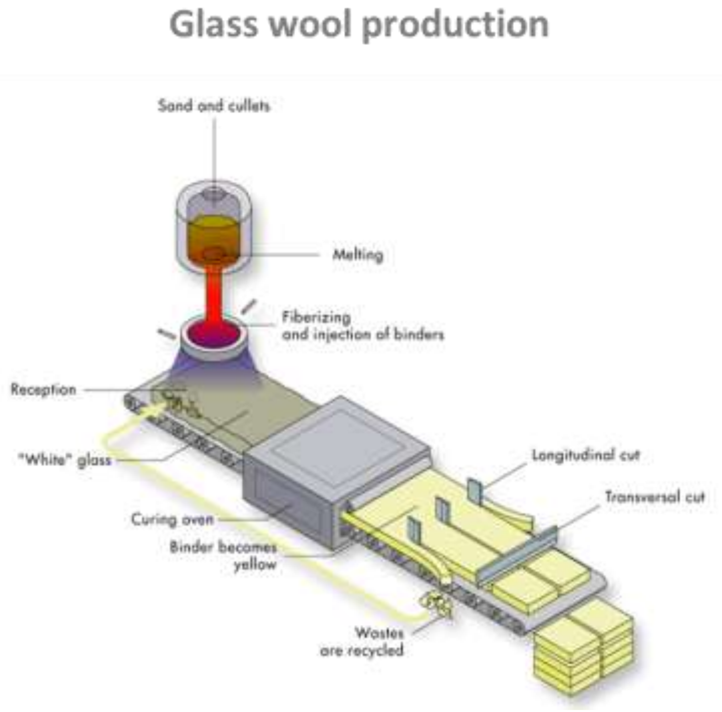
A1, Raw material supply
This module takes into account the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process.

Specifically, the raw material supply covers production 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 and boat 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: A4, transport to the building site and A5, installation in the building.

Description of scenarios and additional technical information:

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 e.g. long distance truck, boat, etc.	Average truck trailer with a 24t payload, diesel consumption 38 liters for 100 km
Distance	65 km
Capacity utilisation (including empty returns)	100 % of the capacity in volume 30 % of empty returns
Bulk density of transported products	13 kg/m^3
Volume capacity utilisation factor	1

A5, Installation in the building:

This module includes wastage of products during the implementation, the additional production processes to compensate the loss and the waste processing which occur in this stage.

Scenarios used for quantity of product wastage and waste processing are:

PARAMETER	VALUE
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	5 %
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 landfill 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 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:

The stage includes the different modules of end-of-life : C1, de-construction, demolition, C2, transport to waste processing C3, waste processing for reuse, recovery and/or recycling; C4, disposal.

Description des scenarios et des informations techniques supplémentaires :

C1, de-construction, 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.

PARAMETER	VALUE/DESCRIPTION
Collection process specified by type	616 g of glass wool (collected with mixed construction waste)
Recovery system specified by type	No re-use, recycling or energy recovery
Disposal specified by type	616 g of glass wool are landfilled
Assumptions for scenario development (e.g. transportation)	Average truck trailer with a 24t payload, diesel consumption 38 liters for 100 km 25 km

Reuse/recovery/recycling potential, D

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 impact method has been used, together with DEAM (2006) and Ecoinvent 2.2 databases for generic data.

Raw materials and energy consumption, as well as transport distances have been taken directly from the manufacturing plant of Isover Saint Gobain Argentina in 2013.

Influence of particular thicknesses:

As this EPD covers a range of thicknesses, a multiplication factor was used to determine their individual environmental impacts. In order to calculate the multiplication factors, a reference unit was chosen (R value = 1 m2.K/W for 41 mm) which also acts as our functional unit. The various impacts for the other thicknesses were compared against this reference unit and a multiplication factor was calculated.

The table below highlights the multiplication factors for each individual thickness in the product family. In order to determine the environmental impacts associated with a specific product thickness, multiply the LCA results by the corresponding multiplication factor.

Product Thickness (mm)	Multiplication Factor
38	0.95
41	1.00

ENVIRONMENTAL IMPACTS

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	
Global Warming Potential (GWP) - *kg CO2 equiv/FU*	1.4E+00	1.1E-02	7.2E-02	0	0	0	0	0	0	0	0	4.2E-03	0	1.2E-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*	1.9E-07	7.6E-09	1.0E-08	0	0	0	0	0	0	0	0	2.9E-09	0	9.9E-10	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*	1.3E-02	6.5E-05	6.6E-04	0	0	0	0	0	0	0	0	2.5E-05	0	1.0E-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*	1.9E-03	1.6E-05	9.8E-05	0	0	0	0	0	0	0	0	6.2E-06	0	4.2E-06	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.														
Photochemical ozone creation (POPC) *Ethene equiv/FU*	5.0E-04	1.4E-06	2.5E-05	0	0	0	0	0	0	0	0	5.6E-07	0	2.5E-07	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*	3.1E-07	1.8E-12	1.5E-08	0	0	0	0	0	0	0	0	7.0E-13	0	0	MND
Abiotic depletion potential for fossil ressources (ADP-fossil fuels) - *MJ/FU*	2.0E+01	1.3E-01	1.0E+00	0	0	0	0	0	0	0	0	5.1E-02	0	1.5E-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*	3.0E+00	1.2E-04	1.5E-01	0	0	0	0	0	0	0	0	4.5E-05	0	2.9E-05	MND
Use of renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) *MJ/FU*	3.0E+00	1.2E-04	1.5E-01	0	0	0	0	0	0	0	0	4.5E-05	0	2.9E-05	MND
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials *- MJ/FU*	2.3E+01	1.4E-01	1.1E+00	0	0	0	0	0	0	0	0	5.2E-02	0	1.3E-02	MND
Use of non-renewable primary energy used as raw materials *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) *- MJ/FU*	2.3E+01	1.4E-01	1.1E+00	0	0	0	0	0	0	0	0	5.2E-02	0	1.3E-02	MND
Use of secondary material *kg/FU*	4.0E-01	0	2.0E-02	0	0	0	0	0	0	0	0	0	0	0	MND
Use of renewable secondary fuels- *MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels *- MJ/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of net fresh water *- m3/FU*	1.6E-02	1.3E-05	8.2E-04	0	0	0	0	0	0	0	0	4.9E-06	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*	6.3E-03	3.0E-06	3.2E-04	0	0	0	0	0	0	0	0	1.2E-06	0	0	MND
Non-hazardous waste disposed *kg/FU*	1.2E-01	7.9E-06	4.7E-02	0	0	0	0	0	0	0	0	3.0E-06	0	6.2E-01	MND
Radioactive waste disposed *kg/FU*	2.6E-05	2.2E-06	1.5E-06	0	0	0	0	0	0	0	0	8.3E-07	0	0	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*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling *kg/FU*	8.7E-02	3.8E-08	4.4E-03	0	0	0	0	0	0	0	0	1.5E-08	0	0	MND
Materials for energy recovery *kg/FU*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy *MJ/FU*	1.5E-02	0	7.3E-04	0	0	0	0	0	0	0	0	0	0	0	MND

LCA interpretation

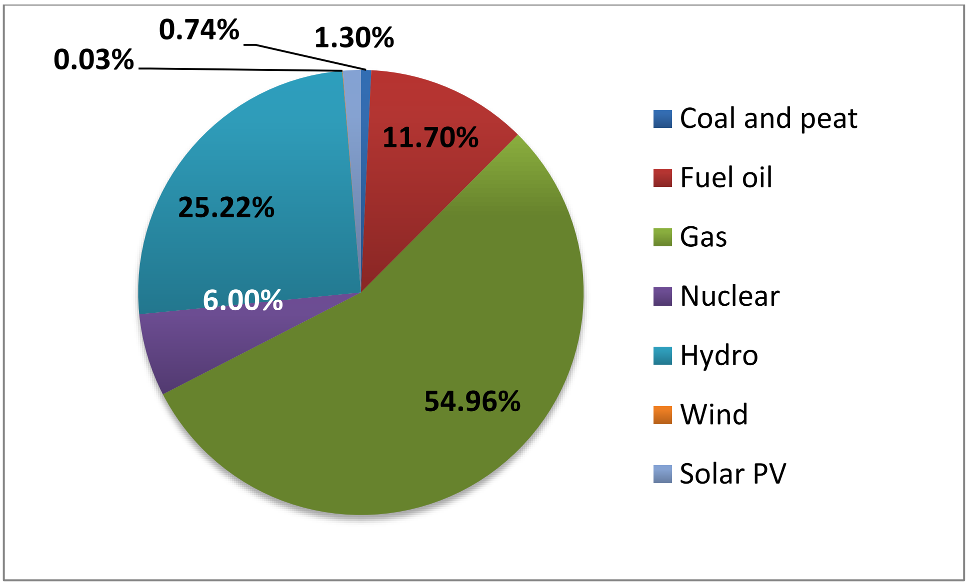
The Product stage (A1-A3) is responsible for over 95% of the impact of the product for the following impacts: Global warming, Non-renewable resources consumption and Energy and Water.
Waste production is primarily attributed to the End-of-life stage. This is due to 100% of the product is landfilled at the end of its life.
25.53 MJ of the total primary energy comes from the Product stage of the life cycle. The main fuel used on Isover-Saint Gobain Argentina is natural gas. It accounts for over 80% of energy usage.

[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.

Additional information

The electricity production model considered for the modelling of Saint-Gobain plant is:
401 Electricity (Argentina, 2008): Production

TYPE OF INFORMATION	DESCRIPTION
Location	Representative of average production in Argentina (2008)
Geographical representativeness description	Breakdown of energy sources in Argentina (source: IEA 2008):-: Coal and peat: 0.74%- Fuel oil: 11.70%- Gas: 54.96%- Nuclear: 6%- Hydro: 25.22%- Wind: 0.03%- Solar PV: 2.5 %
Reference year	2008
Type of data set	Cradle to gate
Source	IEA 2008



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