Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

Glass fiber composite material based window profiles - general, enhanced and high end models

from

Chongqing Polycomp International Corporation

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Programme information

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Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification	
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Approved by:	*The International EPD® System*
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Company information

Owner of the EPD:

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Description of the organisation:

Chongqing Polycomp International Corp. (CPIC) is a large state-owned enterprise integrating R&D, production and sales of fiberglass products. CPIC mainly produces high-quality alkali-free fiberglass and glass fabric series products.

CPIC was established in 1991. The former is Chongqing Fiberglass Factory established in 1971. Yuntianhua Group Co., Ltd. made investment in 1999 and now becomes the major shareholder. CPIC has the total assets of more than RMB 10 billion and more than 6,000 employees. CPIC has established production bases in Chongqing, Shanghai, Zhuhai, Changzhou, Brazil and Bahrain. The annual capacity of fiberglass exceeds 600,000 t, and that of glass fabric reaches up to 150 million meters. CPIC has 4 sales subsidiaries respectively in North America, Europe, Russia and Hong Kong.

CPIC is devoted to produce stable-quality and continuously improved fiberglass products, and always treats the quality as the life of the enterprise. The quality of CPIC's products always take the lead in China and meet the general international standards. Through several years of exploration and contribution, CPIC has owned world-class independent core technologies and 67 invention and utility patents including TM®- glass (high strength and high modulus fiberglass) and ECT-glass (general high-performance fiberglass). The product roving was granted the title of “China Brand”, and passed the certification of Germanischer Lloyd (GL), Lloyd's Register of Shipping (LR) and Food and Drug Administration (FDA). CPIC’s products have been sold to North America, the Middle East, Europe, Southeast Asia, Africa, etc., with the export volume exceeding 50% of total sales volume. Now, CPIC has developed stable cooperative relation with more than 30 foreign companies such as GE and Dupont. CPIC’s products are widely used in the fields of urban architecture, interior decoration, automobile industry and mechatronics, and gradually occupy the emerging markets of wind power generation, aviation, etc.

In 1990s, CPIC grasped the historic opportunity for the rapid development of China's fiberglass industry and the integrative recombination of the world's fiberglass industry to rapidly realize international and integrated industry layout in the international market. In the future, CPIC plans to strengthen the quality and expand the market, and comprehensively enhance the core competitiveness of the enterprise by continuously optimizing the industry structure, making more efforts to extend the industry chain and vigorously developing new environment-friendly fiberglass products with large market demand and high technical content. CPIC will make corresponding changes according to global economic adjustment, proactively insist on internationalization and integration, and constantly pursue innovation and excellence by standing on the market and customer service, striving to become one of international excellent suppliers in the world’s fiberglass industry.

Name and location of production site:

Chongqing, P.R. China

Product information

Product name:
Glass fiber composite material based window profile - general, enhanced and high end models

UN CPC code:
371 Glass and glass products

Geographical scope: China

Product description:
The products belong to enhanced thermoset composite series and have the following three models:

- Glass fiber composite material based window profile, general model
- Glass fiber composite material based window profile, enhanced model
- Glass fiber composite material based window profile, high end model

Product Application:
As a “new generation” product after traditional wooden, steel, aluminium and PVC window profile, fiberglass window profile has excellent air tightness, water tightness, wind pressure resistance, outstanding sound insulation and thermal insulation performance, and can also meet the requirements of fire resistance. It is a new type of product with various impressive characteristics. Therefore, it is grabbing a bigger share of the replacement window market every year.

The fiberglass window profiles from CPIC can be used in various new construction and renovation projects. The products are essentially composed of glass fibers and resin, materials that expand and contract very little with temperature changes in the weather, and also provide the final products with increased energy efficiency and added strength. At the same time, the surface of the profile can be treated differently according to the customer's needs, to meet diverse process and performance requirements of the customer.

Product identification:

Tensile strength	⩾1100 MPa
Elastic modulus	⩾50 GPa
Bending strength	⩾1400 MPa
Unnotched impact strength	⩾200 KJ/m^2

	Window Profile, general model	Window Profile, enhanced model	Window Profile, high end model
Density	1.151 kg/m	1.502 kg/m	1.697 kg/m

Manufacturing Process:
As shown in Figure 1, the fiberglass window profile is fabricated through the pultrusion process. Glass fiber reinforced materials such as rovings, felts, belts or cloths are first impregnated with polyurethane resin. The polyurethane resin is mainly composed of a mixture of polyol and an isocyanate. Isocyanate is selected for optimum pultrusion characteristics such as low viscosity (ensured complete impregnation of fibers), long gelation time (flexible start and stop time), rapid polymerization process (increased molding speed), and good surface finish.

The unreacted polyurethane resin flows into an injection box where the composite reinforcement is wet-out and then subsequently pulled into the hot pultrusion die, which controls the shape, size, and finish of the final products. These materials combine and catalyze to provide tensile and torsion strength. A puller is then used to control the speed of the process and generate a tremendous dragging force on the products. Finally, a cut-off saw is utilized to cut the final products.

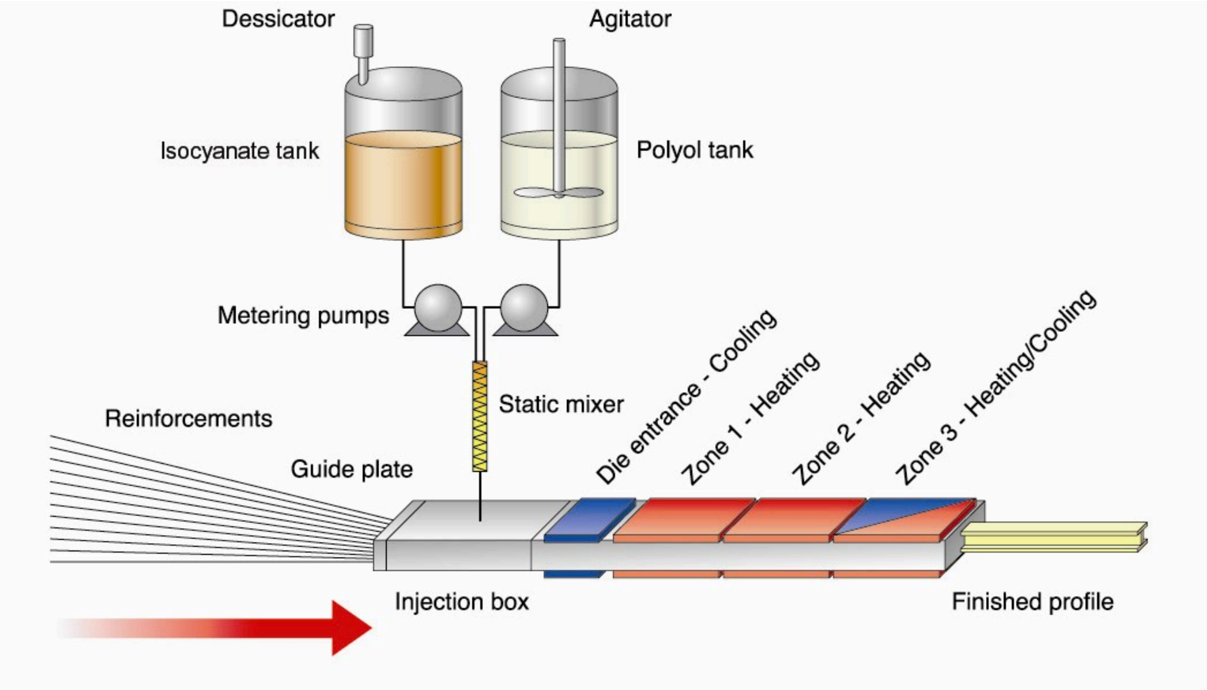

Figure 1 Thermoset pultrusion process

Content declaration

Product

Materials / chemical substances	Window Profile, general model	Window Profile, enhanced model	Window Profile, high end model	CAS Number	Environmental / hazardous properties
Glass fiber	82.00%	83.00%	85.00%		No dangerous substances according to (EC) No. 1907/2006
Isocyanate	9.59%	9.06%	7.99%	9016-87-9	GHS-07 GHS-08
Polyol	8.41%	7.94%	7.01%		No dangerous substances according to (EC) No. 1907/2006

Packaging

After manufacturing, the window profiles will be packaged with PE, PS, and paper. For each meter of window profile, the following amounts of packaging materials are consumed.

Materials	Amount per unit
PE	0.012 g
PS	5.760 g
Paper	5.740 g

LCA information

Functional unit:
The functional unit is 1 meter of window profile.

Time representativeness:
All data are representative of year 2018.

Database(s) and LCA software used:
1mi1 Platform was used for the LCA modelling. The model includes the key (aggregated) LCI data regarding each A1-A4 stage.
Ecoinvent 2016, ELCD and other international databases, as well as some references to the local dataset of 1mi1 Platform were used.

System diagram:

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																	
Product Stage			**Construction process stage**		**Use Stage**							**End of life stage**					**Resource recovery stage**
Raw Material	Transport	Manufacturing	Transport	Assembly / Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND		MND

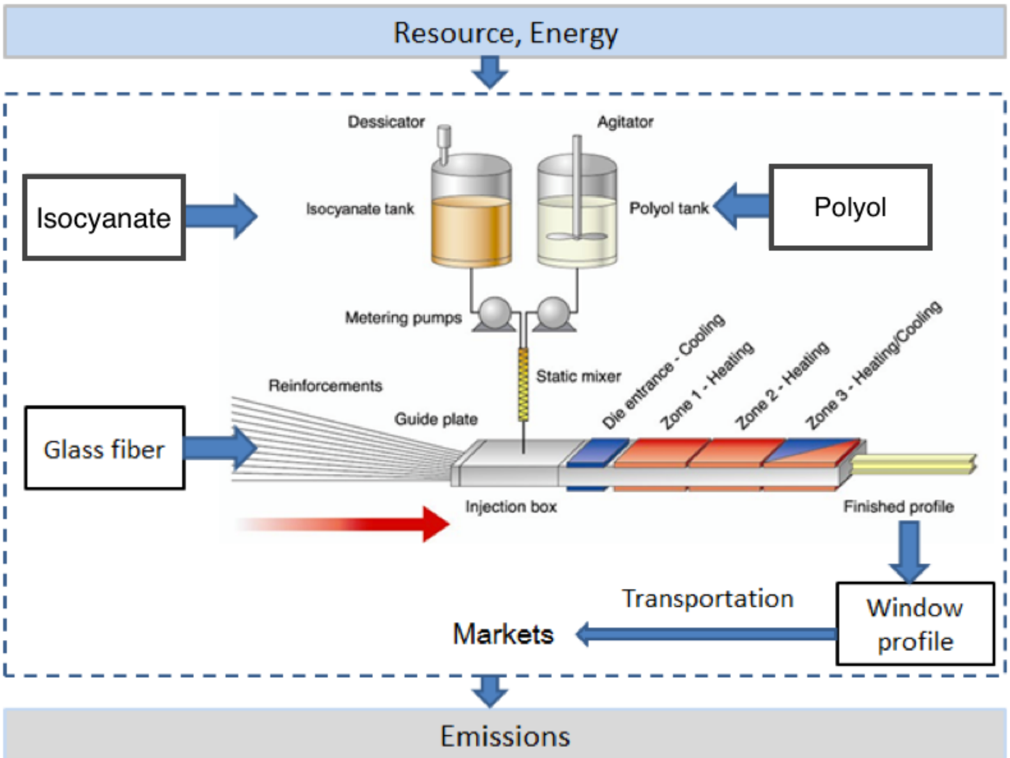

Figure 2 System boundary of the LCA study

Additional technical information for stage A4			
Scenario title	**Parameter**	**Units (expressed per declared unit)**	**Value**
A4 Transport to Site	Vehicle type used for transport	N/A	Lorry
	Vehicle load capacity	tonne	10
	Fuel type and consumption	Diesel, L/100km	31.11
	Distance to central warehouse or storage, if relevant	km	1,500
	Distance to construction site	km	-
	Capacity utilization (including empty returns)	%	50
	Bulk density of transported products	kg/m^3	unknown
	Volume capacity utilization factor (factor:=1or <1 or >=1 for compressed or nested packaged products)	Not applicable	

<u>Description of system boundaries:</u>
The EPD only covers the Cradle to Gate plus transportation during construction stage, because other stages are very dependent on particular scenarios and are better developed for specific building or construction works.

<u>Excluded lifecycle stages:</u>
The installation stage on the construction site, the usage stage and end-of-life stage of the window profiles are excluded from this study. However, the waste generated during A3 manufacturing process was nevertheless reported in the study.

<u>Assumption and limitations:</u>
In order to carry out the LCA study, the following main assumptions were made:

- For the raw materials isocyanate and polyol, the LCI data could not be obtained from the upstream supplier. Therefore, the data of similar materials from database were adopted for the calculation.
- The products will be transported to East China by lorry, a distance of 1500 km was assumed.
- The upstream data is mainly based on the supply chain, supplemented by the database data.
- Background data were from Ecoinvent 2016, ELCD and other international databases, as well as some references to the local dataset of 1mi1 Platform.

<u>Allocation:</u>
During the production process of glass fiber products, the use of raw materials and resource were calculated according to the relationship between output and energy consumption, water consumption and related resources, avoiding the use of mass, energy and economic distribution method.

During manufacturing process, there is no generation of by-products that need to be allocated in this situation.

<u>Cut-off rules:</u>
Raw materials that account for less than 1% of the mass of the product were allowed not to be considered in the study, including the transportation of the associated materials. The infrastructure for manufacturing was not included in the LCA, including the machine, either.

<u>Electricity source:</u>
As required in PCR Section 10, “If the electricity in A3 accounts for more than 30% of the total energy in stage A1 to A3, the energy sources behind the electricity grid in module A3 shall be documented in the EPD and given in g CO_2e/kWh”.

In this LCA, the grid mix data on electricity of for the site in Chongqing is based on grid mixes of the State Grid Corporation of China (SGCC). The electricity inventory is based on the year of 2015 for Chinese electricity generation (China Energy Statistics).

In Chinese map of electricity generation, thermal power is the principal part of total national installed capacity and electricity generation. Development of hydropower is slower than that of thermal power, and nuclear power is still in its initial step. Power generation from renewable energy resources, such as wind, solar energy and tide, are usually not included due to the small share in electricity generation in China. However, the renewable energy was also considered in this study by taking into account a small ratio of wind, solar and other renewable energy generation in China.

In 2015, the source of power supply is 73.3% thermal power, 19.4% hydropower and 2.9% nuclear power. The transmission of electricity in all cases is taken from the power station via a high voltage electricity grid to low voltage electricity suitable for domestic use, with a loss factor of 7.52% of the electricity produced at the power station, and a loss of 6.15% by the electricity consumption at the power plants.

The applied electricity data set used in the manufacturing phase is 1,133g CO_2 eq./kWh.

Environmental performance

Although the three models of CPIC fiberglass window profiles are manufactured by the same company with the same manufacturing process, differences among several environmental indicators of the three models are higher than ±10%. The LCA results are therefore presented separately for each model as follows.

Potential environmental impact for CPIC Window Profile, general model

PARAMETER	UNIT	A1	A2	A3	A4
Global warming potential (GWP)	kg CO_2 eq.	2.15E0	7.60E-2	2.20E-1	3.74E-1
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.92E-7	1.37E-8	2.12E-9	6.77E-8
Acidification potential (AP)	kg SO_2 eq.	1.11E-2	3.79E-4	1.12E-3	1.87E-3
Eutrophication potential (EP)	kg PO_4^{3-} eq.	2.87E-3	8.94E-5	1.59E-4	4.40E-4
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	5.80E-4	1.42E-5	4.30E-5	7.02E-5
Abiotic depletion potential – Elements	kg Sb eq.	1.07E-3	2.63E-7	4.45E-8	1.30E-6
Abiotic depletion potential – Fossil resources	MJ, net calorific value	3.02E1	1.20E0	1.88E0	5.90E0

Use of resources for CPIC Window Profile, general model

PARAMETER		UNIT	A1	A2	A3	A4
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.86E0	1.60E-2	2.19E-1	7.86E-2
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
	TOTAL	MJ, net calorific value	1.86E0	1.60E-2	2.19E-1	7.86E-2
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	3.33E1	1.11E0	3.57E0	5.47E0
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
	TOTAL	MJ, net calorific value	3.33E1	1.11E0	3.57E0	5.47E0
Secondary material		kg	0.00E0	0.00E0	0.00E0	0.00E0
Renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Non-renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Net use of fresh water		m^3	1.54E-1	8.88E-3	5.00E-3	4.37E-2

Waste production and output flows for CPIC Window Profile, general model

Waste production

PARAMETER	UNIT	A1	A2	A3	A4
Hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Non-hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Radioactive waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0

Output flows

PARAMETER	UNIT	A1	A2	A3	A4
Components for reuse	kg	-	-	-	-
Material for recycling	kg	-	-	-	-
Materials for energy recovery	kg	-	-	-	-
Exported energy, electricity	MJ	-	-	-	-
Exported energy, thermal	MJ	-	-	-	-

Potential environmental impact for CPIC Window Profile, enhanced model

PARAMETER	UNIT	A1	A2	A3	A4
Global warming potential (GWP)	kg CO_2 eq.	2.73E0	9.42E-2	2.87E-1	4.88E-1
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	2.40E-7	1.70E-8	2.77E-9	8.84E-8
Acidification potential (AP)	kg SO_2 eq.	1.42E-2	4.70E-4	1.46E-3	2.44E-3
Eutrophication potential (EP)	kg PO_4^{3-} eq.	3.61E-3	1.11E-4	2.07E-4	5.75E-4
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	7.33E-4	1.77E-5	5.62E-5	9.15E-5
Abiotic depletion potential – Elements	kg Sb eq.	1.40E-3	3.26E-7	5.81E-8	1.69E-6
Abiotic depletion potential – Fossil resources	MJ, net calorific value	3.87E1	1.48E0	2.45E0	7.69E0

Use of resources for CPIC Window Profile, enhanced model

PARAMETER		UNIT	A1	A2	A3	A4
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2.41E0	1.98E-2	2.86E-1	1.03E-1
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
	TOTAL	MJ, net calorific value	2.41E0	1.98E-2	2.86E-1	1.03E-1
Primary energy resources –	Use as energy carrier	MJ, net calorific value	4.26E1	1.38E0	4.67E0	7.13E0
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0

Non-renewable	TOTAL	MJ, net calorific value	4.26E1	1.38E0	4.67E0	7.13E0
Secondary material		kg	0.00E0	0.00E0	0.00E0	0.00E0
Renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Non-renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Net use of fresh water		m^3	1.97E-1	1.10E-2	6.53E-3	5.71E-2

Waste production and output flows for CPIC Window Profile, enhanced model

Waste production

PARAMETER	UNIT	A1	A2	A3	A4
Hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Non-hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Radioactive waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0

Output flows

PARAMETER	UNIT	A1	A2	A3	A4
Components for reuse	kg	-	-	-	-
Material for recycling	kg	-	-	-	-
Materials for energy recovery	kg	-	-	-	-
Exported energy, electricity	MJ	-	-	-	-
Exported energy, thermal	MJ	-	-	-	-

Potential environmental impact for CPIC Window Profile, high end model

PARAMETER	UNIT	A1	A2	A3	A4
Global warming potential (GWP)	kg CO_2 eq.	2.92E0	9.33E-2	3.25E-1	5.53E-1
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	2.45E-7	1.69E-8	3.13E-9	1.00E-7
Acidification potential (AP)	kg SO_2 eq.	1.52E-2	4.65E-4	1.65E-3	2.76E-3
Eutrophication potential (EP)	kg PO_4^{3-} eq.	3.79E-3	1.10E-4	2.35E-4	6.50E-4
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	7.74E-4	1.75E-5	6.36E-5	1.04E-4
Abiotic depletion potential – Elements	kg Sb eq.	1.63E-3	3.23E-7	6.58E-8	1.91E-6
Abiotic depletion potential – Fossil resources	MJ, net calorific value	4.00E1	1.47E0	2.77E0	8.71E0

Use of resources for CPIC Window Profile, high end model

PARAMETER		UNIT	A1	A2	A3	A4
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2.70E0	1.96E-2	3.24E-1	1.16E-1
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
	TOTAL	MJ, net calorific value	2.70E0	1.96E-2	3.24E-1	1.16E-1
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	4.62E1	1.36E0	5.28E0	8.07E0
	Used as raw materials	MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
	TOTAL	MJ, net calorific value	4.62E1	1.36E0	5.28E0	8.07E0
Secondary material		kg	0.00E0	0.00E0	0.00E0	0.00E0
Renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Non-renewable secondary fuels		MJ, net calorific value	0.00E0	0.00E0	0.00E0	0.00E0
Net use of fresh water		m^3	2.13E-1	1.09E-2	7.39E-3	6.46E-2

Waste production and output flows for CPIC Window Profile, high end model

Waste production

PARAMETER	UNIT	A1	A2	A3	A4
Hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Non-hazardous waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0
Radioactive waste disposed	kg	0.00E0	0.00E0	0.00E0	0.00E0

Output flows

PARAMETER	UNIT	A1	A2	A3	A4
Components for reuse	kg	-	-	-	-
Material for recycling	kg	-	-	-	-
Materials for energy recovery	kg	-	-	-	-
Exported energy, electricity	MJ	-	-	-	-
Exported energy, thermal	MJ	-	-	-	-

References

General Programme Instructions of the International EPD® System. Version 3.0.

PCR 2012:01 Construction Products and Construction Services, Version 2.3 (2018-11-15)

EN 15804:2012+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

ISO 21930:2017 Environmental declaration of building products

ISO 14025:2006 Environmental labels and declarations -- Type III environmental declarations - Principles and procedures

ISO 14040:2006 Environmental management -- Life cycle assessment -- Principles and framework

ISO 14044:2006 Environmental management -- Life cycle assessment -- Requirements and guidelines