POLFLAM®
FIRE RESISTANT GLASS

ENVIRONMENTAL PRODUCT DECLARATION

POLFLAM GAIA LOW-CARBON FIRE-RESISTANT GLASS

Owner of the EPD:	POLFLAM Sp. z o.o.
Issued:	**24.01.2025**
Valid until:	**24.01.2030**

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PROGRAMME INFORMATION

Owner of the EPD:
POLFLAM Sp. z o.o.

Products covered by the EPD:
Fire-resistant glass POLFLAM
EI, EW, FR GAIA 16-20 mm;
EI, EW, FR GAIA 21-55 mm;
BR GAIA 30-50 mm.

Programme owner:
Łukasiewicz Research Network – Institute of Ceramics and Building Materials
http://www.icimb.pl/opole/

Owner of the EPD:
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Date of issuance:
24.01.2025

Declared unit:
1 m^2

EPD valid until:
24.01.2030

Scope:
The declaration owner is responsible for the underlying information and evidence. Łukasiewicz Research Network – Institute of Ceramics and Building Materials Environmental Engineering Center in Opole is not responsible for the manufacturer's information and data and evidence regarding the life cycle assessment.
Declarations resulting from different programs or performed not in accordance with the standard may not be compared.

Product Category Rules (PCR):

PN-EN 15804+A2:2020-03 Sustainability of construction works. Environmental product declarations. Basic principles of categorization of construction products, ICIMB-PCR A

Representativeness:

Polish product, year 2023

Reference Service Life (RSL):

30 years

Reasons for performing LCA:

B2B

Life cycle Analysis (LCA):

LCA covers modules A1-A4, C1-C4 and D according to PN-EN 15804+A2 (Cradle-to-Gate with options)

Łukasiewicz Research Network – Institute of Ceramics and Building Materials, Environmental Engineering Center provides access to the type III EPD for fire-resistance glass produced by POLFLAM sp. z o.o. to the interested parties.

MANUFACTURER AND PRODUCT DESCRIPTION

POLFLAM® has been in the glass industry since 1992 and has specialized in the production and sale of fire-resistant glass since 2005. In February 2019 the acquisition of POLFLAM by Baltisse was completed.

We are cooperating since many years with system providers of steel, aluminium and timber systems making Polflam fire-resistant glass available in a wide range of systems for every market. Today POLFLAM® is a completely independent manufacturer of fire-resistant glass: from technology to research and production.

We also offer additional product-related services:

- laboratory facilities for testing fire-resistant glass and complete fire-resistant systems
- advisory services and trainings

POLFLAM GAIA is the world's first low-carbon fire-resistant glass. It has been skillfully crafted by combining our hydrogel technology developed by POLFLAM's research lab with the distinctive attributes of low-carbon float glass. Employing environmentally conscious methods, such as the use of alternative fuels, renewable energy, and raw material recycling, this glass ensures a significantly reduced carbon footprint.

POLFLAM® is a synonym for product quality, reliable and comprehensive service at every stage of the project. The group of products covered by the declaration are as follows:

- Fire-resistant glass EW GAIA
- Fire-resistant glass EI GAIA
- Fire-resistant glass BR GAIA
- Fire-resistant glass FR GAIA

The indicative composition of products covered by the declaration is presented in the table below.

The percentage depends on the type of product.

Table 1 Indicative composition of the products covered by the declaration

Material	Mass fraction [%]
Glass	50-80
Fire protection interlayer (Hydrogel)	20-40
Sealants	2-6
Spacer	2-6

POLFLAM GAIA fire-resistant glass production begins with the arrival of large-sized low-carbon glass panes, which are then transferred to an automated warehouse connected to the horizontal cutting tables. The glass is cut to the required sizes and marked with a product and an unique ID code for traceability purposes and after that loaded onto an initial sorting system whichorganizes the material flow. Based on customer requirements, the glass then undergoes special edge treatment: seaming, grinding or polishing. The glass sheets are thoroughly cleaned in the washing machine and then transferred to the tempering furnaces.
After the tempering process, the glass panes re-enter the downstream sorting system, where they are awaiting for an assembly process.

The assembly process begins with a vertical washing machine where the glass panes undergo a thorough cleaning process. Each pane undergoes careful inspection in a quality control scanner. Meanwhile, our dedicated team produces the necessary spacer bars for the assembly.

Once the quality control check is completed, the spacer bars are installed between the glass panes. Our assembly process involves combining two glass units separated by spacer bar and primary sealant, forming a cavity that is later filled with a hydrogel. The glass edge is precisely sealed with secondary sealant, ensuring maximum tightness of the cavity. After drying of the edge sealant the cavity is being filled with the hydrogel and then it undergoes the curing process, further enhancing the performance of POLFLAM glass.

Before being packed on stillages, each glass unit with applied product labels undergoes a final quality control in accordance with our stringent internal guidelines. This ensures that every glass unit meets our highest quality standards.

Finally, our finished glass unit is securely packed on either steel or wooden stillages and carefully wrapped with foil.

The safely packed glass units are then loaded onto trucks, ready for delivery to their final destination.

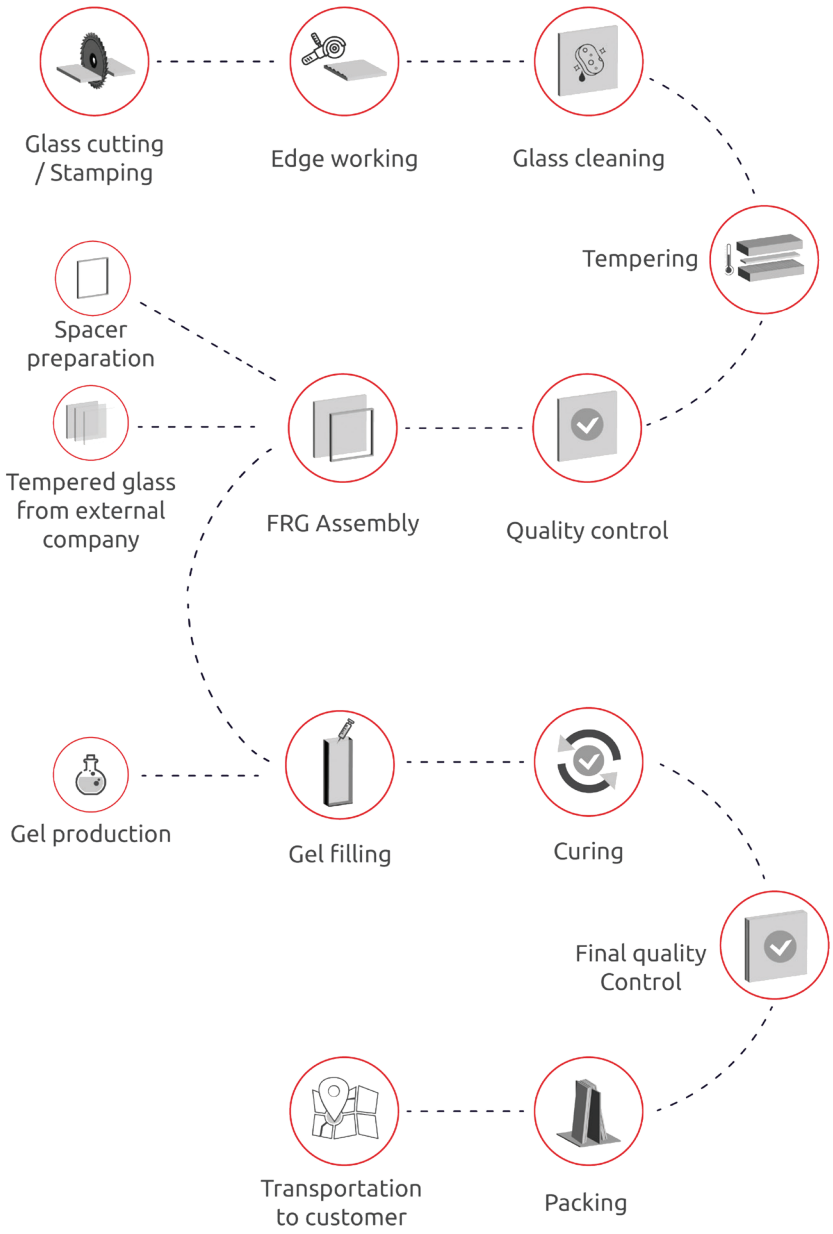

Fig. 1: The production diagram of fire-resistant glass by POLFLAM®

The production plant of POLFLAM®

POLFLAM EI GAIA and POLFLAM EW GAIA are fully transparent fire-resistant glasses for various applications. POLFLAM EI GAIA fire-resistant glass meets integrity with full thermal insulation and POLFLAM EW GAIA fire-resistant glass meets integrity with reduced heat radiation. The two product families are based on the hydrogel technology developed by POLFLAM® and meets requirements of EN 14449. Monolithic POLFLAM EI GAIA and POLFLAM EW GAIA fire-resistant glass consist of two thermally toughened safety low-carbon glass panes according to EN 12150 with a minimum thickness of 5 mm, separated by a metal or composite spacer bar around the edges of the glass and a single cavity filled with a hydrogel interlayer with a minimal thickness of 6 mm. The spacer bar with applied Butyl on both sides as primary seal is positioned between the two glass panes and sealed around the perimeter with Polysulphide or Silicone as secondary seal. The hydrogel is produced at POLFLAM® factory according to the company's own proprietary formula.

Monolithic POLFLAM EI GAIA and POLFLAM EW GAIA fire-resistant glass are designed for internal applications and as Insulated Glass Units for external building applications.

POLFLAM EI GAIA and POLFLAM EW GAIA fire-resistant glass are available in the fire resistance classes according to EN 13501-2:

- EI 15 up to EI 180
- EW 30 up to EW 120

Construction of the fire-resistant glass is presented below:

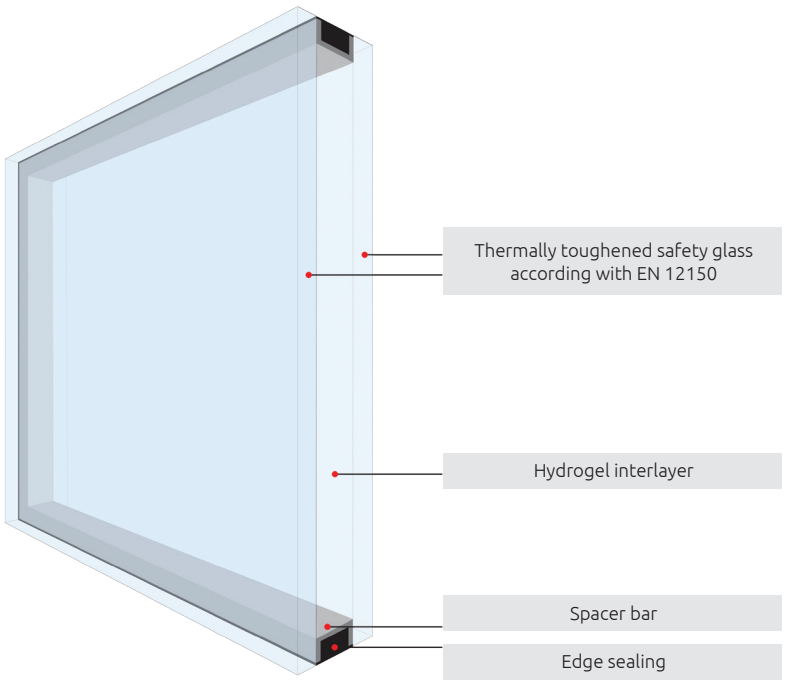

Figure 2: Diagram of the construction of fire-resistant glass produced by POLFLAM®

POLFLAM EI GAIA AND POLFLAM EW GAIA

Monolithic POLFLAM GAIA fire-resistant glass, made from 5 mm thermally toughened safety low-carbon glass, is used in internal partitions, windows, doors, and facades.

POLFLAM GAIA		EI 15	EI 30	EI 60		EI 90		EI 120		EI 180
Nominal thickness [mm]		16	20	25	28	32	35	35	40	55
Thickness tolerance [mm]		± 2	± 2	± 2	± 2	± 3	± 3	± 3	± 3	± 3
Weight [kg/m²]		33	38	45	49	52	57	57	64	83
Fire resistance	EN 13501-2	EI 15	EI 30	EI 60	EI 60	EI 90	EI 90	EI 120	EI 120	EI 180
Light transmittance τ_v [%]	EN 410	88*	87	87	87	85	87	87	86	85
Total solar energy transmittance g [%]	EN 410	73*	72	70	71	68	70	70	68	66
Thermal properties U_g [W/m²K]	EN 673	4.8*	4.4	4.0*	3.7	3.6*	3.3	3.3	3.0	NPD
Sound reduction index R_w (C; C_{tr}) [dB]	EN 12758	41 (-2; -3)	42 (-2; -3)	44 (-2; -4)	45 (-1; -3)	44 (-2; -3)	47 (-1; -4)	47 (-1; -4)	48 (-1; -4)	45 (-1; -4)
Pendulum body impact resistance	EN 12600	1(B)1								
Reaction to fire	EN 13501-1	B-s1, d0								
Max. temperature range		-40 °C / +50 °C								
Curved glass		yes								

* estimated value

POLFLAM GAIA		EW 30		EW 60		EW 90		EW 120	
Nominal thickness [mm]		16	20	16	20	16	20	16	20
Thickness tolerance [mm]		± 2	± 2	± 2	± 2	± 2	± 2	± 2	± 2
Weight [kg/m²]		33	38	33	38	33	38	33	38
Fire resistance	EN 13501-2	EW 30	EW 30	EW 60	EW 60	EW 90	EW 90	EW 120	EW 120
Light transmittance τ_v [%]	EN 410	88*	87	88*	87	88*	87	88*	87
Total solar energy transmittance g [%]	EN 410	73*	72	73*	72	73*	72	73*	72
Thermal properties U_g [W/m²K]	EN 673	4.8*	4.4	4.8*	4.4	4.8*	4.4	4.8*	4.4
Sound reduction index R_w (C; C_{tr}) [dB]	EN 12758	41 (-2; -3)	42 (-2; -3)	41 (-2; -3)	42 (-2; -3)	41 (-2; -3)	42 (-2; -3)	41 (-2; -3)	42 (-2; -3)
Pendulum body impact resistance	EN 12600	1(B)1							
Reaction to fire	EN 13501-1	B-s1, d0							
Max. temperature range		-40 °C / +50 °C							
Curved glass		yes							

* estimated value

POLFLAM BR GAIA fire-resistant glass

POLFLAM BR GAIA fire-resistant glass can be installed with the vertical sides of the glasses directly connected (butt-joint) to each other without the use of vertical posts or framing system and is based on a 10 mm thermally toughened safety low-carbon glass.

POLFLAM GAIA		EI 30	EI 60		EI 90	EI 120
Nominal thickness [mm]		30	35	38	45	50
Thickness tolerance [mm]		± 2	± 3	± 3	± 3	± 3
Weight [kg/m²]		65	69	75	82	90
Fire resistance	EN 13501-2	EI 30	EI 60	EI 60	EI 90	EI 120
Light transmittance τ_v [%]	EN 410	84	84	84	84	84
Total solar energy transmittance g [%]	EN 410	68	67	67	64	66
Thermal properties U_g [W/m²K]	EN 673	4.6*	4.2*	3.6*	3.8*	2.9
Sound reduction index R_w (C; C_{tr}) [dB]	EN 12758	44 (-2; -3)	44 (-2; -3)	44 (-1; -3)	47 (-2; -3)	46 (-1; -3)
Pendulum body impact resistance	EN 12600	1(B)1				
Reaction to fire	EN 13501-1	B-s1, d0				
Max. temperature range		-40 °C / +50 °C				
Curved glass		yes				

* estimated value

POLFLAM FR GAIA fire-resistant glass

POLFLAM FR GAIA fire-resistant glass can be installed in the FR System allowing fire-resistant glass to be installed directly in openings of walls of various materials without the need for a commercial fire-resistant framing system and is based on a 5 mm thermally toughened safety low-carbon glass.

POLFLAM FR GAIA		EI 30	EI 60	EI 90	EI 120	EI 180
Nominal thickness [mm]		20	25	35	35	55
Thickness tolerance [mm]		± 2	± 3	± 3	± 3	± 3
Weight [kg/m²]		38	45	57	57	83
Fire resistance	EN 13501-2	EI 30	EI 60	EI 90	EI 120	EI 180
Light transmittance τ_v [%]	EN 410	87	87	87	87	85
Total solar energy transmittance g [%]	EN 410	72	70	70	70	66
Thermal properties U_g [W/m²K]	EN 673	4.4	4.0*	3.3	3.4*	NPD
Sound reduction index R_w (C; C_{tr}) [dB]	EN 12758	42 (-2; -3)	44 (-2; -3)	47 (-1; -4)	45 (-1; -4)	45 (-1; -4)
Pendulum body impact resistance	EN 12600	1(B)1				
Reaction to fire	EN 13501-1	B-s1, d0				
Max. temperature range		-40 °C / +50 °C				
Curved glass		yes				

* estimated value

LCA: CALCULATION RULES

The EPD is based on average data provided by the owner of the declaration POLFLAM Sp. z o.o. for production plant located in Jeziorzany.

System limitations	The life cycle analysis of the tested products includes modules A1-A3, A4, C1-C4 and D (Cradle to Gate with options) in accordance with EN 15804.
Data collection period	Data on the production process were provided in 2024 for the period 01.01.2023 - 31.12.2023 (12 months) and correspond to the production technology of the time.
Declared unit	1 m^2
Assumptions	**A1** – extraction and consumption of raw materials refers to specific mass shares in the production process, per unit declared of the product, **A2** – distances from the place of obtaining raw materials to the production plant individual for each raw material, means of transport differentiated due to the method of delivery of raw materials, **A3** – CO_2, NO_x, SO_2 and dust emission values from the production process obtained as a result of estimation based on fuel consumption, **A4** – refers to the transport of the final product to the construction site is treated as the average weight values of transports to customers, **C1** – describes the handling of POLFLAM GAIA fire-resistant glass during disassembly/demolition. Calculations are made on the basis of the developed scenario, **C2** – refers to the transport of construction waste to a recovery or disposal plant. Calculations are made on the basis of the developed scenario, **C3** – takes into account the environmental impact during the processing of demolition waste, containing elements of POLFLAM GAIA fire-resistant glass, in a waste recovery plant. Calculations are made on the basis of the developed scenario, **C4** – takes into account the environmental impact of storage and recycling of POLFLAM GAIA fire-resistant glass elements. Calculations are made on the basis of the developed scenario, **D** – refers to the impact and effects of the use of secondary material. The calculations are performed based on the developed scenario.
Cut-off-criteria	99% of all bulk streams involved in the production process were taken into account. All the energy used in the process was taken into account in the EPD.
General data	The data for the calculations come from Ecoinvent v. 3.10 and have been supplemented with KOBiZE CO_2, SO_2, NO_2, CO and total particulate matter emission indicators for electricity, December 2023. Emission factors for electricity were determined using the actual KOBiZE data. The Polish electricity emission factor (Ecoinvent supplemented with current national data from KOBiZE) is 0.597 kg CO_2/kWh. A detailed analysis of data quality was part of an external audit.
Allocation	All data on the components manufactured in the plant were provided by the owner of the declaration POLFLAM Sp. z o.o. and were referred to the declared unit of the product – 1 m^2. **The allocation rules used in this EPD are based on the general ICIMB-PCR A principles.**

LCA: SCENERIOS AND ADDITIONAL TECHNICAL DATA

The life cycle assessment has been developed in accordance with the requirements of PN-EN ISO 15804+A2:2020, PN-EN ISO 14025 and PN-EN ISO 14040. The rules for product categorization have been adopted in accordance with the PN-EN 15804 standard.

For the life cycle analysis of products covered by the cradle to gate with options environmental declaration, scenarios have been developed for modules A4, C1-C4 and D:

Module A4 – transport to the construction site – Based on the manufacturer's declaration, the following scenario was adopted - Transport is carried out by trucks with a load capacity of 16-32 tons meeting the EURO 6 emission standards, average distance from the plant to the customer 350 km - data from the customer.

Module C1 – Disassembly/demolition – Manual demolition and initial sorting on site have been adopted. The consumption of energy and other raw materials in this module has been omitted due to negligible values The separated fractions from the separation of fire-resistant glass are directed to the waste treatment plant. The modulus is zero.

Module C2 – Transport – Waste is transported to the treatment plant, where, after separating the recyclable fraction and the fraction intended for landfill, the appropriate quantities are directed to further processes.

- 100% of the waste constituting used fire-resistant glass is transported to a recovery plant. It is assumed that 70% of fire-resistant glass is recycled and 30% is landfilled.
- Transport is carried out by trucks with a load capacity of 7.5-16 tons, meeting the EURO 6 emission standards.
- Transport to the recycling plant and to the landfill takes place at a distance of 100 km from the demolition site.

Module C3 - Waste treatment – All waste goes to the waste treatment plant. Electricity consumption per 1 kg of waste is 0.03 kWh/kg, and fuel consumption is 0.315 MJ/kg. The following processes were assumed for the calculations: unloading (loader), crushing (crusher).

Module C4 – Waste management – It has been assumed that waste that can no longer be used in any other way is sent to the landfill. These are wastes separated in the processing process (module C3).

Module D – Material reuse potential – for fire-resistant glass, it is assumed that 70% of the product is recycled.

LCA: RESULTS

The table below shows the LCA modules included in the calculation of the environmental impact categories for the products covered by the declaration.

SYSTEM BOUNDARIES															
Products stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Production	Transport	Construction process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstriction	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	X	X	X	X	X

X – module included in LCA
MND – module not declared

Products stage
A1 Raw material supply
A2 Transport
A3 Production

Construction process stage
A4 Transport
A5 Construction process

End-of-life stage
C1 Deconstruction
C2 Transport
C3 Waste processing
C4 Disposal

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

LCA: RESULTS

The following tables present the results of the LCA analysis for POLFLAM GAIA fire-resistant glass.

Explanations of the abbreviations used to describe the impact categories are given below:

GWP-total	Global warming potential
GWP-fossil	Global warming potential fossil fuel
GWP-biogenic	Global warming potential biogenic
GWP-luluc	Global warming potential land use and land change
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential of land and water
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
EP-marine	Eutrophication potential, fraction of nutrients reaching marine end compartment
EP-terrestial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADP-minerals&metals	Abiotic depletion potential for nonfossil resources
ADP-fossil	Abiotic depletion potential for fossil resources
WDP	Water (user) deprivation potential
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	Use of renewable primary energy resources used as raw materials
PERT	Total use of renewable primary energy resources
PEN-RE	Use of non-renewable primary energy resources excluding non-renewable primary energy resources used as raw materials
RE	Use of non-renewable primary energy resources used as raw materials
PENRT	Total use of non-renewable primary energy resources
SM	Use of secondary material
RSF	Use of renewable fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water

MAIN IMPACT INDICATORS: 1 m² POLFLAM EI, EW, FR GAIA (16-20 mm)								
	Life Cycle Stage							
Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-total	**kg CO_2 eq.**	**5,50E+01**	**6,66E-02**	**0,00E+00**	**4,02E-01**	**8,42E-01**	**2,03E-02**	**-5,50E-01**
GWP-fossil	kg CO_2 eq.	5,89E+01	6,65E-02	0,00E+00	4,02E-01	8,41E-01	2,02E-02	-4,93E-01
GWP-biogenic	kg CO_2 eq.	-3,91E+00	4,61E-05	0,00E+00	2,35E-04	9,40E-04	5,18E-05	-5,68E-02
GWP-luluc	kg CO_2 eq.	6,23E-02	2,21E-05	0,00E+00	1,27E-04	4,11E-04	3,23E-06	-2,17E-04
ODP	kg CFC11 eq.	1,60E-06	1,32E-09	0,00E+00	8,03E-09	9,41E-09	7,55E-10	-4,52E-09
AP	mol H+ eq.	3,79E-01	1,39E-04	0,00E+00	7,89E-04	6,38E-03	2,44E-04	-1,71E-03
EP-freshwater	kg PO_4 eq.	2,78E-02	4,50E-06	0,00E+00	2,63E-05	3,10E-04	9,21E-07	-2,20E-05
EP-marine	kg N eq.	7,83E-02	3,33E-05	0,00E+00	1,86E-04	2,66E-03	5,39E-05	-1,06E-03
EP-terrestrial	mol N eq.	8,56E-01	3,59E-04	0,00E+00	2,01E-03	2,85E-02	5,89E-04	-7,13E-03
POCP	kg NMVOC eq.	2,60E-01	2,30E-04	0,00E+00	1,33E-03	8,47E-03	2,38E-04	-3,64E-03
ADP-minerals & metals	kg Sb eq.	4,95E-04	2,16E-07	0,00E+00	1,28E-06	5,58E-07	2,54E-08	-6,81E-07
ADP-fossil	MJ	7,51E+02	9,35E-01	0,00E+00	5,61E+00	1,04E+01	5,04E-01	-3,67E+00
WDP	WDP (m^3) world eq.	2,23E+01	3,88E-03	0,00E+00	2,14E-02	2,95E-02	1,74E-03	5,60E-01

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM EI, EW, FR GAIA (16-20 mm)								
	Life Cycle Stage							
Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	4,88E+02	1,61E-02	0,00E+00	1,09E-01	4,18E-01	2,00E-02	-6,95E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	4,88E+02	1,61E-02	0,00E+00	1,09E-01	4,18E-01	2,00E-02	-6,95E-02
PEN-RE	MJ	8,12E+02	9,39E-01	0,00E+00	5,59E+00	1,13E+01	9,72E-01	-4,20E+00
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,12E+02	9,39E-01	0,00E+00	5,59E+00	1,13E+01	9,72E-01	-4,20E+00
SM	kg	7,07E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	2,67E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	7,64E-01	1,73E-04	0,00E+00	1,42E-03	4,75E-03	4,86E-05	-5,24E-04

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM EI, EW, FR GAIA (16-20 mm)								
	Life Cycle Stage							
Indicator	**Unit (expressed per DU)**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste	kg	1,95E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,16E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	0,00E+00
Contents organic carbon in packaging (kg C_{org})	5,75E-02

MAIN IMPACT INDICATORS: 1 m² POLFLAM EI, EW, FR GAIA (21-55 mm)								
	Life Cycle Stage							
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	**kg CO_2 eq.**	**6,26E+01**	**6,66E-02**	**0,00E+00**	**3,34E-01**	**7,00E-01**	**1,66E-02**	**-5,84E-01**
GWP-fossil	kg CO_2 eq.	6,65E+01	6,65E-02	0,00E+00	3,34E-01	6,99E-01	1,65E-02	-5,37E-01
GWP-biogenic	kg CO_2 eq.	-3,87E+00	4,61E-05	0,00E+00	1,96E-04	7,82E-04	4,23E-05	-4,63E-02
GWP-luluc	kg CO_2 eq.	6,88E-02	2,21E-05	0,00E+00	1,05E-04	3,41E-04	2,63E-06	-1,78E-04
ODP	kg CFC11 eq.	1,82E-06	1,32E-09	0,00E+00	6,68E-09	7,82E-09	6,16E-10	-3,42E-09
AP	mol H+ eq.	4,26E-01	1,39E-04	0,00E+00	6,56E-04	5,31E-03	2,59E-04	-1,49E-03
EP-freshwater	kg PO_4 eq.	3,02E-02	4,50E-06	0,00E+00	2,19E-05	2,58E-04	7,52E-07	-1,80E-05
EP-marine	kg N eq.	8,53E-02	3,33E-05	0,00E+00	1,55E-04	2,21E-03	4,40E-05	-1,14E-03
EP-terrestrial	mol N eq.	9,38E-01	3,59E-04	0,00E+00	1,67E-03	2,37E-02	4,81E-04	-5,98E-03
POCP	kg NMVOC eq.	2,90E-01	2,30E-04	0,00E+00	1,11E-03	7,04E-03	1,94E-04	-3,00E-03
ADP-minerals & metals	kg Sb eq.	6,94E-04	2,16E-07	0,00E+00	1,06E-06	4,64E-07	2,07E-08	-5,56E-07
ADP-fossil	MJ	8,77E+02	9,35E-01	0,00E+00	4,66E+00	8,66E+00	4,11E-01	-2,82E+00
WDP	WDP (m^3) world eq.	2,66E+01	3,88E-03	0,00E+00	1,78E-02	2,46E-02	1,42E-03	4,64E-01

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM EI, EW, FR GAIA (21-55 mm)								
	Life Cycle Stage							
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	4,96E+02	1,61E-02	0,00E+00	9,03E-02	3,48E-01	2,12E-02	-5,83E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	4,96E+02	1,61E-02	0,00E+00	9,03E-02	3,48E-01	2,12E-02	-5,83E-02
PEN-RE	MJ	9,40E+02	9,39E-01	0,00E+00	4,65E+00	9,42E+00	1,03E+00	-3,50E+00
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	9,40E+02	9,39E-01	0,00E+00	4,65E+00	9,42E+00	1,03E+00	-3,50E+00
SM	kg	7,07E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	2,67E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	8,70E-01	1,73E-04	0,00E+00	1,18E-03	3,95E-03	5,16E-05	-4,37E-04

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM EI, EW, FR GAIA (21-55 mm)								
	Life Cycle Stage							
Indicator	**Unit (expressed per DU)**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste	kg	1,95E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,16E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	0,00E+00
Contents organic carbon in packaging (kg C_{org})	5,73E-02

MAIN IMPACT INDICATORS: 1 m² POLFLAM BR GAIA (30-50 mm)								
	Life Cycle Stage							
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	**kg CO_2 eq.**	**8,95E+01**	**6,66E-02**	**0,00E+00**	**9,06E-01**	**1,90E+00**	**7,42E-02**	**-1,14E+00**
GWP-fossil	kg CO_2 eq.	1,99E+02	6,65E-02	0,00E+00	9,05E-01	1,89E+00	7,40E-02	-1,01E+00
GWP-biogenic	kg CO_2 eq.	-6,13E+00	4,61E-05	0,00E+00	5,30E-04	2,12E-03	1,89E-04	-1,29E-01
GWP-luluc	kg CO_2 eq.	7,36E-01	2,21E-05	0,00E+00	2,86E-04	9,26E-04	1,18E-05	-4,98E-04
ODP	kg CFC11 eq.	5,66E-06	1,32E-09	0,00E+00	1,81E-08	2,12E-08	2,76E-09	-1,18E-08
AP	mol H+ eq.	1,68E+00	1,39E-04	0,00E+00	1,78E-03	1,44E-02	4,61E-04	-3,79E-03
EP-freshwater	kg PO_4 eq.	4,59E-02	4,50E-06	0,00E+00	5,94E-05	6,99E-04	3,37E-06	-5,13E-05
EP-marine	kg N eq.	3,13E-01	3,33E-05	0,00E+00	4,19E-04	5,99E-03	1,97E-04	-2,19E-03
EP-terrestrial	mol N eq.	3,63E+00	3,59E-04	0,00E+00	4,53E-03	6,43E-02	2,15E-03	-1,70E-02
POCP	kg NMVOC eq.	1,05E+00	2,30E-04	0,00E+00	3,00E-03	1,91E-02	8,69E-04	-8,62E-03
ADP-minerals & metals	kg Sb eq.	1,40E-03	2,16E-07	0,00E+00	2,89E-06	1,26E-06	9,29E-08	-1,59E-06
ADP-fossil	MJ	2,39E+03	9,35E-01	0,00E+00	1,26E+01	2,35E+01	1,84E+00	-9,34E+00
WDP	WDP (m^3) world eq.	7,54E+01	3,88E-03	0,00E+00	4,81E-02	6,66E-02	6,38E-03	1,26E+00

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM BR GAIA (30-50 mm)								
	Life Cycle Stage							
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	9,39E+02	1,61E-02	0,00E+00	3,29E-01	9,47E-01	5,22E-02	-2,10E-01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	9,39E+02	1,61E-02	0,00E+00	3,29E-01	9,47E-01	5,22E-02	-2,10E-01
PEN-RE	MJ	9,76E+02	9,39E-01	0,00E+00	1,69E+01	3,51E+01	2,54E+00	-1,27E+01
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	9,76E+02	9,39E-01	0,00E+00	1,69E+01	3,51E+01	2,54E+00	-1,27E+01
SM	kg	1,41E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	1,44E+00	1,73E-04	0,00E+00	4,28E-03	1,81E-02	1,27E-04	-1,58E-03

POLFLAM BR GAIA (30-50 mm)

INDICATORS DESCRIBING RESOURCE CONSUMPTION: 1 m² POLFLAM BR GAIA (30-50 mm)								
	Life Cycle Stage							
Indicator	**Unit (expressed per DU)**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste	kg	1,95E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,33E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	0,00E+00
Contents organic carbon in packaging (kg C_{org})	1,15E-01

LITERATURE

LITERATURE

- *ICIMB-PCR A. General Product Category Rules for Construction Products.*
- *PN-EN ISO 14025:2014-04, Environmental labels and declarations -- Type III environmental declarations -- Rules and procedures.*
- *PN-EN 15804+A2:2020, Sustainability of building structures -- Environmental product declarations -Basic principles of categorization of construction products.*
- *PN-EN ISO 14040:2009 Environmental management. Life Cycle Assessment. Principles and structure.*
- *PN-EN ISO 14044:2009, Environmental management. Life Cycle Assessment. Requirements and guidelines.*
- *EN 15942:2012, Sustainability of construction works – Environmental product declarations – Communication format business-to-business.*
- *PN-EN ISO 12543-4:2022-05, Glass in construction — Laminated glass and safety laminated glass — Part 4: Durability test methods.*
- *PN-EN 572-1:2012, Glass in building. Basic soda-lime silicate glass products- Definitions and general physical and mechanical properties.*
- *KOBiZE CO2, SO2, NOx, CO and total particulate matter emission factors for electricity, December 2023.*
- *M. Asif, A. Davidson, T.Muneer, Mlmech: LIFE CYCLE OF WINDOW MATERIALS - A COMPARATIVE ASSESSMENTFICBSE Millennium Fellow School of Engineering , Napier University, 10 Colinton Road, Edinburgh EH10 5DT, U.K.*
- *Asif, M., Muneer, T. and Kubie, J, „Sustainability analysis of window frames", Building Services Engineering Research and Technology. 2005, vol. 26, no. 1, pp. 71-87.*
- *Weir, G. and Muneer, T., „Energy and environmental impact analysis of double-glazed windows", Energy Conversion and Management 1998, vol. 39, no. 3-4, pp. 243-256.*
- *Heinz Stichnothe1,2 and Adisa Azapagic1 Life cycle assessment of recycling PVC window frames Resources Conservation and Recycling · February 2013 DOI: 10.1016/j.resconrec.2012.12.005*

PARTITIONS

WINDOWS
AND DOORS

FACADES
AND ROOFS

FLOORS

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