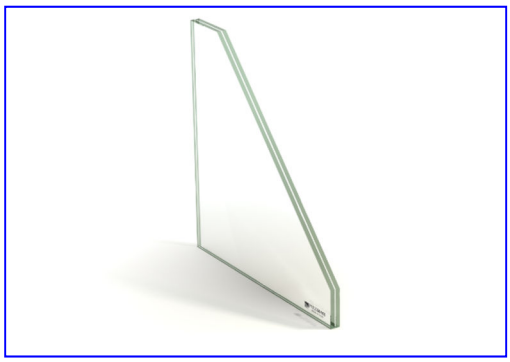
Environmental Product Declaration (EPD)

Declaration code EPD-FEV-GB-61.0



PRESS GLASS
Holding SA

flat glass

Float glass, thermally toughened safety glass and laminated safety glass

Basis:

DIN EN ISO 14025
EN15804

Company EPD
Environmental
Product **D**eclaration

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Environmental Product Declaration (EPD)

Declaration code EPD-FEV-GB-61.0

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Practitioner of the LCA	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim, Germany
Declaration holder	PRESS GLASS Holding SA ul. Golfowa 19 42-274 Konopiska, Poland www.pressglass.com Note: Additional declaration holders are listed on page 3.
Declaration code	EPD-FEV-GB-61.0
Designation of declared product	Float glass, thermally toughened safety glass and laminated safety glass
Scope	Float glass, thermally toughened safety glass and laminated safety glass for further processing into insulating glass unit and applications as glass for the building industry (use in the building envelope and in the finishing of structural facilities/structures).
Basis	This EPD was prepared on the basis of EN ISO 14025:2011 and DIN EN 15804:2012+A2:2019. In addition, the "Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen" (General guideline for preparation of Type III Environmental Product Declarations) applies. The declaration is based on PCR documents EN 17074 „PCR for flat glass products", "PCR Part A" PCR-A-0.3:2018 and "Flat glass in building industry" PCR-FG-2.0:2021.
Validity	Publication date: 06.02.2023 / Last revision: 13.02.2023 / Next revision: 06.02.2028 This verified Company Environmental Product Declaration (company EPD) applies solely to the specified products and is valid for a period of five years from the date of publication in accordance with DIN EN 15804.
LCA Basis	The LCA was prepared in accordance with DIN EN ISO 14040 and DIN EN ISO 14044. The data collected from five production plants of the company PRESS GLASS Holding SA were used as a data basis, as well as generic data from the database "GaBi 10". LCA calculations were carried out for the included "cradle to grave" including all upstream chains (e.g. raw material extraction, etc.).
Notes	The ift-Guidance Sheet "Conditions and Guidance for the Use of ift Test Documents" applies. The declaration holder assumes full liability for the underlying data, certificates and verifications.

Christian Kehrer Head of Certification and Surveillance Body	Dr. Torsten Mielecke Chairman of Expert Committee ift-EPD and PCR	Patrick Wortner External verifier

Further declaration holders

This EPD is valid for the following plants in addition to the declaration holder named on page 1:

- PRESS GLASS SA
  ul. Geodetów 4
  97-500 Radomsko
- PRESS GLASS SA
  ul. Cielmicka 44
  43-100 Tychy
- PRESS GLASS SA
  ul. Skarszewska 11
  83-110 Tczew
- PRESS GLASS SA
  Miętno 40
  72-200 Nowogard
- PRESS GLASS d.o.o.
  dr. Marijana Mlinarića 5
  42203 Jalžabet

1 General Product Information

Product definition

The EPD belongs to the product group flat glass and applies to

1 m² and 1 mm float glass, thermally toughened safety glass and laminated safety glass
of company PRESS GLASS Holding SA

The functional unit is obtained by summing up:

Product group (PG)	Assessed product	Area	Density	Thick-ness
PG1	Float glass	10.00 kg/m²	2.50 g/cm³	4 mm
PG2	Thermally toughened safety glass	15.96 kg/m²	2.50 g/cm³	6 mm
PG3	Laminated safety glass	12.92 kg/m²	2.27 g/cm³	6 mm

Table 1 Product groups

The average unit is declared as follows:
Directly used material flows are determined by means of manufactured areas (m^2) and allocated to the declared unit. All other inputs and outputs in the production were scaled to the declared unit in their entirety since no direct assignment to the area is possible. The reference period is the year 2020.

Product description

Float glass (FG)
Flat glass refers to both uncoated and coated float glass. Float glass is a clear, flat soda lime silicate glass with parallel, fire-polished surfaces, in some cases bearing metal-oxide-based coatings to modify the radiation (thermal insulation and/or solar control) properties of the glass.

Thermally toughened safety glass (TSG) consists of a single pane that has been specially heat-treated to give the glass increased impact resistance. If the glass breaks under exposure to a high load, it disintegrates into very small fragments without forming sharp edges.

Laminated safety glass (LSG) consists of at least two glass panes lying one on top of the other, with one or several layers of a tear-resistant, viscoelastic film positioned between the panes, which consist of polyvinyl butyral (PVB).

The theoretical configuration of the laminated safety glasses presented in this EPD is as follows:

- LSG: 4 mm FG, 2 mm PVB foil

Cutting/properties: Flat glass is generally supplied in stock sizes of 600 x 321 cm. It is cut and processed into thermally toughened safety glass or laminated safety glass on a project-specific basis.

For a detailed product description refer to the manufacturer specifications or the product specifications of the respective offer/quotation.

Product manufacture

Soda lime silicate glass (float glass):
The raw materials are introduced as a mixture into the furnace where they are melted at a temperature of approx. 1,560 ℃, ge nerally using gas as an energy resource.

The glass is shaped by distributing the mass of liquid glass over a bath of molten tin. The glass sheet is then cooled evenly and cut to size.

Coated glass is float glass that has been coated with a metal-oxide-based coating using various processes (sputtering, evaporation, pyrolytic processes). The coating is a few atom layers thick.
In the manufacture of ESG, float glass is heated to its transition temperature (min. 640 ℃) and then rapidly cooled. This causes the surfaces of the glass to cool and contract faster than the remaining material. This creates additional compressive strength in the surfaces that makes the resulting glass tougher.

For the manufacture of VSG, a PVB film is placed between the panes of glass and these are pressed together in an autoclave under the action of heat and pressure.

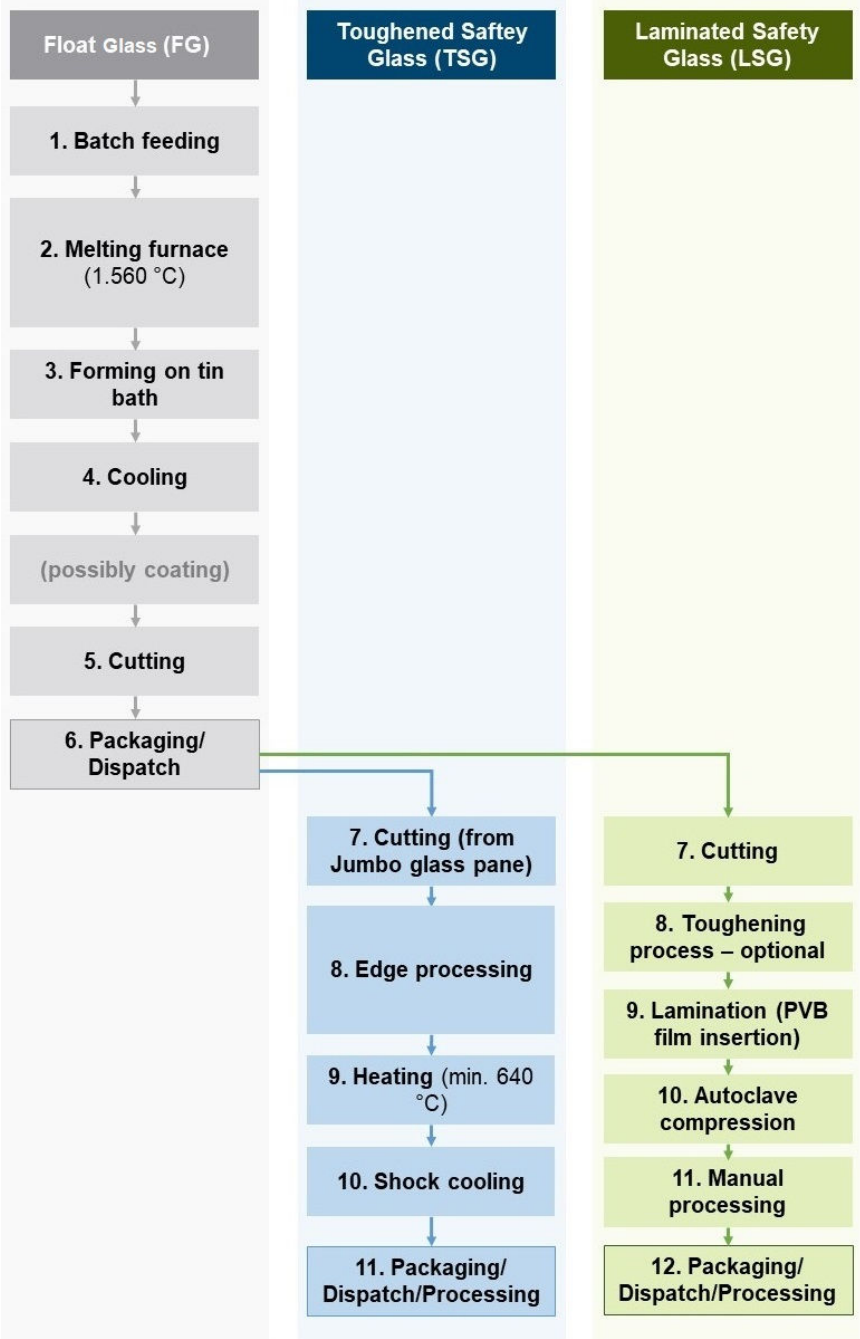


Illustration 1 Product manufacture

The manufacturing processes described are applicable to all manufacturing sites of all manufacturers in Europe, because no production processes are used for the manufacture of FG, ESG and VSG that differ significantly from the above.

Application

Float glass, thermally toughened safety glass and laminated safety glass for further processing into insulating glass unit and applications as glass for the building industry (use in the building envelope and in the finishing of structural facilities/structures).

Test evidence / reports

The following verifications are held:

- Product quality according to EN 1279-6

For information on further and updated verifications (incl. other national approvals) refer to www.pressglass.com.

Quality assurance

The following quality assurance system are in place:

- Product quality according to ift certification scheme insulating glass unit (QM 327)

Management systems

The following management systems are held:

- Quality management system to DIN EN ISO 9001:2015
- Environmental management system to DIN EN ISO 14001:2015

Additional information

For additional verifications of applicability or conformity refer to the CE marking and the documents accompanying the product, if applicable.

Float glass, thermally toughened safety glass and laminated safety glass meet the following building-physical performance characteristics:

	Float glass	Toughened safety glass	Laminated safety glass
Resistance	EN 572	EN 12150	EN 14449
Failure pattern	--	EN 12150	EN 14449
Residual loadbearing capacity	no	no	yes

Performance characteristics in accordance with EN 1279-5 have been tested and certified.

2 Materials used

Primary materials

The primary materials used are listed in the LCA (see Section 7).

Declarable substances

No substances according to REACH candidate list are included (declaration of 15.11.2022).

All relevant safety data sheets can be obtained from company PRESS GLASS Holding SA.

3 Construction process stage

Processing recommendations, installation

Observe the instructions for assembly/installation, operation, maintenance and disassembly, provided by the manufacturer. For this, see www.pressglass.com

4 Use stage

Emissions to the environment

No emissions to indoor air, water and soil are known. According to EN 17074, the consideration of VOC emissions in glass products is not relevant.

Reference service life (RSL)

The RSL information was provided by the manufacturer. The RSL must be established under specified reference conditions of use and relate to the declared technical and functional performance of the product within the building. It must be determined according to all specific rules given in European product standards or, if none are available, according to a c-PCR. It must also take into account ISO 15686-1, -2, -7 and -8. If there is guidance on deriving RSLs from European Product Standards or a c-PCR, then such guidance must take precedence.
If it is not possible to determine the service life as the RSL in accordance with ISO 15686, the BBSR table “Nutzungsdauer von Bauteilen zur Lebenszyklusanalyse nach BNB” (service life of building components for life cycle assessment in accordance with the sustainable construction evaluation system) can be used. For further information and explanations refer to www.nachhaltigesbauen.de.

For this EPD the following applies:
For a "cradle to grave" EPD and Module D (A + B + C + D), a reference service life (RSL) must be specified.
The service life for Float glass, thermally toughened safety glass and laminated safety glass of company PRESS GLASS Holding SA is specified as 30 years according to EN 17074.

The service life is dependent on the characteristics of the product and in-use conditions.

The service life solely applies to the characteristics specified in this EPD or the corresponding references.
The reference service life (RSL) does not reflect the actual life span, which is usually determined by the service life and the refurbishment of a building. It does not give any information on the useful life, warranty referring to performance characteristics or guarantees.

5 End-of-life stage

Possible end-of-life stages

Float glass, thermally toughened safety glass and laminated safety glass is fed to central collection points. There the products are usually shredded and sorted into their constituents. The end-of-life stage depends on the site where the products are used and is therefore subject to the local regulations. Observe the locally applicable regulatory requirements.

In this EPD, the modules of after-use are presented according to the market situation.
Glass as well as plastics are recycled to certain parts. Residual fractions are sent to landfill or, in part, thermally recycled.

Disposal routes

The LCA includes the average disposal routes.

All life cycle scenarios are detailed in the Annex.

6 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle assessments (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

As a basis for this, life cycle assessments were prepared for Float glass, thermally toughened safety glass and laminated safety glass. These LCAs are in conformity with the requirements set out in DIN EN 15804 and the international standards DIN EN ISO 14040, DIN EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

6.1 Definition of goal and scope

Aim

The goal of the LCA is to demonstrate the environmental impacts of the products. In accordance with DIN EN 15804, the environmental impacts covered by this Environmental Product Declaration are presented for the entire product life cycle in the form of basic information. No other additional environmental impacts are specified.

Data quality, data availability and geographical and time-related system boundaries

The specific data originate exclusively from the 2020 fiscal year. They were collected on-site at the plants of company PRESS GLASS Holding SA located in 97-500 Radomsko (Poland), 72-200 Nowogard-Mietno (Poland), 83-110 Tczew (Poland), 43-100 Tychy (Poland), 42203 Jalzabet (Croatia) and originate in parts from company records and partly from values directly obtained by measurement. Validity of the data was checked by the ift Rosenheim.

The generic data originate from the “GaBi 10” professional and building materials databases. The last update of both databases was in 2022. Data from before this date originate also from these databases and are not more than 6 years old. No other generic data were used for the calculation.

Data gaps were either filled with comparable data or conservative assumptions, or the data were cut off in compliance with the 1% rule.

The life cycle was modelled using the sustainability software tool “GaBi” for the development of life cycle assessments.

Scope / system boundaries

The system boundaries refer to the supply of raw materials and purchased parts, manufacture/production, use and end-of-life stage of Float glass, thermally toughened safety glass and laminated safety glass. For float glass, additional specific data for production at the sub-supplier were taken into account (M-EPD-FEV-002005).

No other additional data from sub-suppliers or other sites were used for this EPD.

Cut-off criteria

All company data collected, i.e. all commodities/input and raw materials used, the thermal energy and electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the products, were excluded.

The transport distances of the pre-products used were taken into consideration as a function of 100% of the mass of the products.
The transport mix is consisted as follows and is derived from the research project "EPDs for transparent components":

- Truck, 26 – 28 t total weight / 18.4 t payload, Euro 6, freight, 85% capacity used, 100 km,
- Truck-trailer, 28 – 34 t total weight / 22 t payload, Euro 6, 50% capacity used, 50 km,
- Freight train, electrical and diesel driven; D 60%, E 51% capacity used, 50 km,
- Seagoing vessel, consumption mix, 50 km.

The criteria for the exclusion of inputs and outputs as set out in DIN EN 15804 are fulfilled. From the data analysis it can be assumed that the total of negligible processes per life cycle stage does not exceed 1% of the mass/primary energy. This way the total of negligible processes does not exceed 5% of the energy and mass input. The life cycle calculation also includes material and energy flows that account for less than 1%.

6.2 Inventory analysis

Aim

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared/functional units.

Life cycle stages

The complete life cycle of Float glass, thermally toughened safety glass and laminated safety glass is shown in the annex. The product stage "A1 – A3", construction process stage "A4 – A5", use stage "B1 – B7", end-of-life stage "C1 – C4" and the benefits and loads beyond the system boundaries "D" are considered.

Benefits

The below benefits have been defined as per DIN EN 15804:

- Benefits from recycling
- Benefits (thermal and electrical) from incineration

Allocation of co-products

No allocations occur during production.

Allocations for re-use, recycling and recovery

If the products are reused/recycled and recovered during the product stage (rejects), the elements are shredded, if necessary and then sorted into their constituents. This is done by various process plants, e.g. magnetic separators.

The system boundaries were set following their disposal, reaching the end-of-waste status.

Allocations beyond life cycle boundaries

The use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken into consideration that reflects the economic value of the product after recycling (recyclate).
Secondary material designated as inputs to float glass, thermally toughened safety glass and laminated safety glass is calculated as input without loads. Expenses are recorded in modules C3 and C4 and credits in module D.
The system boundary set for the recycled material refers to collection.

Secondary material

The use of secondary material by PRESS GLASS Holding SA was not considered in Module A3. Secondary material is used in float glass.

Inputs

The following manufacturing-related inputs were included in the LCA per 1 m and 1 mm float glass, thermally toughened safety glass and laminated safety glass:

Energy
The "Press Glass electricity mix" (see Table 2) is used for the electricity mix. The "Press Glass natural gas mix" (see

Gas composition	Shares in %		
	FG	TSG	LSG
Gas mix Poland	-	89	100
Gas mix Slovenia	-	11	0

Table 3) is assumed for the input material gas.

Gas composition	Shares in %		
	FG	TSG	LSG
Gas mix Poland	-	89	100
Gas mix Slovenia	-	11	0

Power composition	Shares in %		
	FG	TSG	LSG
Electricity mix Poland	98	97	100
Electricity mix Slovenia	2	3	0

Table 2 Press Glass power mix

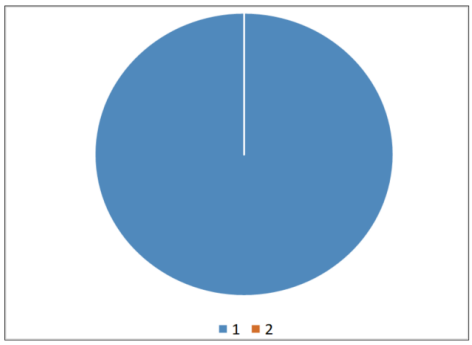
Gas composition	Shares in %		
	FG	TSG	LSG
Gas mix Poland	-	89	100
Gas mix Slovenia	-	11	0

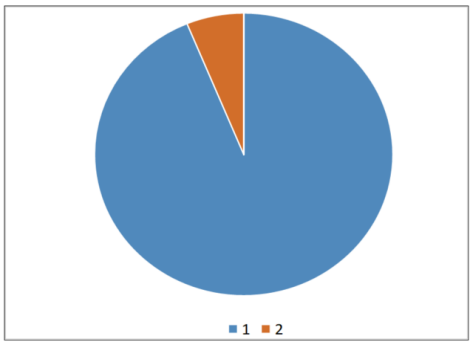
Table 3: Natural Gas Mix Press Glass

A portion of the process heat is used for space heating. This can, however, not be quantified, hence a “worst case” figure was taken into account for the product.

Water
In the individual production process steps, the water consumption per 1 m² and 1 mm product is 3.18E-03 l for FG, 3.25E-03 l for TSG and 1.98E-02 l for LSG.
The consumption of fresh water specified in Section 6.3 originates (among others) from the process chain of the pre-products and the process water for cooling.

Raw material / pre-products
The chart below shows the share of raw materials/pre-products in percent.





Float glass/thermally toughened safety glass Laminated safety glass
Illustration 2 Percentage of individual materials per declared unit

N°	Material	Mass in %		
		FG	TSG	LSG
1	Float glass*	100	100	83.4
2	PVB-interlayer	-	-	16.6

*Float glass contains 3.5% glass cullet (secondary material)
Table 4 Percentage of individual materials per declared unit

Ancillary materials and consumables
Ancillary materials and consumables: 2.61 g for FG, 2.55 g for TSG and 24.44 g for LSG.

Product packaging
The amounts used for product packaging are as follows:

N°	Material	Mass in g		
		FG	TSG	LSG
1	uPVC	6.45	0.33	2.62
2	Steel	0.10	0.02	0.00
3	Paper / Cardboard	3.99	0.20	1.62
4	Wood	39.53	2.01	16.06

Table 5 Weight in g of packaging per declared unit

Biogenic carbon content
Only the biogenic carbon content of the associated packaging is reported, as the total mass of biogenic carbon-containing materials is less than 5% of the total mass of the product and associated packaging. According to

EN 16449, the following amounts of biogenic carbon are generated for packaging:

N°	Part	Content in kg C		
		FG	TSG	LSG
1	In the corresponding packaging	0.019	0.001	0.007

Table 6 Biogenic carbon content of the packaging at the factory gate

Outputs

The following manufacturing-related outputs were included in the LCA per 1 m and 1 mm float glass, thermally toughened safety glass and laminated safety glass:

Waste

Secondary raw materials were included in the benefits.
See Section 6.3 Impact assessment.

Waste water

No wastewater is generated during production for FG, 1.80E-03 l for TSG and 1.98E-02 l for LSG.

6.3 Impact assessment

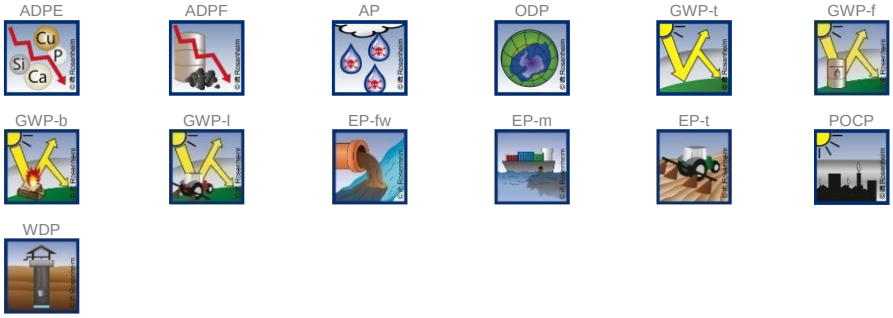
Aim

The impact assessment covers both inputs and outputs. The impact categories applied are stated below:

Impact categories

The models for impact assessment were applied as described in DIN EN 15804-A2.
The impact categories presented in the EPD are as follows:

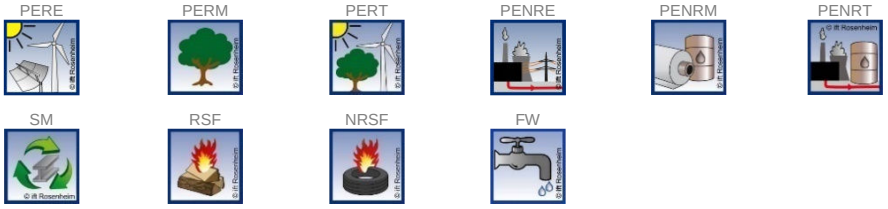
- Depletion of abiotic resources - minerals and metals,
- Depletion of abiotic resources - fossil fuels,
- Acidification,
- Ozone depletion,
- Climate change - total,
- Climate change - fossil,
- Climate change - biogenic,
- Climate change - land use and land use change,
- Eutrophication freshwater,
- Eutrophication salt water,
- Eutrophication land,
- Photochemical ozone creation,
- Water use.



Resource management

The models for impact assessment were applied as described in DIN EN 15804-A2.
The following resource use indicators are presented in the EPD:

- Renewable primary energy as energy source;
- Renewable primary energy for material use;
- Total use of renewable primary energy;
- Non-renewable primary energy as energy source;
- Renewable primary energy for material use;
- Total use of non-renewable primary energy;
- Use of secondary materials;
- Use of renewable secondary fuels;
- Use of non-renewable secondary fuels;
- Net use of freshwater resources.

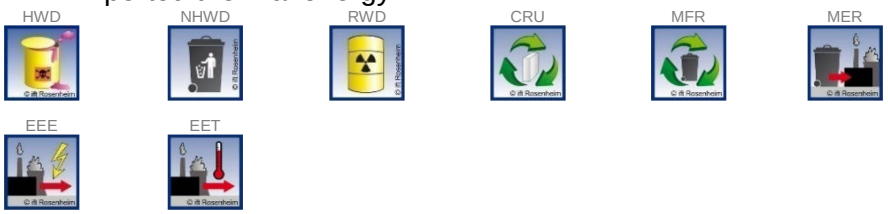


Waste

The waste generated during the production of 1 m² and 1 mm float glass, thermally toughened safety glass and laminated safety glass is evaluated and shown separately for the fractions trade wastes, special wastes and radioactive wastes. Since waste handling is modelled within the system boundaries, the amounts shown refer to the deposited wastes. A portion of the waste indicated is generated during the manufacture of the pre-products.

The models for impact assessment were applied as described in DIN EN 15804-A2.
The following waste categories and indicators for output closures are presented in the EPD:

- Disposed hazardous waste;
- Disposed non-hazardous waste;
- Radioactive waste disposed;
- Components for re-use;
- Materials for recycling;
- Materials for energy recovery;
- Exported electrical energy;
- Exported thermal energy.

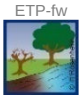


Additional environmental impact indicators

The models for impact assessment were applied as described in DIN EN 15804-A2.
The additional impact categories presented in the EPD are as follows:

- Fine dust missions,

- Ionizing radiation, human health,
- Ecotoxicity (freshwater),
- Human toxicity, carcinogenic effects,
- Human toxicity, non-carcinogenic effects,
- Impacts associated with land use/soil quality.

PM 
IRP 
ETP-fw 
HTP-c 
HTP-nc 
SQP 

Results per 1 m² and 1 mm float glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators																
GWP-t	kg CO_2 equivalent	4.85	0.20	9.72E-02	0.00	1.29E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.88E-03	3.88E-02	2.54E-02	-0.40
GWP-f	kg CO_2 equivalent	4.87	0.20	2.00E-02	0.00	1.28E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.87E-03	3.84E-02	2.61E-02	-0.40
GWP-b	kg CO_2 equivalent	-2.81E-02	-2.69E-04	7.72E-02	0.00	7.13E-07	0.00	0.00	0.00	0.00	0.00	0.00	-2.57E-06	3.46E-04	-7.74E-04	-1.04E-03
GWP-l	kg CO_2 equivalent	3.01E-03	1.09E-03	2.16E-07	0.00	7.33E-09	0.00	0.00	0.00	0.00	0.00	0.00	1.04E-05	8.12E-06	4.82E-05	-4.48E-05
ODP	kg CFC-11-eq.	1.60E-09	1.17E-14	1.19E-14	0.00	1.31E-16	0.00	0.00	0.00	0.00	0.00	0.00	1.12E-16	5.62E-13	6.14E-14	-9.29E-13
AP	mol H^+-eq.	6.03E-02	6.47E-04	1.61E-05	0.00	1.55E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.17E-06	8.43E-05	1.85E-04	-2.48E-03
EP-fw	kg P-eq.	5.52E-06	5.81E-07	2.59E-09	0.00	2.56E-10	0.00	0.00	0.00	0.00	0.00	0.00	5.56E-09	1.12E-07	4.43E-08	-2.47E-07
EP-m	kg N-eq.	1.07E-02	3.00E-04	4.53E-06	0.00	4.97E-08	0.00	0.00	0.00	0.00	0.00	0.00	7.60E-07	1.89E-05	4.73E-05	-7.05E-04
EP-t	mol N-eq.	0.13	3.35E-03	7.78E-05	0.00	5.27E-07	0.00	0.00	0.00	0.00	0.00	0.00	8.90E-06	1.98E-04	5.20E-04	-8.03E-03
POCP	kg NMVOC-eq.	3.02E-02	5.85E-04	1.19E-05	0.00	2.46E-07	0.00	0.00	0.00	0.00	0.00	0.00	1.90E-06	5.11E-05	1.44E-04	-1.41E-03
ADPF*²	MJ	79.68	2.60	1.90E-02	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.49E-02	0.70	0.34	-5.96
ADPE*²	kg Sb equivalent	2.43E-07	1.63E-08	2.82E-10	0.00	1.46E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.56E-10	1.05E-08	2.68E-09	-3.14E-08
WDP*²	m^3 world-eq. deprived	0.63	1.74E-03	9.89E-03	0.00	3.04E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.67E-05	8.74E-03	2.86E-03	-2.56E-02
Resource management																
PERE	MJ	2.13	0.15	0.71	0.00	2.34E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-03	0.39	5.13E-02	-0.64
PERM	MJ	0.70	0.00	-0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	2.83	0.15	5.74E-03	0.00	7.03E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-03	0.39	5.13E-02	-0.64
PENRE	MJ	79.55	2.61	0.15	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.50E-02	0.70	0.34	-5.96
PENRM	MJ	0.13	0.00	-0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	79.68	2.61	1.90E-02	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.50E-02	0.70	0.34	-5.96
SM	kg	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	1.78E-02	1.67E-04	2.32E-04	0.00	7.40E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.60E-06	3.69E-04	8.67E-05	-8.83E-04
Categories of waste																
HWD	kg	1.55E-07	1.25E-11	2.22E-12	0.00	3.80E-13	0.00	0.00	0.00	0.00	0.00	0.00	1.20E-13	6.03E-11	1.76E-11	-8.72E-10
NHWD	kg	4.52	3.74E-04	7.47E-04	0.00	3.14E-06	0.00	0.00	0.00	0.00	0.00	0.00	3.58E-06	5.25E-04	1.75	-4.83E-02
RWD	kg	1.13E-04	3.21E-06	7.61E-07	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	3.07E-08	1.11E-04	3.81E-06	-1.75E-04
Output material flows																
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	1.99	0.00	9.88E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.12	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.27	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
GWP-t – global warming potential - total **GWP-f** – global warming potential fossil fuels **GWP-b** – global warming potential - biogenic **GWP-l** – global warming potential - land use and land use change **ODP** – ozone depletion potential **AP** - acidification potential **EP-fw** - eutrophication potential - aquatic freshwater **EP-m** - eutrophication potential - aquatic marine **EP-t** - feutrophication potential - terrestrial **POCP** - photochemical ozone formation potential **ADPF*²** - abiotic depletion potential – fossil resources **ADPE*²** - abiotic depletion potential – minerals&metals **WDP*²** – Water (user) deprivation potential **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **PENRT** - total use of non-renewable primary energy resources **SM** - use of secondary material **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of fresh water **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

Results per 1 m² and 1 mm float glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	5.70E-07	3.46E-09	8.19E-11	0.00	1.04E-12	0.00	0.00	0.00	0.00	0.00	0.00	1.30E-11	6.99E-10	2.28E-09	-1.41E-08
IRP*[1]	kBq U235-eq.	6.19E-04	4.71E-04	8.99E-05	0.00	1.24E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.51E-06	1.89E-02	4.24E-04	-2.93E-02
ETP-fw*[2]	CTUe	203.51	1.81	8.33E-03	0.00	1.54E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.73E-02	0.31	0.19	-6.74
HTP-c*[2]	CTUh	3.91E-09	3.64E-11	3.43E-13	0.00	4.17E-14	0.00	0.00	0.00	0.00	0.00	0.00	3.48E-13	8.77E-12	2.92E-11	-4.20E-11
HTP-nc*[2]	CTUh	4.33E-08	2.16E-09	2.16E-11	0.00	1.95E-12	0.00	0.00	0.00	0.00	0.00	0.00	1.83E-11	3.21E-10	3.24E-09	-3.80E-09
SQP*[2]	dimensionless	16.04	0.90	6.43E-03	0.00	4.87E-05	0.00	0.00	0.00	0.00	0.00	0.00	8.57E-03	0.25	7.12E-02	-0.44

Key:
PM – particulate matter emissions potential **IRP*[1]** – ionizing radiation potential – human health **ETP-fw*[2]** - Eco-toxicity potential – freshwater **HTP-c*[2]** - Human toxicity potential – cancer effects **HTP-nc*[2]** - Human toxicity potential – non-cancer effects **SQP*[2]** – soil quality potential

Disclaimers:

*1 This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Results per 1 m² and 1 mm thermally toughened safety glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators																
GWP-t	kg CO_2 equivalent	11.18	0.19	4.95E-03	0.00	1.29E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.88E-03	3.88E-02	2.54E-02	-0.37
GWP-f	kg CO_2 equivalent	11.13	0.19	1.07E-03	0.00	1.28E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.87E-03	3.84E-02	2.61E-02	-0.37
GWP-b	kg CO_2 equivalent	3.63E-02	-2.64E-04	3.88E-03	0.00	7.13E-07	0.00	0.00	0.00	0.00	0.00	0.00	-2.57E-06	3.46E-04	-7.74E-04	-8.83E-04
GWP-l	kg CO_2 equivalent	5.55E-03	1.07E-03	5.80E-09	0.00	7.33E-09	0.00	0.00	0.00	0.00	0.00	0.00	1.04E-05	8.12E-06	4.82E-05	-4.16E-05
ODP	kg CFC-11-eq.	8.64E-11	1.14E-14	6.54E-16	0.00	1.31E-16	0.00	0.00	0.00	0.00	0.00	0.00	1.12E-16	5.62E-13	6.14E-14	-7.34E-13
AP	mol H^+-eq.	0.12	6.35E-04	7.65E-07	0.00	1.55E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.17E-06	8.43E-05	1.85E-04	-2.44E-03
EP-fw	kg P-eq.	1.15E-05	5.70E-07	1.28E-10	0.00	2.56E-10	0.00	0.00	0.00	0.00	0.00	0.00	5.56E-09	1.12E-07	4.43E-08	-2.07E-07
EP-m	kg N-eq.	2.15E-02	2.95E-04	2.19E-07	0.00	4.97E-08	0.00	0.00	0.00	0.00	0.00	0.00	7.60E-07	1.89E-05	4.73E-05	-6.94E-04
EP-t	mol N-eq.	0.25	3.29E-03	3.84E-06	0.00	5.27E-07	0.00	0.00	0.00	0.00	0.00	0.00	8.90E-06	1.99E-04	5.20E-04	-7.91E-03
POCP	kg NMVOC-eq.	5.97E-02	5.74E-04	5.70E-07	0.00	2.46E-07	0.00	0.00	0.00	0.00	0.00	0.00	1.90E-06	5.11E-05	1.44E-04	-1.38E-03
ADPF*²	MJ	171.90	2.55	8.23E-04	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.49E-02	0.70	0.34	-5.42
ADPE*²	kg Sb equivalent	5.78E-07	1.60E-08	1.47E-11	0.00	1.46E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.56E-10	1.05E-08	2.68E-09	-2.69E-08
WDP*²	m^3 world-eq. deprived	1.10	1.71E-03	5.06E-04	0.00	3.04E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.67E-05	8.74E-03	2.86E-03	-2.25E-02
Resource management																
PERE	MJ	7.94	0.15	3.58E-02	0.00	2.34E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-03	0.39	5.13E-02	-0.50
PERM	MJ	3.55E-02	0.00	-3.55E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	7.98	0.15	3.12E-04	0.00	7.03E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-03	0.39	5.13E-02	-0.50
PENRE	MJ	171.89	2.56	7.56E-03	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.50E-02	0.70	0.34	-5.42
PENRM	MJ	6.74E-03	0.00	-6.74E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	171.90	2.56	8.21E-04	0.00	3.73E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.50E-02	0.70	0.34	-5.42
SM	kg	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	3.55E-02	1.64E-04	1.19E-05	0.00	7.40E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.60E-06	3.69E-04	8.67E-05	-7.53E-04
Categories of waste																
HWD	kg	2.82E-07	1.23E-11	1.20E-13	0.00	3.80E-13	0.00	0.00	0.00	0.00	0.00	0.00	1.20E-13	6.03E-11	1.76E-11	-7.97E-10
NHWD	kg	8.27	3.67E-04	3.77E-05	0.00	3.14E-06	0.00	0.00	0.00	0.00	0.00	0.00	3.58E-06	5.25E-04	1.75	-4.81E-02
RWD	kg	7.31E-04	3.15E-06	4.13E-08	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	3.07E-08	1.11E-04	3.81E-06	-1.36E-04
Output material flows																
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	1.72	0.00	1.52E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	9.90E-02	0.00	7.08E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.22	0.00	1.51E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
GWP-t – global warming potential - total **GWP-f** – global warming potential fossil fuels **GWP-b** – global warming potential - biogenic **GWP-l** – global warming potential - land use and land use change **ODP** – ozone depletion potential **AP** - acidification potential **EP-fw** - eutrophication potential - aquatic freshwater **EP-m** - eutrophication potential - aquatic marine **EP-t** - feutrophication potential - terrestrial **POCP** - photochemical ozone formation potential **ADPF*²** - abiotic depletion potential – fossil resources **ADPE*²** - abiotic depletion potential – minerals&metals **WDP*²** – Water (user) deprivation potential **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **PENRT** - total use of non-renewable primary energy resources **SM** - use of secondary material **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of fresh water **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

Results per 1 m² and 1 mm thermally toughened safety glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	1.08E-06	3.39E-09	3.48E-12	0.00	1.04E-12	0.00	0.00	0.00	0.00	0.00	0.00	1.30E-11	6.99E-10	2.28E-09	-1.38E-08
IRP*[1]	kBq U235-eq.	7.10E-02	4.62E-04	4.87E-06	0.00	1.24E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.51E-06	1.89E-02	4.24E-04	-2.27E-02
ETP-fw*[2]	CTUe	388.18	1.77	3.99E-04	0.00	1.54E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.73E-02	0.31	0.19	-6.64
HTP-c*[2]	CTUh	7.25E-09	3.57E-11	-1.23E-14	0.00	4.17E-14	0.00	0.00	0.00	0.00	0.00	0.00	3.48E-13	8.77E-12	2.93E-11	-3.67E-11
HTP-nc*[2]	CTUh	9.46E-08	2.12E-09	9.94E-13	0.00	1.95E-12	0.00	0.00	0.00	0.00	0.00	0.00	1.83E-11	3.21E-10	3.24E-09	-3.60E-09
SQP*[2]	dimensionless	13.34	0.88	3.37E-04	0.00	4.87E-05	0.00	0.00	0.00	0.00	0.00	0.00	8.57E-03	0.25	7.12E-02	-0.35

Key:
PM – particulate matter emissions potential **IRP*[1]** – ionizing radiation potential – human health **ETP-fw*[2]** - Eco-toxicity potential – freshwater **HTP-c*[2]** - Human toxicity potential – cancer effects **HTP-nc*[2]** - Human toxicity potential – non-cancer effects **SQP*[2]** – soil quality potential

Disclaimers:

*1 This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Results per 1 m² and 1 mm laminated safety glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators																
GWP-t	kg CO_2 equivalent	21.25	4.43E-02	4.04E-02	0.00	3.86E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.70E-03	0.51	2.31E-02	-0.87
GWP-f	kg CO_2 equivalent	21.10	4.41E-02	8.88E-03	0.00	3.84E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.70E-03	0.51	2.37E-02	-0.86
GWP-b	kg CO_2 equivalent	0.15	-6.04E-05	3.15E-02	0.00	2.13E-05	0.00	0.00	0.00	0.00	0.00	0.00	-2.34E-06	3.62E-04	-7.03E-04	-2.18E-03
GWP-l	kg CO_2 equivalent	6.99E-03	2.44E-04	1.09E-07	0.00	2.20E-07	0.00	0.00	0.00	0.00	0.00	0.00	9.43E-06	1.52E-05	4.38E-05	-5.99E-05
ODP	kg CFC-11-eq.	7.27E-08	2.62E-15	4.66E-15	0.00	3.92E-15	0.00	0.00	0.00	0.00	0.00	0.00	1.01E-16	6.58E-13	5.57E-14	-4.42E-09
AP	mol H^+-eq.	0.15	1.45E-04	6.83E-06	0.00	4.63E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.97E-06	1.57E-04	1.68E-04	-2.44E-03
EP-fw	kg P-eq.	2.09E-05	1.31E-07	1.08E-09	0.00	7.66E-09	0.00	0.00	0.00	0.00	0.00	0.00	5.05E-09	1.36E-07	4.02E-08	-7.42E-07
EP-m	kg N-eq.	2.46E-02	6.74E-05	1.90E-06	0.00	1.49E-06	0.00	0.00	0.00	0.00	0.00	0.00	6.90E-07	3.49E-05	4.30E-05	-6.18E-04
EP-t	mol N-eq.	0.29	7.53E-04	3.25E-05	0.00	1.58E-05	0.00	0.00	0.00	0.00	0.00	0.00	8.08E-06	5.51E-04	4.72E-04	-6.84E-03
POCP	kg NMVOC-eq.	8.00E-02	1.31E-04	5.06E-06	0.00	7.35E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.73E-06	9.56E-05	1.31E-04	-1.84E-03
ADPF*²	MJ	338.80	0.58	8.39E-03	0.00	1.12E-01	0.00	0.00	0.00	0.00	0.00	0.00	2.26E-02	0.84	0.31	-15.20
ADPE*²	kg Sb equivalent	9.81E-07	3.66E-09	1.14E-10	0.00	4.36E-10	0.00	0.00	0.00	0.00	0.00	0.00	1.41E-10	1.30E-08	2.43E-09	-6.54E-08
WDP*²	m^3 world-eq. deprived	2.34	3.91E-04	4.09E-03	0.00	9.12E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.51E-05	5.21E-02	2.59E-03	-5.78E-02
Resource management																
PERE	MJ	23.67	3.32E-02	0.29	0.00	2.10E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.29E-03	0.42	4.66E-02	-1.96
PERM	MJ	0.29	0.00	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	23.96	3.32E-02	2.28E-03	0.00	2.10E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.29E-03	0.42	4.66E-02	-1.96
PENRE	MJ	319.39	0.59	6.24E-02	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	2.27E-02	6.65	13.86	-15.20
PENRM	MJ	19.41	0.00	-5.40E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.81	-13.55	0.00
PENRT	MJ	338.80	0.59	8.39E-03	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	2.27E-02	0.84	0.31	-15.20
SM	kg	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	9.52E-21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	1.12E-19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	7.60E-02	3.75E-05	9.62E-05	0.00	2.22E-04	0.00	0.00	0.00	0.00	0.00	0.00	1.45E-06	1.39E-03	7.88E-05	-2.18E-03
Categories of waste																
HWD	kg	3.46E-07	2.80E-12	8.84E-13	0.00	1.14E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.09E-13	7.27E-11	1.60E-11	-1.07E-09
NHWD	kg	9.84	8.39E-05	3.09E-04	0.00	9.43E-05	0.00	0.00	0.00	0.00	0.00	0.00	3.25E-06	4.72E-02	1.59	-2.83E-02
RWD	kg	4.86E-03	7.21E-07	3.06E-07	0.00	3.01E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.79E-08	1.09E-04	3.46E-06	-6.18E-04
Output material flows																
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	8.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.55	0.00	5.74E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00
EET	MJ	1.21	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67	0.00	0.00

Key:
GWP-t – global warming potential - total **GWP-f** – global warming potential fossil fuels **GWP-b** – global warming potential - biogenic **GWP-l** – global warming potential - land use and land use change **ODP** – ozone depletion potential **AP** - acidification potential **EP-fw** - eutrophication potential - aquatic freshwater **EP-m** - eutrophication potential - aquatic marine **EP-t** - feutrophication potential - terrestrial **POCP** - photochemical ozone formation potential **ADPF*²** - abiotic depletion potential – fossil resources **ADPE*²** - abiotic depletion potential – minerals&metals **WDP*²** – Water (user) deprivation potential **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **PENRT** - total use of non-renewable primary energy resources **SM** - use of secondary material **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of fresh water **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

Results per 1 m² and 1 mm laminated safety glass																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	1.36E-06	7.76E-10	3.65E-11	0.00	3.12E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.18E-11	1.55E-09	2.07E-09	-1.56E-08
IRP*[1]	kBq U235-eq.	0.68	1.06E-04	3.65E-05	0.00	3.71E-05	0.00	0.00	0.00	0.00	0.00	0.00	4.09E-06	1.79E-02	3.85E-04	-9.97E-02
ETP-fw*[2]	CTUe	449.17	0.41	3.53E-03	0.00	4.62E-02	0.00	0.00	0.00	0.00	0.00	0.00	1.57E-02	0.35	0.17	-5.51
HTP-c*[2]	CTUh	9.79E-09	8.18E-12	2.63E-13	0.00	1.24E-12	0.00	0.00	0.00	0.00	0.00	0.00	3.16E-13	1.49E-11	2.66E-11	-1.05E-10
HTP-nc*[2]	CTUh	1.21E-07	4.86E-10	9.37E-12	0.00	5.84E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.66E-11	9.54E-10	2.94E-09	-4.42E-09
SQP*[2]	dimensionless	32.39	0.20	2.60E-03	0.00	1.46E-03	0.00	0.00	0.00	0.00	0.00	0.00	7.78E-03	0.29	6.46E-02	-1.27

Key:
PM – particulate matter emissions potential **IRP*[1]** – ionizing radiation potential – human health **ETP-fw*[2]** - Eco-toxicity potential – freshwater **HTP-c*[2]** - Human toxicity potential – cancer effects **HTP-nc*[2]** - Human toxicity potential – non-cancer effects **SQP*[2]** – soil quality potential

Disclaimers:

*1 This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

6.4 Interpretation, LCA presentation and critical review

Evaluation

The environmental impacts of

- Float glass (PG1)
- Thermally toughened safety glass (PG2)
- Laminated safety glass (PG3)

differ considerably from each other. The differences lie in the different pre-products and raw materials used and their respective masses. This was mainly due to the different amounts of float glass used. In the case of thermally toughened safety glass, additional environmental effects result from thermal toughening. In the case of laminated safety glass, additional deviations result from the use of the PVB plastic foil.

In the area of production, the environmental impact of the glass mainly results from the use of float glass or its pre-chains, as well as from the use of electricity in the manufacturing process. The packaging materials used for float glass and thermally toughened safety glass have little influence. In the case of laminated safety glass, the environmental impacts additionally come primarily from the use of PVB plastic foil and their respective pre-chains.
Furthermore, in the case of float glass and thermally toughened safety glass, the transport of the packaged product to the construction site (A4) contributes to a certain extent to the environmental impact.

In scenario C4, only marginal expenditures for the physical pretreatment and the landfill operation are to be expected. Allocation to individual products is almost impossible for site disposal.
When recycling the products, glass can be credited with about 4.2% of the environmental impacts occurring in the life cycle in Scenario D for float glass, about 2.5% for thermally toughened safety glass, and about 0.7% for laminated safety glass. For the PVB plastic foil in laminated safety glass, the figure is 1.8%.
The charts below show the allocation of the main environmental impacts.

The values obtained from the LCA calculation are suitable for the certification of buildings.

Diagrams

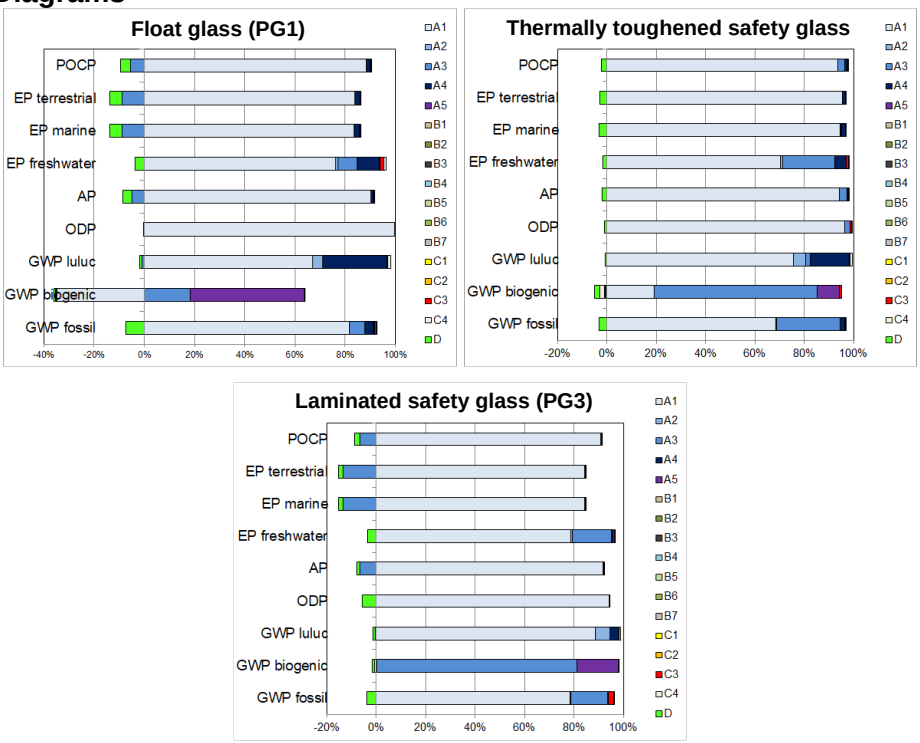


Illustration 3 Percentage of the modules in selected environmental impact indicators

Report

The LCA report underlying this EPD was developed according to the requirements of DIN EN ISO 14040 and DIN EN ISO 14044 as well as DIN EN 15804 and DIN EN ISO 14025. It is deposited with ift Rosenheim. The results and conclusions reported to the target group are complete, correct, without bias and transparent. The results of the study are not designed to be used for comparative statements intended for publication.

Critical review

The critical review of the LCA and of the report took place in the course of verification of the EPD and was carried out by the external auditor Patrick Wortner, MBA and Eng., Dipl.-Ing.

7 General information regarding the EPD

Comparability

This EPD was prepared in accordance with DIN EN 15804 and is therefore only comparable to those EPDs that also comply with the requirements set out in DIN EN 15804.
Any comparison must refer to the building context and the same boundary conditions of the various life cycle stages.
For comparing EPDs of construction products, the rules set out in DIN EN 15804, Clause 5.3, apply.

Communication

The communications format of this EPD meets the requirements of EN 15942:2012 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to DIN EN 15804.

Verification

Verification of the Environmental Product Declaration is documented in accordance with the ift "Richtlinie zur Erstellung von Typ III

Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out in DIN EN ISO 14025.

This declaration is based on PCR documents "PCR Part A" PCR-A-0.3:2018, “Flat Glass in Building" PCR-FG-2.0:2021 and EN 17074 „PCR Glass in Building“.

The European standard EN 15804 serves as the core PCR [a)]
Independent verification of the Declaration and statement according to EN ISO 14025:2010 ☐ internal ☒ external
Independent third party verifier: [b)] Patrick Wortner
[a)] Product category rules [b)] Optional for business-to-business communication Mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4).

Revisions of this document

N°	Date	Note	Person in charge	Testing personnel
1	06.02.2023	External verification	Pscherer	Wortner
2	13.02.2023	Formal adjustment	Pscherer	Wortner

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9 Annex

Description of life cycle scenarios for Float glass, thermally toughened safety glass and laminated safety glass

Product stage			Con-struction process stage		Use stage*							End-of-life stage				Benefits and loads beyond system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	production	Transport	Construction/installation process	Use	maintenance	Repair	replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling potential
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

* For declared B-modules, the calculation of the results is performed taking into account the specified RSL related to one year

The scenarios were calculated taking into account the defined RSL (see 4 Use stage).

The scenarios were furthermore based on the research project “EPDs for transparent building components” (1) and on EN 17074.

Note: The standard scenarios selected are presented in bold type. They were also used for calculating the indicators in the summary table.

✓ Included in the LCA
— Not included in the LCA

A4 Transport to construction site

No.	Scenario	Description
A4.1	**Transport from production site to construction sites Abroad**	**40 t truck (Euro 5 mix), diesel, 27 t payload, 100 % capacity utilization, approx. 600 km there and back with 10 % capacity utilization**
A4.2	Transport from production site to construction sites Domestic	40 t truck (Euro 5 mix), diesel, 27 t payload, 100 % capacity utilization, approx. 150 km there and back with 10 % capacity utilization

A4 Transport to construction site	Transport weight [kg/m²]	Density [kg/m³]
PG1	2.55	2.50 kg/m³
PG2	2.50	2.50 kg/m³
PG3	2.29	2.27 kg/m³

The scenarios were calculated per kg and can be scaled to the product group using the above masses. The values in the summary table are already shown per declared unit.

A4 Transport to construction site per kg	Unit	A4.1	A4.2
Core indicators			
GWP-t	kg CO_2 equivalent	**7.74E-02**	1.93E-02
GWP-f	kg CO_2 equivalent	**7.70E-02**	1.93E-02
GWP-b	kg CO_2 equivalent	**-1.05E-04**	-2.64E-05
GWP-l	kg CO_2 equivalent	**4.26E-04**	1.06E-04
ODP	kg CFC-11-eq.	**4.57E-15**	1.14E-15
AP	mol H^+-eq.	**2.54E-04**	6.34E-05
EP-fw	kg P-eq.	**2.28E-07**	5.70E-08
EP-m	kg N-eq.	**1.18E-04**	2.94E-05
EP-t	mol N-eq.	**1.31E-03**	3.29E-04
POCP	kg NMVOC-eq.	**2.29E-04**	5.73E-05
ADPF	MJ	**1.02**	0.26
ADPE	kg Sb equivalent	**6.38E-09**	1.60E-09
WDP	m³ world-eq. deprived	**6.83E-04**	1.71E-04
Resource management			
PERE	MJ	**5.80E-02**	1.45E-02
PERM	MJ	**0.00**	0.00
PERT	MJ	**5.80E-02**	1.45E-02
PENRE	MJ	**1.02**	0.26
PENRM	MJ	**0.00**	0.00
PENRT	MJ	**1.02**	0.26
SM	kg	**0.00**	0.00
RSF	MJ	**0.00**	0.00
NRSF	MJ	**0.00**	0.00
FW	m³	**6.56E-05**	1.64E-05
Categories of waste			
HWD	kg	**4.90E-12**	1.22E-12
NHWD	kg	**1.47E-04**	3.66E-05
RWD	kg	**1.26E-06**	3.15E-07
Output material flows			
CRU	kg	**0.00**	0.00
MFR	kg	**0.00**	0.00
MER	kg	**0.00**	0.00
EEE	MJ	**0.00**	0.00
EET	MJ	**0.00**	0.00

Additional environmental impact indicators			
PM	Disease incidence	**1.36E-09**	3.39E-10
IRP	kBq U235-eq.	**1.85E-04**	4.62E-05
ETPfw	CTUe	**0.71**	0.18
HTPc	CTUh	**1.43E-11**	3.57E-12
HTPnc	CTUh	**8.48E-10**	2.12E-10
SQP	dimensionless	**0.35**	8.78E-02

A5 Construction/Installation

No.	Scenario	Description
A5	**Manual**	**The products are installed without additional lifting and auxiliary equipment.** **According to EN 17074, the glass products are delivered in the final configuration and ready for installation.**

In case of deviating consumption during installation/assembly of the products which forms part of the site management, they are covered at the building level.

Ancillary materials, consumables, use of energy and water, other resource use, material losses, direct emissions as well as waste during construction / installation are negligible.

It is assumed that the packaging material in the Module construction / installation is sent to waste handling. Waste is only thermally recycled in line with the conservative approach: Benefits from A5 are specified in module D. Benefits from waste incineration: Benefits from waste incineration: electricity replaces electricity mix (EU-28); thermal energy replaces thermal energy from natural gas (EU-28). Transport to the recycling plants is not taken into account.

Since this is a single scenario, the results are shown in the relevant summary table.

B1 Use
According to EN 17074, the use of glass products in buildings does not generate any environmental impact and may therefore be disregarded.

B2 Inspection, maintenance, cleaning

B2.1 Cleaning

No.	Scenario	Description
B2.1	**Rarely, manual**	**According to EN 17074:** **Manually with 0.2 l cleaning solution (0.2 l water with 0.01 l cleaner) per m², annually.** (2)

Ancillary materials, consumables, use of energy, material losses and waste as well as transport distances during cleaning are negligible.

Since this is a single scenario, the results are shown in the relevant summary table.

The results were based on one year, taking into account the RSL.

B2.2 Maintenance - not relevant
According to EN 17074, glass products do not require maintenance activities during their service life.

Ancillary materials, consumables, use of energy and water, material losses and waste as well as transport distances during maintenance are negligible.

Since this is a single scenario, the results are shown in the summary table.

B3 Repair - not relevant
According to EN 17074, glass products do not require repair activities during their service life.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances during repair are negligible.

Since this is a single scenario, the results are shown in the summary table.

B4 Exchange / Replacement

No.	Scenario	Description
B4.1	**No replacement**	**According to EN 17074, a replacement is not planned.**
B4.2	Normal and high load and exceptional load	One-time replacement after 30 years (RSL)*.

* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

According to EN 17074, glass products do not require replacement activities during their service life.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

The environmental impacts of the scenario B4.2 originate from the product, construction and disposal phases.
Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances are taken into account.

In the following table, the results were based on one year, taking into account the RSL.

B4 Exchange / Replacement	Unit	B4.1	B4.2 - FG	B4.2 - TSG	B4.2 - LSG
Core indicators					
GWP-t	kg CO_2 equivalent	**0.00**	4.81	11.08	21.05
GWP-f	kg CO_2 equivalent	**0.00**	4.75	11.03	20.87
GWP-b	kg CO_2 equivalent	**0.00**	4.74E-02	3.86E-02	0.18
GWP-l	kg CO_2 equivalent	**0.00**	4.12E-03	6.65E-03	7.26E-03
ODP	kg CFC-11-eq.	**0.00**	1.60E-09	8.63E-11	0.00
AP	mol H^+-eq.	**0.00**	5.88E-02	0.12	0.14
EP-fw	kg P-eq.	**0.00**	6.02E-06	1.20E-05	0.00
EP-m	kg N-eq.	**0.00**	1.03E-02	2.11E-02	2.41E-02
EP-t	mol N-eq.	**0.00**	0.12	0.25	0.28
POCP	kg NMVOC-eq.	**0.00**	2.96E-02	5.91E-02	7.91E-02
ADPF	MJ	**0.00**	77.40	170.09	335.23
ADPE	kg Sb equivalent	**0.00**	2.41E-07	5.80E-07	0.00

WDP	m³ world-eq. deprived	**0.00**	0.62	1.09	2.33
Resource management					
PERE	MJ	**0.00**	2.79	8.06	23.88
PERM	MJ	**0.00**	0.00	0.00	0.00
PERT	MJ	**0.00**	2.79	8.06	23.88
PENRE	MJ	**0.00**	77.41	170.10	335.23
PENRM	MJ	**0.00**	0.00	0.00	0.00
PENRT	MJ	**0.00**	77.41	170.10	335.23
SM	kg	**0.00**	0.18	0.32	0.40
RSF	MJ	**0.00**	0.00	0.00	0.00
NRSF	MJ	**0.00**	0.00	0.00	0.00
FW	m³	**0.00**	1.78E-02	3.54E-02	7.59E-02
Categories of waste					
HWD	kg	**0.00**	1.54E-07	2.81E-07	3.45E-07
NHWD	kg	**0.00**	6.22	9.97	11.38
RWD	kg	**0.00**	5.72E-05	7.13E-04	4.83E-03
Output material flows					
CRU	kg	**0.00**	0.00	0.00	0.00
MFR	kg	**0.00**	2.74	2.47	9.36
MER	kg	**0.00**	0.00	0.00	0.00
EEE	MJ	**0.00**	0.26	0.11	0.61
EET	MJ	**0.00**	0.56	0.23	1.33
Additional environmental impact indicators					
PM	Disease incidence	**0.00**	5.62E-07	1.07E-06	1.35E-06
IRP	kBq U235-eq.	**0.00**	-8.79E-03	6.81E-02	0.67
ETPfw	CTUe	**0.00**	199.11	383.83	443.98
HTPc	CTUh	**0.00**	3.95E-09	7.28E-09	9.80E-09
HTPnc	CTUh	**0.00**	4.53E-08	9.67E-08	1.21E-07
SQP	dimensionless	**0.00**	16.83	14.20	32.54

B5 Improvement/modernization - not relevant
According to EN 17074, glass products do not require renewal activities during their service life.

For updated information refer to the relevant instructions for assembly/installation, operation and maintenance issued by PRESS GLASS Holding SA.

Ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances during installation are negligible.

Since this is a single scenario, the results are shown in the summary table.

B6 Operational energy use
According to EN 17074, there is no energy consumption during normal use.

There is no transport consumption for energy use in buildings. Ancillary materials, consumables and water, waste materials and other scenarios are negligible.

Since this is a single scenario, the results are shown in the summary table.

B7 Operational water use
According to EN 17074, no water consumption occurs during intended operation. Water consumption for cleaning is specified in Module B2.1.

There is no transport consumption for water use in buildings. Ancillary materials, consumables, waste materials and other scenarios are negligible.

Since this is a single scenario, the results are shown in the summary table.

C1 Deconstruction

No.	Scenario	Description
C1	**Deconstruction**	**According to EN 17074 (9.8.4 Disposal phase (C1 to C4)):** • **Glass 30 % deconstruction, 70 % residues (landfill)** **Further deconstruction rates are possible, give adequate reasons.**

No relevant inputs or outputs apply to the scenario selected. The energy consumed for deconstruction is negligible. Any arising consumption is marginal.

Since this is a single scenario, the results are shown in the relevant summary table.

In case of deviating consumption the removal of the products forms part of site management and is covered at the building level.

C2 Transport

No.	Scenario	Description
C2	**Transport**	**Transport to collection point with 40 t truck (Euro 0-6 Mix), diesel, 27 t payload, 80 % capacity used, 50 km**

Since this is a single scenario, the results are shown in the relevant summary table.

C3 Waste management

No.	Scenario	Description
C3	**Current market situation**	**Share for recirculation of materials:** • **100% glass in melt** (EN 17213) • **Plastics 66 % thermal recycling in incineration plants** (Zukunft Bauen, 2017) • **Plastics 34 % recycled** (Zukunft Bauen, 2017)

Electricity consumption of recycling plant: 0.5 MJ/kg.

As the products are placed on the European market, the disposal scenario is based on average European data sets.

The below table presents the disposal processes and their percentage by mass/weight. The calculation is based on the above mentioned shares in percent related to the declared unit of the product system.

C3 Disposal	Unit	FG	TSG	LSG
Collection process, collected separately	kg	0.75	0.75	0.68
Collection process, collected as mixed construction waste	kg	1.75	1.75	1.59
Recovery system, for re-use	kg	0.00	0.00	0.00
Recovery system, for recycling	kg	0.75	0.75	0.49
Recovery system, for energy recovery	kg	0.00	0.00	0.19
Disposal	kg	1.75	1.75	1.59

The 100% scenarios differ from the current average recovery shown here (in background report C3.4). The evaluation of each scenario is described in the background report.

Since this is a single scenario, the results are shown in the summary table.

C4 Disposal

No.	Scenario	Description
C4	**Disposal**	**The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as "disposed" (EU-28).**

The 100% scenarios differ from the current average recovery shown here (in background report C4.4). The evaluation of each scenario is described in the background report.

The consumption in scenario C4 results from physical pre-treatment, waste recycling and management of the disposal site. The benefits obtained here from the substitution of primary material production are allocated to Module D, e.g. electricity and heat from waste incineration.

Since this is a single scenario, the results are shown in the summary table.

D Benefits and loads from beyond the system boundaries

No.	Scenario	Description
D	**Recycling potential**	**Aluminium recyclate from C3 excluding the recyclate used in A3 replaces 60% of aluminium; Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel; Stainless steel scrap from C3 excluding the scrap used in A3 replaces 60% of stainless steel; Glass recyclate from C3 excluding the glass shards used in A3 replace 60% of container glass; Plastic recyclate from C3 excluding the plastics used in A3 replaces 60% of plastic granules. Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (EU-28); thermal energy replaces thermal energy from natural gas (EU-28).**

The values in Module D result from recycling of the packaging material in Module A5 and from deconstruction at the end of service life.

The 100% scenarios differ from the current average recovery shown here (in background report D.1). The evaluation of each scenario is described in the background report.

Since this is a single scenario, the results are shown in the summary table.

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Notes
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