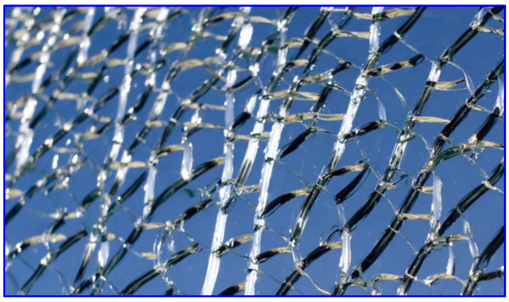
Environmental Product Declaration (EPD)

Declaration code M-EPD-FEG-GB-001007

Note: This EPD is based on the model EPD flat glass.



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Tvitec System Glass S.L.

flat glass

Float glass and thermally toughened safety glass, heat soaked thermally toughened safety glass and heat strengthened glass

Basis:

DIN EN ISO 14025
EN 15804 + A2

Model EPD
Environmental
Product **D**eclaration

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Environmental Product Declaration (EPD)

ROSENHEIM

Declaration code M-EPD-FEG-GB-001007

Programme operator	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim, Germany
Practitioner of LCA	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim, Germany
Group of Declaration holders	Tvitec System Glass S.L. Pol. Ind. El Bayo P19 ESP-24492 Cubillos del Sil, León, Spain www.tvitecglass.com Note: Related declaration holders can be found on page 3.
Declaration code	M-EPD-FEG-GB-001007
Designation of declared product	FG as well as TSG, heat soaked TSG and HSG
Scope	Float glass (FG), thermally toughened safety glass (TSG), heat soaked thermally toughened safety glass (HS TSG) and heat strengthened glass (HSG) processing into insulating glass unit and for use as glass for buildings (in the building envelope and for finishing of works / 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 "PCR Part A" PCR-A-0.3:2018, “Flat glass in building industry" PCR-FG-2.0:2021 as well as EN 17074.
Validity	Publication date: 24.01.2024 — Last revision: 26.02.2024 — Valid until: 24.01.2029 This verified Model Environmental Product Declaration applies solely to the specified products and is valid for a period of five years from the date of publication according to DIN EN 15804.
LCA Basis	The LCA was prepared according to DIN EN ISO 14040 and DIN EN ISO 14044. The data collected from selected members of the Bundesverband Flachglas e. V. (Federal Flat Glass Association) were used as a data basis, as well as generic data from the database “LCA for Experts 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. ift Rosenheim GmbH is not liable for the contents of the model EPD. The parties involved in the preparation are each liable for the information and evidence they provide.

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

Related declaration holders of Tvitec System Glass S.L.:

Tvitec System Glass S.L.
Pol. Ind. El Bayo P19
ESP-24492 Cubillos del Sil,
León, Spain
www.tvitecglass.com

tvitec

SOLUCIONES INTEGRALES DE CURVADO SL (S.I.C.)
Polígono Industrial Eral
25617, Sentiu De Sio (Lérida)
Spain
www.cricursa.com

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1 General Product Information

Product definition

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

1 m² and 1 mm FG or TSG, HS TSG and HSG
made by Tvitec System Glass S.L.

The functional unit is obtained by summing up:

Product group (PG) [(1)]	Declared unit	Density
PG 1: Float glass, FG	1 m² and 1 mm	2.50 g/cm³
PG 2: Thermally toughened safety glass (TSG) heat soaked thermally toughened safety glass (HS TSG) and heat strengthened glass (HSG)	1 m² and 1 mm	2.50 g/cm³

(1) In the text continuation, the abbreviation PG with the respective number or the abbreviation given is used for the respective product groups. For PG 2, the terms "TSG, HS TSG and HSG" are used below.

Table 1 Product groups

Assessed product	Weight per unit area	Thickness
FG	2.50 kg/m²	1 mm
TSG, HS TSG and HSG[(2)]	2.50 kg/m²	1 mm

(2) For the product group TSG, HS TSG and HSG (PG 2), a production mix of TSG, HS TSG and HSG is balanced on the basis of determined production data.

Table 2 Reference products

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 period from 2021 - 2022.

The validity of this EPD excludes the following variants/components:

- Fire protection glass
- Coated float glass[(3)]

(3) This model EPD only covers uncoated float glass.

Product description

Float glass:
Float glass (FG) 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:
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. Heat strengthened glass (HSG) undergoes the same manufacturing process as TSG, but is cooled more slowly. This gives it greater strength than float glass, but less than TSG. If overloaded, it breaks like float glass. Heat soaked TSG is TSG that has undergone a further heat soak test.

Cutting/characteristics
Flat glass is generally supplied in stock sizes of 600 x 321 cm. It is cut and processed into thermally toughened 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, FG)
The raw materials are introduced as a mixture into the furnace where they are melted at a temperature of approx. 1,560 °C, 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. Coating of float glass is not taken into account in this LCA.

Thermally toughened safety glass (TSG), heat soaked thermally toughened safety glass (HS TSG) and heat strengthened glass (HSG)
In the manufacture of TSG, float glass is heated to its transition temperature (min. 640 °C) 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. Heat soaked TSG is TSG that has undergone a further heat soak test.
Heat strengthened glass (HSG) undergoes the same manufacturing process, but is cooled more slowly, resulting in a lower degree of impressed toughening.

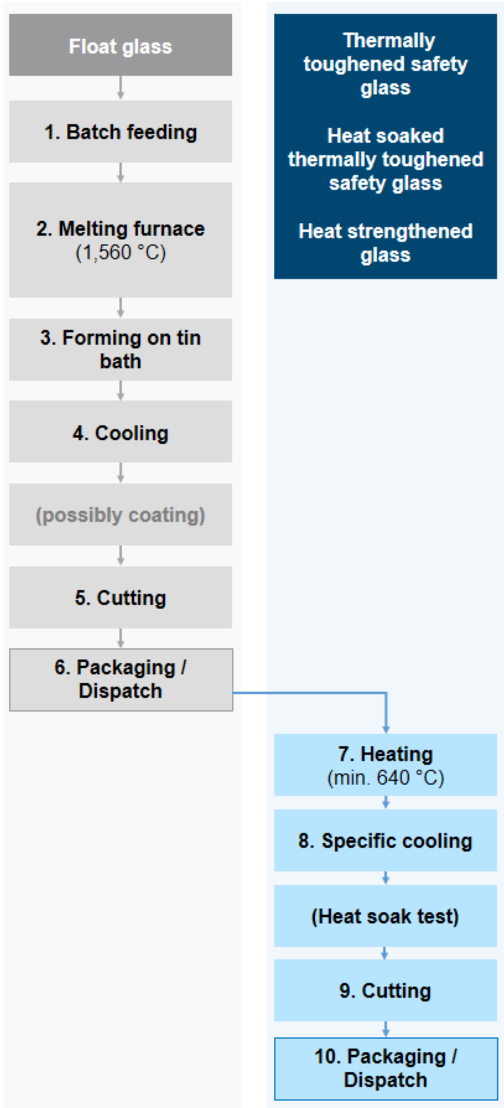


Illustration 1 Manufacturing process

Application

Float glass and thermally toughened safety glass for processing into insulating glass units and for use as glass for buildings (in the building envelope and for finishing of works / structures).

Quality assurance

The following quality assurance system are in place:

- Quality assurance according to RAL-RG 525
- CEKAL

RAL quality assurance can be specified.
See https://www.ral-guetezeichen.de/gz-einzelansicht/?gz=gz_525

Management systems

The following management systems are held:

- Quality management system as per DIN EN ISO 9001:2015
- Environmental management system as per 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 and thermally toughened safety glass fulfill the following building-physical performance characteristics:

Characteristics	Flat glass	TSG, HS TSG and HSG	HSG
Resistance	EN 572	EN 12150	EN 1863
Failure pattern	--	EN 12150	EN 1863
Residual loadbearing capacity	no	no	no

Table 3 Building-physical properties per product group

2 Materials used

Primary materials

The raw materials used can be found in Section 6.2 Inventory analysis (Inputs).
The primary materials used are listed in the LCA (see Section 6).

Declarable substances

The product contains no substances from the REACH candidate list (declaration dated 06.02.2024).

All relevant safety data sheets are available from Tvitec System Glass S.L.

3 Construction process stage

Processing recommendations, installation

Float glass (i.e. uncoated and, in some cases, coated float glass) can be processed into thermally toughened safety glass, heat soaked thermally toughened safety glass, heat strengthened glass, laminated safety glass and insulating glass units. It can also be used separately; depending on the application, other processes such as cutting, polishing or drilling may be applied.

Thermally toughened safety glass, heat soaked thermally toughened safety glass and heat strengthened glass can be processed into laminated safety glass and insulating glass units. It can also be used separately; depending on the application, other processes such as cutting, polishing or drilling may be applied prior to the thermal toughening process

Observe the instructions for assembly/installation, operation, maintenance and disassembly, provided by the manufacturer.

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 FG as well as TSG, heat soaked TSG and HSG of company Tvitec System Glass S.L. 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 RSL does not reflect the actual life time, which is usually determined by the service life and the redevelopment 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

FG as well as TSG, heat soaked TSG and HSG are sent to central recycling companies. 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.

This EPD shows the end-of-life modules based on EN 17074 (Market situation).
Glass is recycled to certain parts. Residual fractions are sent to landfill.

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 FG as well as TSG, heat soaked TSG and HSG. The 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 and EN ISO 14025 as well as based on ISO 21930.

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 period 2021 - 2022. They were collected on-site at the plants of selected members of the Bundesverband Flachglas e. V. (Federal Flat Glass Association) 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.

For each product group, data was collected from several manufacturers in different European countries. The number, location and coverage of the total production volume in Germany by the balanced production volume of German manufacturers are shown below.

Product group	FG	TSG, HS TSG and HSG
Number and location	1x Germany 1x Poland	2x Germany
Market share	52.69 %	3.61 %

Table 4 Number and location of data suppliers and coverage of the total production volume in Germany by the balanced production volume of German manufacturers per product group

The coverage of the production volume in relation to the European region cannot be quantified due to unavailable data. An extrapolation of the model EPD to manufacturers within the EU (with the exception of Germany) therefore takes place in an undefined quality. This requires,

among other things, the selection of a safety margin of 30 % (see chapter 6.3).
The generic data originates from the professional database and building materials database software “LCA for Experts 10”. The last update of both databases was in 2023. Data from before this date originate also from these databases and are not more than nine years old. No other generic data were used for the calculation.

Generic data are selected as accurately as possible in terms of geographic reference. If no country-specific data sets are available or if the regional reference cannot be determined, European or globally valid data sets are used.

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 “LCA for Experts” for the development of life cycle assessments.

The data quality complies with the requirements of prEN 15941:2022.

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 FG as well as TSG, heat soaked TSG and HSG.
Additional data for float glass (PG 1 of this EPD, A1-A3) was taken into account for thermally toughened safety glass (PG 2). No additional data from pre-suppliers or other sites were taken into consideration.

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.
A truck-semitrailer (34-40 t total weight, 27 t payload) with Euro 0-6 Mix is used for recorded transport distances for pre-products. 61% capacity was used (according to the standard data set). The Euro standard mix and capacities used are representative of the usual supply chain situations and can therefore be applied.

For transport distances that are not recorded in the company, a transport mix is assumed in the LCA. 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, electric and diesel-operated, D 60%, E 51% utilization, 50 km,
- Seagoing vessel, consumption mix, 50 km.

In addition to the transport distances for pre-products, transport distances for waste were also taken into account. The transport of generated waste in A3 was mapped with the following scenario:

- Transport to collection point with 28-34 t truck (Euro 0-6 Mix), diesel, 22 t payload, for total return trip: 50 % capacity used and 100 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 FG as well as TSG, heat soaked TSG and HSG 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
Allocations for re-use, recycling and recovery

No allocations occur during production.
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).
The secondary material included as inputs in float glass is calculated as input without loads. No benefits are assigned to Module D, but consumption to Modules C3 and C4 (worst case consideration).
The system boundary set for the recycled material refers to collection.

Secondary material

The use of secondary materials in Module A3 was considered. Secondary material is used in float glass.

Material	Cullet in %
Foreign cullet	15.10
Factory cullet	9.28

Table 5 Percentage of cullet

Inputs

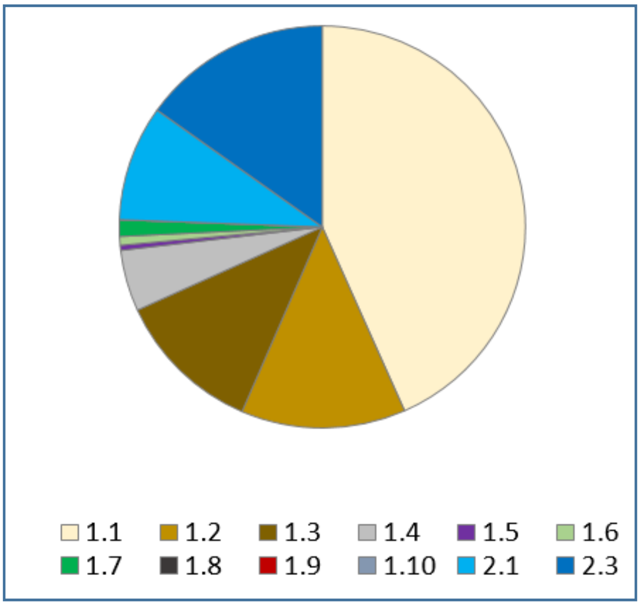
The LCA includes the following production-relevant inputs per 1 m² and 1 mm FG or TSG, HS TSG and HSG:

Energy
For the input material natural gas, "Natural gas mix RER" and for the input material propane, "Propane RER" was assumed. For the input material liquefied petroleum gas (LPG), "Liquefied petroleum gas (LPG) RER" and for diesel, "Diesel mix RER" was assumed. The power consumption is based on "Strommix Deutschland" (Germany electricity mix).

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
The water consumed by the individual process steps for the manufacture amounts to a total of 0.84 l (PG 1) as well as 4.68 l (PG 2) per m² of the element.
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 charts below show the share of raw materials/pre-products in percent.



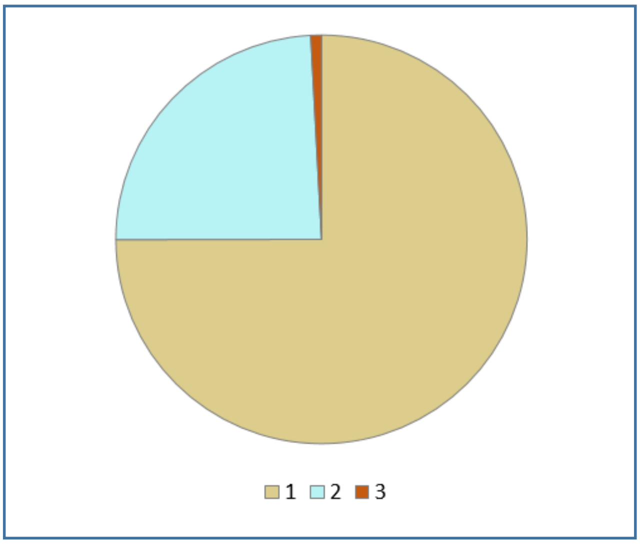


Illustration 2 Percentage of individual materials per declared unit (PG 1 and PG 2)

No.	Material	Mass in % per 1 m² and 1 mm	
		PG 1	PG 2*
1	**Primary raw materials (batch)**	**75.62**	**74.98**
1.1	Sand	43.29	
1.2	Soda	13.09	
1.3	Dolomite rock	11.72	
1.4	Chalk	4.91	
1.5	Sodium sulphate	< 1	
1.6	Feldspar	< 1	
1.7	Nepheline	1.33	
1.8	Coal	< 1	
1.9	Iron oxide	< 1	
1.10	Burnt dolomite	< 1	
2	**Cullet**	**24.38**	**24.18**
2.1	Factory cullet	9.28	
2.2	Foreign cullet	15.10	
3	**Coloring**	**0.00**	**0.84**

* Proportions of primary raw materials and cullet result from float glass production

Table 6 Percentage of individual materials per declared unit (PG 1 and PG 2)

Ancillary materials and consumables
There are 215 g (PG 1) and 2.14 g (PG 2) of ancillary materials and consumables.

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

No.	Material	Mass in g	
		PG 1	PG 2
1	PE film	0.79	0.33
2	Plastic container	0.44	-
3	Wood	5.12	37.18
4	Cardboard	6.08	-
5	Steel strapping	0.38	-
6	PET strapping	-	0.86
7	Cork spacer plates	-	2.15
8	Reusable steel frame	120.50	

Table 7 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:

No.	Part	Content in kg C per m²	
		PG 1	PG 2
1	In the corresponding packaging	4.47E-03	1.76E-02

Table 8 Biogenic carbon content of the packaging at the factory gate

Outputs

The following manufacturing-related outputs were included in the LCA per 1 m² and 1 mm float glass or thermally toughened safety glass:

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

Waste water
During production, 0.15 l (PG 1) and 4.81 l (PG 2) of wastewater is generated.

6.3 Impact assessment

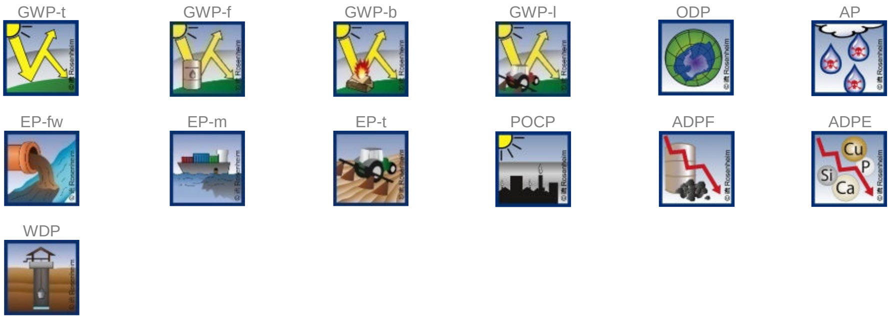
Aim

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

Core indicators

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

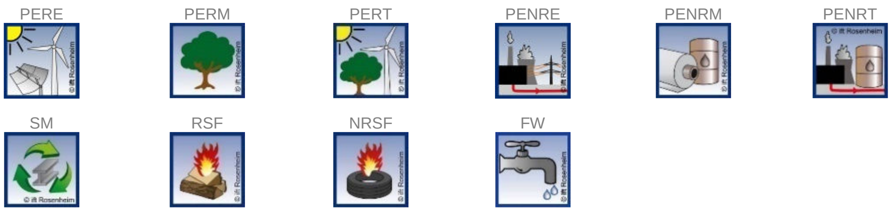
- Climate change - total (GWP-t)
- Climate change - fossil (GWP-f)
- Climate change - biogenic (GWP-b)
- Climate change - land use & land use change (GWP-l)
- Ozone depletion (ODP)
- Acidification (AP)
- Eutrophication freshwater (EP-fw)
- Eutrophication salt water (EP-m)
- Eutrophication land (EP-t)
- Photochemical ozone creation (POCP)
- Depletion of abiotic resources - fossil fuels (ADPF)
- Depletion of abiotic resources - minerals and metals (ADPE)
- Water use (WDP)



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 (PERE)
- Renewable primary energy for material use (PERM)
- Total use of renewable primary energy (PERT)
- Non-renewable primary energy as energy source (PENRE)
- Renewable primary energy for material use (PENRM)
- Total use of non-renewable primary energy (PENRT)
- Use of secondary materials (SM)
- Use of renewable secondary fuels (RSF)
- Use of non-renewable secondary fuels (NRSF)
- Net use of freshwater resources (FW)

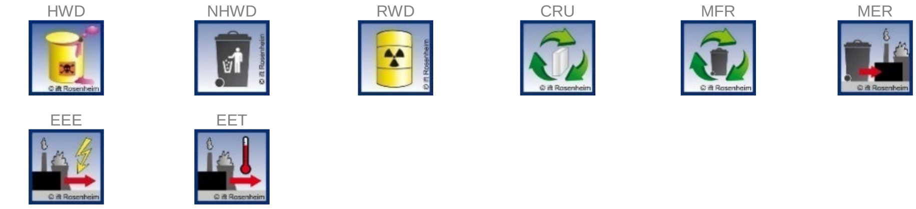


Waste

The waste generated during the production of 1 m² and 1 mm FG or TSG, HS TSG and HSG 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:

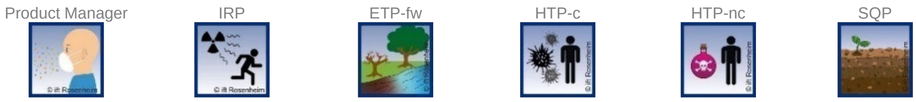
- Disposed hazardous waste (HWD)
- Non-hazardous waste disposed (NHWD)
- Radioactive waste disposed (RWD)
- Components for re-use (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)



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:

- Particulate matter emissions (PM)
- Ionizing radiation, human health (IRP)
- Ecotoxicity – freshwater (ETP-fw)
- Human toxicity, carcinogenic effects (HTP-c)
- Human toxicity, non-carcinogenic effects (HTP-nc)
- Impacts associated with land use/soil quality (SQP)



Safety margins

In this EPD, some indicator values are provided with a safety margin of 30 % in accordance with the ÖKOBAUDAT manual. These safety margins are intended to conservatively estimate the environmental impacts under worst-case assumptions. The indicators concerned and the reasons for the award amount are documented in the background report.

Results per 1 m² and 1 mm Float glass FG

	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	3.06	0.33	1.90E-02	0.00	4.83E-03	0.00	0.00	0.00	0.00	0.00	0.00	3.04E-02	4.46E-02	3.34E-02	-0.20
GWP-f	kg CO_2 equivalent	3.07	0.33	4.36E-03	0.00	4.81E-03	0.00	0.00	0.00	0.00	0.00	0.00	3.04E-02	4.42E-02	3.42E-02	-0.20
GWP-b	kg CO_2 equivalent	-7.73E-03	-3.50E-03	1.46E-02	0.00	2.23E-05	0.00	0.00	0.00	0.00	0.00	0.00	-3.22E-04	3.68E-04	-8.73E-04	-6.93E-04
GWP-l	kg CO_2 equivalent	1.25E-03	2.98E-03	1.86E-07	0.00	3.64E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.77E-04	4.75E-06	1.06E-04	-2.88E-05
ODP	kg CFC-11-eq.	5.74E-12	2.82E-14	4.21E-15	0.00	6.20E-15	0.00	0.00	0.00	0.00	0.00	0.00	3.89E-15	8.06E-13	8.68E-14	-4.47E-13
AP	mol H^+-eq.	1.12E-02	3.60E-04	5.89E-06	0.00	4.94E-06	0.00	0.00	0.00	0.00	0.00	0.00	5.41E-05	9.32E-05	2.42E-04	-1.27E-03
EP-fw	kg P-eq.	2.09E-06	1.17E-06	1.38E-09	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	1.09E-07	1.63E-07	6.88E-08	-1.26E-07
EP-m	kg N-eq.	2.35E-03	1.22E-04	1.90E-06	0.00	1.69E-06	0.00	0.00	0.00	0.00	0.00	0.00	2.17E-05	2.24E-05	6.27E-05	-3.72E-04
EP-t	mol N-eq.	3.41E-02	1.44E-03	2.68E-05	0.00	1.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	2.48E-04	2.33E-04	6.89E-04	-4.24E-03
POCP	kg NMVOC-eq.	5.54E-03	3.13E-04	5.02E-06	0.00	8.19E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.86E-05	5.95E-05	1.89E-04	-7.42E-04
ADPF*[2]	MJ	36.96	4.38	7.45E-03	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-3.02
ADPE*[2]	kg Sb equivalent	5.44E-08	2.08E-08	3.39E-11	0.00	1.38E-10	0.00	0.00	0.00	0.00	0.00	0.00	1.96E-09	6.77E-09	1.57E-09	-5.41E-09
WDP*[2]	m^3 world-eq. deprived	0.23	3.72E-03	2.80E-03	0.00	1.16E-02	0.00	0.00	0.00	0.00	0.00	0.00	3.60E-04	9.74E-03	3.74E-03	-1.15E-02
Resource management																
PERE	MJ	2.27	0.31	0.24	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.96E-02	0.55	7.41E-02	-0.30
PERM	MJ	0.18	0.00	-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
PERT	MJ	2.45	0.31	5.60E-02	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.96E-02	0.55	7.41E-02	-0.30
PENRE	MJ	36.94	4.39	4.02E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-3.02
PENRM	MJ	2.52E-02	0.00	-2.52E-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
PENRT	MJ	36.97	4.39	1.50E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-3.02
SM	kg	0.55	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	6.39E-03	3.42E-04	6.59E-05	0.00	2.88E-04	0.00	0.00	0.00	0.00	0.00	0.00	3.24E-05	4.43E-04	1.15E-04	-3.93E-04
Categories of waste																
HWD	kg	1.22E-07	1.63E-11	9.58E-14	0.00	1.78E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.26E-12	-3.87E-11	9.92E-12	-3.50E-10
NHWD	kg	0.16	6.33E-04	5.89E-04	0.00	1.24E-04	0.00	0.00	0.00	0.00	0.00	0.00	6.21E-05	6.73E-04	2.28	-2.58E-02
RWD	kg	4.87E-04	5.68E-06	3.12E-07	0.00	3.62E-07	0.00	0.00	0.00	0.00	0.00	0.00	7.63E-07	1.46E-04	5.17E-06	-7.63E-05
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	5.95E-04	0.00	3.79E-04	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	1.39E-02	0.00	2.34E-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
EET	MJ	2.51E-02	0.00	4.87E-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 Float glass FG														
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	1.96E-07	2.30E-09	3.86E-11	0.00	3.43E-11	0.00	0.00	0.00	0.00	0.00	0.00	3.69E-10	7.85E-10	2.98E-09	-7.42E-09
IRP*1	kBq U235-eq.	7.95E-02	8.19E-04	4.13E-05	0.00	4.02E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.14E-04	2.43E-02	5.98E-04	-1.25E-02
ETP-fw*2	CTUe	151.42	3.06	3.19E-03	0.00	5.33E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.41	0.25	-3.54
HTP-c*2	CTUh	3.74E-07	6.21E-11	2.64E-13	0.00	1.54E-12	0.00	0.00	0.00	0.00	0.00	0.00	5.92E-12	1.35E-11	3.82E-11	-2.25E-11
HTP-nc*2	CTUh	4.44E-05	3.30E-09	1.57E-11	0.00	7.41E-11	0.00	0.00	0.00	0.00	0.00	0.00	3.26E-10	3.33E-10	4.20E-09	-1.93E-09
SQP*2	dimensionless	5.80	1.83	2.46E-03	0.00	2.33E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.36	0.11	-0.22

Key:
PM – particulate matter emissions potential **IRP*1** – ionizing radiation potential – human health **ETP-fw*2** - Ecotoxicity 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 ionising radiation from the soil, from radon and from some building 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.

Table 9 Overall results table for float glass FG

Results per 1 m² and 1 mm TSG, HS TSG and HSG

	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	4.74	0.32	6.81E-02	0.00	4.83E-03	0.00	0.00	0.00	0.00	0.00	0.00	3.04E-02	4.46E-02	3.34E-02	-0.27
GWP-f	kg CO_2 equivalent	4.72	0.32	5.34E-03	0.00	4.81E-03	0.00	0.00	0.00	0.00	0.00	0.00	3.04E-02	4.42E-02	3.42E-02	-0.27
GWP-b	kg CO_2 equivalent	1.27E-02	-3.38E-03	6.28E-02	0.00	2.23E-05	0.00	0.00	0.00	0.00	0.00	0.00	-3.23E-04	3.69E-04	-8.73E-04	-9.95E-04
GWP-l	kg CO_2 equivalent	2.50E-03	2.90E-03	3.87E-07	0.00	3.64E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.77E-04	4.75E-06	1.06E-04	-3.84E-05
ODP	kg CFC-11-eq.	2.85E-11	4.07E-14	9.00E-15	0.00	6.20E-15	0.00	0.00	0.00	0.00	0.00	0.00	3.89E-15	8.06E-13	8.68E-14	-6.68E-13
AP	mol H^+-eq.	1.38E-02	3.87E-04	1.40E-05	0.00	4.94E-06	0.00	0.00	0.00	0.00	0.00	0.00	5.41E-05	9.33E-05	2.42E-04	-1.70E-03
EP-fw	kg P-eq.	1.11E-05	1.14E-06	2.54E-09	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	1.09E-07	1.63E-07	6.88E-08	-1.81E-07
EP-m	kg N-eq.	2.93E-03	1.34E-04	4.04E-06	0.00	1.69E-06	0.00	0.00	0.00	0.00	0.00	0.00	2.17E-05	2.24E-05	6.27E-05	-4.95E-04
EP-t	mol N-eq.	4.09E-02	1.57E-03	5.86E-05	0.00	1.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	2.48E-04	2.33E-04	6.89E-04	-5.64E-03
POCP	kg NMVOC-eq.	7.37E-03	3.41E-04	1.11E-05	0.00	8.19E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.86E-05	5.95E-05	1.89E-04	-9.87E-04
ADPF*[2]	MJ	65.31	4.25	2.26E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-4.16
ADPE*[2]	kg Sb equivalent	2.49E-07	2.05E-08	8.40E-11	0.00	1.38E-10	0.00	0.00	0.00	0.00	0.00	0.00	1.96E-09	6.77E-09	1.57E-09	-7.84E-09
WDP*[2]	m^3 world-eq. deprived	0.54	3.77E-03	9.50E-03	0.00	1.16E-02	0.00	0.00	0.00	0.00	0.00	0.00	3.60E-04	9.74E-03	3.76E-03	-1.61E-02
Resource management																
PERE	MJ	17.59	0.31	0.82	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.96E-02	0.55	7.41E-02	-0.45
PERM	MJ	0.63	0.00	-0.63	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	18.22	0.31	0.19	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.96E-02	0.55	7.41E-02	-0.45
PENRE	MJ	65.28	4.28	5.45E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-4.16
PENRM	MJ	2.45E-02	0.00	-2.45E-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
PENRT	MJ	65.30	4.28	3.00E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.92	0.46	-4.16
SM*[3]	kg	0.62	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	1.95E-02	3.39E-04	2.24E-04	0.00	2.88E-04	0.00	0.00	0.00	0.00	0.00	0.00	3.24E-05	4.43E-04	1.15E-04	-5.60E-04
Categories of waste																
HWD	kg	1.29E-07	1.33E-11	4.85E-13	0.00	1.78E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.26E-12	-3.88E-11	9.92E-12	-4.71E-10
NHWD	kg	0.30	6.51E-04	1.99E-03	0.00	1.24E-04	0.00	0.00	0.00	0.00	0.00	0.00	6.23E-05	6.73E-04	2.28	-3.42E-02
RWD	kg	4.42E-03	8.00E-06	1.24E-06	0.00	3.62E-07	0.00	0.00	0.00	0.00	0.00	0.00	7.64E-07	1.46E-04	5.19E-06	-1.15E-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	0.50	0.00	0.00	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	0.28	0.00	9.44E-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
EET	MJ	0.52	0.00	0.17	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 TSG, HS TSG and HSG														
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	2.47E-07	2.73E-09	9.74E-11	0.00	3.43E-11	0.00	0.00	0.00	0.00	0.00	0.00	3.71E-10	7.85E-10	2.98E-09	-9.87E-09
IRP*1	kBq U235-eq.	0.73	1.19E-03	1.98E-04	0.00	4.02E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.14E-04	2.43E-02	5.98E-04	-1.88E-02
ETP-fw*2	CTUe	178.94	3.03	1.09E-02	0.00	5.33E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.41	0.25	-4.72
HTP-c*2	CTUh	4.22E-07	6.19E-11	9.44E-13	0.00	1.54E-12	0.00	0.00	0.00	0.00	0.00	0.00	5.92E-12	1.35E-11	3.82E-11	-3.07E-11
HTP-nc*2	CTUh	4.98E-05	3.30E-09	6.47E-11	0.00	7.41E-11	0.00	0.00	0.00	0.00	0.00	0.00	3.26E-10	3.33E-10	4.20E-09	-2.61E-09
SQP*2	dimensionless	30.83	1.78	6.76E-03	0.00	2.33E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.36	0.11	-0.32

Key:
PM – particulate matter emissions potential **IRP*1** – ionizing radiation potential – human health **ETP-fw*2** - Ecotoxicity 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 ionising radiation from the soil, from radon and from some building 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.

*3 Reported secondary material (SM) for TSG, heat soaked TSG and HSG results from cullet used in primary glass production (see PG 1 Float glass)

Table 10 Overall results table TSG, HS TSG and HSG

6.4 Interpretation, LCA presentation and critical review

Evaluation

The environmental impacts of

- Float glass FG (PG 1)
- TSG, HS TSG and HSG (PG 2)

differ significantly in individual impact categories. This is due to the fact that float glass is purchased as a pre-product for TSG, heat soaked TSG and HSG and further processed by thermal treatment. Environmental impacts in energy-dependent environmental impacts are therefore significantly higher for thermally toughened safety glass than for float glass.

In the area of production, the environmental impact of float glass is mainly caused by the consumption of soda and, marginally, by the necessary energy sources electricity and natural gas and their respective upstream chains. For TSG, heat soaked TSG and HSG, the quantity of float glass used has a significant impact on the environment. Other marginal shares are accounted for by electricity requirements.

For the utilisation phase, environmental impacts are only attributable to cleaning during the 30-year service life and does not represent a significant proportion of the total environmental impact.

Environmental impacts in the disposal scenarios differ slightly due to the 0.03 kg higher product weight per 1 m² and 1 mm for TSG, HS TSG and HSG as a result of averaging.

In scenario C4, only marginal expenses for physical pre-treatment and landfill operation are to be expected, as it is exclusively a homogeneous and inert material for landfilling.

For glass recycling (downcycling to container glass), 16 % for float glass or 10 % for TSG, heat soaked TSG and HSG of the life cycle environmental impacts of the core indicators without WDP in scenario D can be credited.

The LCA results differ considerably from the results presented in the model EPD prepared 2017. This is partly due to methodological changes in modelling and partly reflects production changes under consideration. The sources of the differences are listed below:

1. Updating of the data basis and optimization of the data collection
2. Different composition of companies used as data providers
3. Instead of the float glass data from the GfE (Glass for Europe) data collection for Europe, average data was determined for two plants
4. Selection of other, more suitable "LCA for Experts" datasets
5. Amendment of background data in "LCA for Experts" (version update)

6. Update of modeling basis due to revision of EN 15804+A1 to EN 15804+A2
7. Use of a safety margin of 30 % on all results
8. Expansion of considered life cycle modules from a "cradle to gate - with options" view to "cradle to grave"

Further formal changes include the following points:

9. Change of laminated safety glass from the original EPD "Flat glass, thermally toughened safety glass and laminated safety glass" to the EPD "Insulating glass unit - double and triple structure", as laminated safety glass, like insulating glass unit, describes structures consisting of several individual panes and the declared unit is now also "1 m²" for laminated safety glass due to the new calculation of individual structures.
10. Consequently, renaming of the EPD to EPD "Float glass, thermally toughened safety glass, heat soaked thermally toughened safety glass and heat strengthened glass" including changed declaration number to M-EPD-FEG and resetting of the sequence number to "-001000" in each case.

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

The diagrams below show the B modules with reference to the specified RSL.

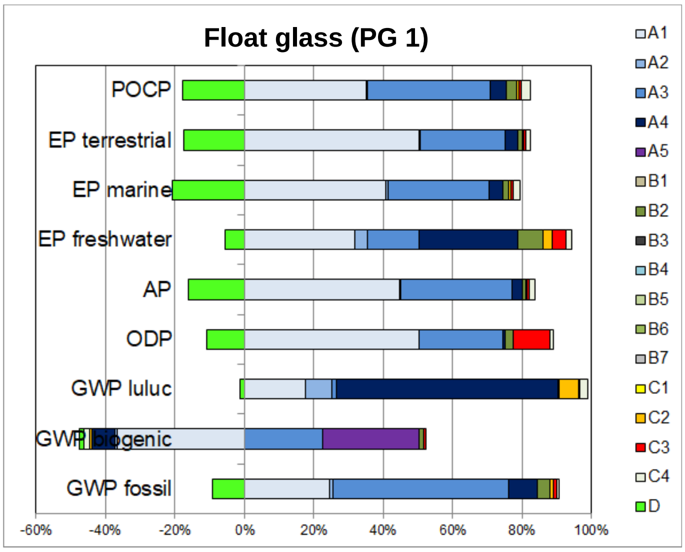


Illustration 3 Percentage of the modules in selected environmental impact indicators (PG 1)

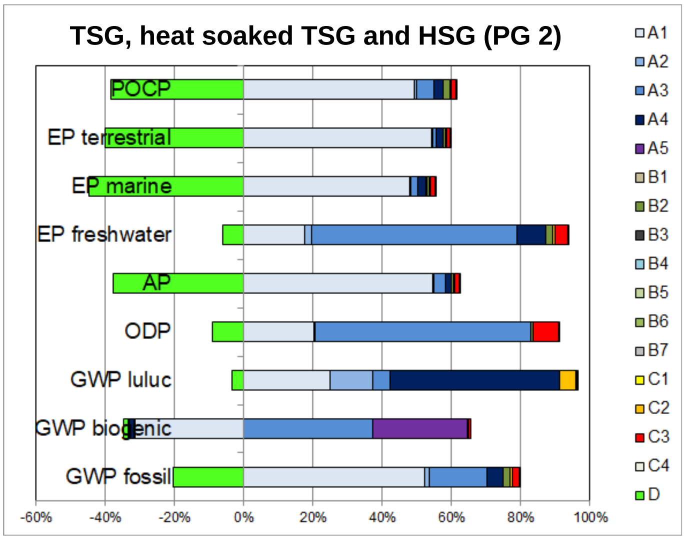


Illustration 4 Percentage of the modules in selected environmental impact indicators (PG 2)

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 Patrick Wortner, MBA and Eng., Dipl.-Ing. (FH), an external verifier.

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.
Any deviations from the average figures and variations in the environmental impacts are documented in the background report.

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 industry" PCR-FG-2.0:2021 as well as EN 17074.

The European standard EN 15804 serves as the core PCR [a)]
Independent verification of the declaration and statement according to EN ISO 14025:2010
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

No.	Date	Note	Person in charge	External verifier
1	24.01.2024	External verification	Pscherer	Wortner

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9 Annex

Description of life cycle scenarios for FG as well as TSG, heat soaked TSG and HSG

Product stage			Construction 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

Table 11 Overview of applied life cycle stages

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 (2) and EN 17213 (3).

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**	**According to the association:** **34-40 t truck (Euro 0-6 mix), diesel, 27 t payload, 100 % capacity utilization, approx. 600 km there and back with 10 % capacity utilization. Total round trip: 1,200 km and 55 % capacity utilization[1]**
A4.2	Transport from production site to construction sites Domestic	**According to the association:** 34-40 t truck (Euro 0-6 mix), diesel, 27 t payload, 100 % capacity utilization, approx. 150 km there and back with 10 % capacity utilization. Total round trip: 300 km and 55 % capacity utilization[1]

[1] Capacity used: utilized loading capacity of the truck

A4 Transport to construction site	Transport weight [kg/m²]	Density [kg/m³]	Capacity load factor[2]
PG 1	2.63	2.50	< 1
PG 2	2.54	2.50	< 1

[2] Capacity load factor:
- = 1 Product completely fills the packaging (without air inclusion)
- < 1 Packaging contains unused volume (e.g.: air, filling material)
- > 1 Product is packed in compressed form

A4 Transport to construction site per 1 kg	Unit	A4.1	A4.2
Core indicators			
GWP-t	kg CO_2 equivalent	**0.12**	3.09E-02
GWP-f	kg CO_2 equivalent	**0.12**	3.09E-02
GWP-b	kg CO_2 equivalent	**-1.39E-03**	-3.49E-04
GWP-l	kg CO_2 equivalent	**1.14E-03**	2.85E-04
ODP	kg CFC-11-eq.	**1.60E-14**	4.00E-15
AP	mol H^+-eq.	**1.52E-04**	3.81E-05
EP-fw	kg P-eq.	**4.50E-07**	1.12E-07
EP-m	kg N-eq.	**5.27E-05**	1.32E-05
EP-t	mol N-eq.	**6.18E-04**	1.54E-04
POCP	kg NMVOC-eq.	**1.34E-04**	3.35E-05
ADPF	MJ	**1.68**	0.42
ADPE	kg Sb equivalent	**8.15E-09**	2.04E-09
WDP	m³ world-eq. deprived	**1.49E-03**	3.71E-04
Resource management			
PERE	MJ	**0.12**	3.05E-02
PERM	MJ	**0.00**	0.00
PERT	MJ	**0.12**	3.05E-02
PENRE	MJ	**1.68**	0.42
PENRM	MJ	**0.00**	0.00
PENRT	MJ	**1.68**	0.42
SM	kg	**0.00**	0.00
RSF	MJ	**0.00**	0.00
NRSF	MJ	**0.00**	0.00
FW	m³	**1.34E-04**	3.34E-05

Categories of waste			
HWD	kg	**5.21E-12**	1.30E-12
NHWD	kg	**2.56E-04**	6.41E-05
RWD	kg	**3.15E-06**	7.87E-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	**1.07E-09**	2.68E-10
IRP	kBq U235-eq.	**4.69E-04**	1.17E-04
ETPfw	CTUe	**1.20**	0.30
HTPc	CTUh	**2.44E-11**	6.09E-12
HTPnc	CTUh	**1.08E-09**	2.71E-10
SQP	dimensionless	**0.70**	0.17

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 recycled in line with the conservative approach. Foil, wood, paper/paperboard/cardboard for thermal recovery, metals for recycling. Reusable packaging is returned to the company and the costs of return transport are neglected. Benefits from A5 are specified in module D. Benefits from waste incineration: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER). Transport to the recycling plants is not taken into account.

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

B1 Use (not relevant)

Refer to Section 4 Use stage - Emissions to the environment.
According to EN 17074, the use of glass products in buildings does not generate any environmental impact and may therefore be disregarded.

B2 Cleaning, maintenance and repair

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

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.**

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.

B2.2 Maintenance and repair (not relevant)
According to EN 17074, glass products do not require maintenance activities during their lifetime.
For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Tvitec System Glass S.L..

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 relevant 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 respective instructions for assembly/installation, operation and maintenance from Tvitec System Glass S.L.

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 relevant summary table.

B4 Exchange/replacement (not relevant)

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 exchange activities during their service life (30 years). Replacement activities of glass products installed in buildings are included in the service life of the glass products, which is why this module is not taken into account. Regarding the assumed 50-year building service life, the one-off replacement is still recognized for information purposes.

For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Tvitec System Glass S.L.

In scenario B4.1, ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances during replacement are negligible.

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

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

B4 Exchange/ Replacement	Unit	PG 1 and PG 2	PG 1	PG 2
		B4.1	B4.2	B4.2
Core indicators				
GWP-t	kg CO_2 equivalent	0.00	3.32	4.56
GWP-f	kg CO_2 equivalent	0.00	3.31	4.48
GWP-b	kg CO_2 equivalent	0.00	1.86E-03	7.02E-02
GWP-l	kg CO_2 equivalent	0.00	4.62E-03	5.60E-03
ODP	kg CFC-11-eq.	0.00	6.23E-12	2.94E-11
AP	mol H^+-eq.	0.00	1.08E-02	9.81E-03
EP-fw	kg P-eq.	0.00	3.49E-06	1.25E-05
EP-m	kg N-eq.	0.00	2.23E-03	1.78E-03
EP-t	mol N-eq.	0.00	3.27E-02	2.77E-02
POCP	kg NMVOC-eq.	0.00	5.46E-03	5.21E-03
ADPF	MJ	0.00	40.13	61.58
ADPE	kg Sb equivalent	0.00	8.07E-08	2.73E-07
WDP	m^3 world-eq. deprived	0.00	0.24	0.54
Resource management				
PERE	MJ	0.00	3.18	19.36
PERM	MJ	0.00	0.00	0.00
PERT	MJ	0.00	3.18	19.36
PENRE	MJ	0.00	40.18	61.61
PENRM	MJ	0.00	0.00	0.00
PENRT	MJ	0.00	40.18	61.61
SM	kg	0.00	0.55	0.62
RSF	MJ	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00
FW	m^3	0.00	7.00E-03	2.01E-02
Categories of waste				
HWD	kg	0.00	1.21E-07	1.28E-07
NHWD	kg	0.00	2.41	0.68
RWD	kg	0.00	5.71E-04	4.61E-03
Output material flows				
CRU	kg	0.00	0.00	0.00
MFR	kg	0.00	0.75	2.64
MER	kg	0.00	0.00	0.00
EEE	MJ	0.00	3.73E-02	0.38
EET	MJ	0.00	7.38E-02	0.69
Additional environmental impact indicators				
PM	Disease incidence	0.00	1.95E-07	2.25E-07
IRP	kBq U235-eq.	0.00	9.34E-02	0.77
ETPfw	CTUe	0.00	151.97	170.23
HTPc	CTUh	0.00	3.75E-07	4.22E-07
HTPnc	CTUh	0.00	4.44E-05	4.98E-05
SQP	dimensionless	0.00	8.08	33.14

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

For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Tvitec System Glass S.L.

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

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

B6 Operational energy use (not relevant)
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 (not relevant)
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 relevant summary table.

C1 Deconstruction

No.	Scenario	Description
C1.1	**Deconstruction (according to EN 17074)**	**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.**
C1.2	Deconstruction (according to research project)	Based on the research project (1) • Deconstruction 95%, Residues (landfill) 5%

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

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

As both scenarios have the same environmental impact, the results are shown in the summary table at C1.

C2 Transport

No.	Scenario	Description
C2.1	**Transport (according to EN 17074)**	**Transport to collection point using 28-34 t truck (Euro 0-6 Mix), Diesel, 22 t payload; for total return trip: 50 % capacity utilization and 100 km.**
C2.2	Transport (according to research project)	Transport to collection point using 28-34 t truck (Euro 0-6 Mix), Diesel, 22 t payload, for total return trip. 50 % capacity utilization and 100 km.

C2 Transport to recycling centre	Transport weight [kg/m²]	
	C2.1	C2.2
PG 1	2.50	2.50
PG 2	2.50	2.50

The results for scenario C2.1 can be found in the overall results tables. The calculation of the results for scenario C2.2 corresponds to the results of scenario C2.1 due to the same transport weights.

C3 Waste management

No.	Scenario	Description
C3.1	**Current market situation (according to EN 17074)**	**Share for recirculation of materials According to EN 17074:** • **100% glass in melt**
C3.2	Current market situation (according to research project)	Share for recirculation of materials Based on the research project: • 90% glass in melt

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	PG 1		PG 2	
		C3.1	C3.2	C3.1	C3.2
Collection process, collected separately	kg	**0.75**	**2.37**	**0.75**	**2.37**
Collection process, collected as mixed construction waste	kg	**1.75**	**0.13**	**1.75**	**0.13**
Recovery system, for re-use	kg	**0.00**	**0.00**	**0.00**	**0.00**
Recovery system, for recycling	kg	**0.75**	**2.14**	**0.75**	**2.14**
Recovery system, for energy recovery	kg	**0.00**	**0.00**	**0.00**	**0.00**
Disposal	kg	**1.75**	**0.36**	**1.75**	**0.36**

C3 Disposal	Unit	PG 1		PG 2	
		C3.1	C3.2	**C3.1**	C3.2
Core indicators					
GWP-t	kg CO_2 equivalent	**4.46E-02**	0.14	**4.46E-02**	0.14
GWP-f	kg CO_2 equivalent	**4.42E-02**	0.14	**4.42E-02**	0.14
GWP-b	kg CO_2 equivalent	**3.68E-04**	1.17E-03	**3.69E-04**	1.17E-03
GWP-l	kg CO_2 equivalent	**4.75E-06**	1.51E-05	**4.75E-06**	1.51E-05
ODP	kg CFC-11-eq.	**8.06E-13**	2.55E-12	**8.06E-13**	2.55E-12
AP	mol H^+-eq.	**9.32E-05**	2.95E-04	**9.33E-05**	2.95E-04
EP-fw	kg P-eq.	**1.63E-07**	5.16E-07	**1.63E-07**	5.16E-07
EP-m	kg N-eq.	**2.24E-05**	7.07E-05	**2.24E-05**	7.07E-05
EP-t	mol N-eq.	**2.33E-04**	7.38E-04	**2.33E-04**	7.38E-04
POCP	kg NMVOC-eq.	**5.95E-05**	1.89E-04	**5.95E-05**	1.89E-04
ADPF	MJ	**0.92**	2.91	**0.92**	2.91
ADPE	kg Sb equivalent	**6.77E-09**	2.15E-08	**6.77E-09**	2.15E-08
WDP	m^3 world-eq. deprived	**9.74E-03**	3.08E-02	**9.74E-03**	3.08E-02
Resource management					
PERE	MJ	**0.55**	1.74	**0.55**	1.74
PERM	MJ	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**0.55**	1.74	**0.55**	1.74
PENRE	MJ	**0.92**	2.91	**0.92**	2.91
PENRM	MJ	**0.00**	0.00	**0.00**	0.00
PENRT	MJ	**0.92**	2.91	**0.92**	2.91
SM	kg	**0.00**	0.00	**0.00**	0.00
RSF	MJ	**0.00**	0.00	**0.00**	0.00
NRSF	MJ	**0.00**	0.00	**0.00**	0.00
FW	m^3	**4.43E-04**	1.40E-03	**4.43E-04**	1.40E-03
Categories of waste					
HWD	kg	**-3.87E-11**	-1.23E-10	**-3.88E-11**	-1.23E-10
NHWD	kg	**6.73E-04**	2.13E-03	**6.73E-04**	2.13E-03
RWD	kg	**1.46E-04**	4.63E-04	**1.46E-04**	4.63E-04
Output material flows					
CRU	kg	**0.00**	0.00	**0.00**	0.00
MFR	kg	**0.75**	2.14	**0.75**	2.14
MER	kg	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**0.00**	0.00	**0.00**	0.00
EET	MJ	**0.00**	0.00	**0.00**	0.00
Additional environmental impact indicators					
PM	Disease incidence	**7.85E-10**	2.48E-09	**7.85E-10**	2.48E-09
IRP	kBq U235-eq.	**2.43E-02**	7.70E-02	**2.43E-02**	7.71E-02
ETPfw	CTUe	**0.41**	1.28	**0.41**	1.28
HTPc	CTUh	**1.35E-11**	4.28E-11	**1.35E-11**	4.29E-11
HTPnc	CTUh	**3.33E-10**	1.05E-09	**3.33E-10**	1.05E-09
SQP	dimensionless	**0.36**	1.14	**0.36**	1.14

C4 Disposal

No.	Scenario	Description
C4.1	**Market situation (according to EN 17074)**	**The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as "disposed" (RER).**
C4.2	Market situation (according to research project)	The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as "disposed" (RER).

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.

C4 Disposal	Unit	PG 1		PG 2	
		C4.1	C4.2	**C4.1**	C4.2
Core indicators					
GWP-t	kg CO_2 equivalent	**3.34E-02**	6.93E-03	**3.34E-02**	6.93E-03
GWP-f	kg CO_2 equivalent	**3.42E-02**	7.09E-03	**3.42E-02**	7.09E-03
GWP-b	kg CO_2 equivalent	**-8.73E-04**	-1.81E-04	**-8.73E-04**	-1.81E-04
GWP-l	kg CO_2 equivalent	**1.06E-04**	2.20E-05	**1.06E-04**	2.20E-05
ODP	kg CFC-11-eq.	**8.68E-14**	1.79E-14	**8.68E-14**	1.79E-14
AP	mol H^+-eq.	**2.42E-04**	5.02E-05	**2.42E-04**	5.02E-05
EP-fw	kg P-eq.	**6.88E-08**	1.43E-08	**6.88E-08**	1.43E-08
EP-m	kg N-eq.	**6.27E-05**	1.30E-05	**6.27E-05**	1.30E-05
EP-t	mol N-eq.	**6.89E-04**	1.43E-04	**6.89E-04**	1.43E-04
POCP	kg NMVOC-eq.	**1.89E-04**	3.91E-05	**1.89E-04**	3.91E-05
ADPF	MJ	**0.46**	9.43E-02	**0.46**	9.43E-02
ADPE	kg Sb equivalent	**1.57E-09**	3.26E-10	**1.57E-09**	3.26E-10
WDP	m^3 world-eq. deprived	**3.74E-03**	7.77E-04	**3.76E-03**	7.77E-04
Resource management					
PERE	MJ	**7.41E-02**	1.53E-02	**7.41E-02**	1.53E-02
PERM	MJ	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**7.41E-02**	1.53E-02	**7.41E-02**	1.53E-02
PENRE	MJ	**0.46**	9.43E-02	**0.46**	9.44E-02
PENRM	MJ	**0.00**	0.00	**0.00**	0.00
PENRT	MJ	**0.46**	9.43E-02	**0.46**	9.44E-02
SM	kg	**0.00**	0.00	**0.00**	0.00
RSF	MJ	**0.00**	0.00	**0.00**	0.00
NRSF	MJ	**0.00**	0.00	**0.00**	0.00
FW	m^3	**1.15E-04**	2.38E-05	**1.15E-04**	2.38E-05
Categories of waste					
HWD	kg	**9.92E-12**	2.05E-12	**9.92E-12**	2.05E-12
NHWD	kg	**2.28**	0.47	**2.28**	0.47
RWD	kg	**5.17E-06**	1.07E-06	**5.19E-06**	1.07E-06
Output material flows					
CRU	kg	**0.00**	0.00	**0.00**	0.00
MFR	kg	**0.00**	0.00	**0.00**	0.00
MER	kg	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**0.00**	0.00	**0.00**	0.00
EET	MJ	**0.00**	0.00	**0.00**	0.00

Additional environmental impact indicators					
PM	Disease incidence	**2.98E-09**	6.18E-10	**2.98E-09**	6.18E-10
IRP	kBq U235-eq.	**5.98E-04**	1.24E-04	**5.98E-04**	1.24E-04
ETPfw	CTUe	**0.25**	5.14E-02	**0.25**	5.15E-02
HTPc	CTUh	**3.82E-11**	7.92E-12	**3.82E-11**	7.92E-12
HTPnc	CTUh	**4.20E-09**	8.71E-10	**4.20E-09**	8.71E-10
SQP	dimensionless	**0.11**	2.29E-02	**0.11**	2.29E-02

D Benefits and loads from beyond the system boundaries

No.	Scenario	Description
D1	**Recycling potential (current market situation according to EN 17074)**	**Glass recyclate from C3 excluding the cullet used in A3 replace 60% of glass;** **Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).**
D2	Recycling potential (current market situation according to research project)	Glass recyclate from C3 excluding the cullet used in A3 replace 60% of glass. Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).

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

D Recycling potential	Unit	PG 1		PG 2	
		D1	D2	**D1**	D2
Core indicators					
GWP-t	kg CO_2 equivalent	**-0.20**	-0.56	**-0.27**	-0.74
GWP-f	kg CO_2 equivalent	**-0.20**	-0.56	**-0.27**	-0.74
GWP-b	kg CO_2 equivalent	**-6.93E-04**	-1.92E-03	**-9.95E-04**	-2.62E-03
GWP-l	kg CO_2 equivalent	**-2.88E-05**	-8.12E-05	**-3.84E-05**	-1.08E-04
ODP	kg CFC-11-eq.	**-4.47E-13**	-1.23E-12	**-6.68E-13**	-1.70E-12
AP	mol H^+-eq.	**-1.27E-03**	-3.63E-03	**-1.70E-03**	-4.81E-03
EP-fw	kg P-eq.	**-1.26E-07**	-3.48E-07	**-1.81E-07**	-4.75E-07
EP-m	kg N-eq.	**-3.72E-04**	-1.06E-03	**-4.95E-04**	-1.40E-03
EP-t	mol N-eq.	**-4.24E-03**	-1.20E-02	**-5.64E-03**	-1.60E-02
POCP	kg NMVOC-eq.	**-7.42E-04**	-2.10E-03	**-9.87E-04**	-2.79E-03
ADPF	MJ	**-3.02**	-8.47	**-4.16**	-11.41
ADPE	kg Sb equivalent	**-5.41E-09**	-1.49E-08	**-7.84E-09**	-2.04E-08
WDP	m^3 world-eq. deprived	**-1.15E-02**	-3.21E-02	**-1.61E-02**	-4.34E-02
Resource management					
PERE	MJ	**-0.30**	-0.83	**-0.45**	-1.15
PERM	MJ	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**-0.30**	-0.83	**-0.45**	-1.15
PENRE	MJ	**-3.02**	-8.47	**-4.16**	-11.41
PENRM	MJ	**0.00**	0.00	**0.00**	0.00
PENRT	MJ	**-3.02**	-8.47	**-4.16**	-11.41
SM	kg	**0.00**	0.00	**0.00**	0.00
RSF	MJ	**0.00**	0.00	**0.00**	0.00

NRSF	MJ	**0.00**	0.00	**0.00**	0.00
FW	m³	**-3.93E-04**	-1.09E-03	**-5.60E-04**	-1.48E-03
Categories of waste					
HWD	kg	**-3.50E-10**	-9.87E-10	**-4.71E-10**	-1.32E-09
NHWD	kg	**-2.58E-02**	-7.35E-02	**-3.42E-02**	-9.73E-02
RWD	kg	**-7.63E-05**	-2.09E-04	**-1.15E-04**	-2.90E-04
Output material flows					
CRU	kg	**0.00**	0.00	**0.00**	0.00
MFR	kg	**0.00**	0.00	**0.00**	0.00
MER	kg	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**0.00**	0.00	**0.00**	0.00
EET	MJ	**0.00**	0.00	**0.00**	0.00
Additional environmental impact indicators					
PM	Disease incidence	**-7.42E-09**	-2.10E-08	**-9.87E-09**	-2.79E-08
IRP	kBq U235-eq.	**-1.25E-02**	-3.43E-02	**-1.88E-02**	-4.76E-02
ETPfw	CTUe	**-3.54**	-10.08	**-4.72**	-13.37
HTPc	CTUh	**-2.25E-11**	-6.14E-11	**-3.07E-11**	-8.19E-11
HTPnc	CTUh	**-1.93E-09**	-5.46E-09	**-2.61E-09**	-7.28E-09
SQP	dimensionless	**-0.22**	-0.59	**-0.32**	-0.82

Imprint

Practitioner of the LCA
ift Rosenheim GmbH
Theodor-Gietl-Straße 7-9
83026 Rosenheim, Germany

Programme operator
ift Rosenheim GmbH
Theodor-Gietl-Straße 7-9
83026 Rosenheim, Germany
Phone +49 (0)8031/261-0
Fax: +49 (0)8031/261-290
E-Mail: info@ift-rosenheim.de
www.ift-rosenheim.de

Group of Declaration holders
Tvitec System Glass S.L.
Pol. Ind. El Bayo P19
ESP-24492 Cubillos del Sil, León, Spain

Declaration holder
Related declaration holders on page 3

Notes
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Bundesverband Flachglas e. V.

ift Rosenheim GmbH
Theodor-Gietl-Straße 7-9
83026 Rosenheim
Phone: +49 (0) 80 31/261-0
Fax: +49 (0) 80 31/261-290
E-Mail: info@ift-rosenheim.de
www.ift-rosenheim.de