Environmental Product Declaration (EPD)

Declaration code M-EPD-VMG-GB-001022

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

Glas Trösch GmbH
SANCO Beratung

flat glass

Laminated safety glass and insulating glass unit (double and triple structure)

Basis:

DIN EN ISO 14025
EN 15804 + A2

Model EPD
Environmental
Product **D**eclaration

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Declaration code M-EPD-VMG-GB-001022

Programme operator	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim, Germany
Practitioner of the LCA	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim, Germany
Group of Declaration holders	Glas Trösch GmbH SANCO Beratung Reuthebogen 7-9 86720 Nördlingen, Germany www.glastroesch.de and www.sanco.de Note: related declaration holders can be found on page 3.
Declaration code	M-EPD-VMG-GB-001022
Designation of declared product	Laminated safety glass and insulating glass unit (double and triple structure)
Scope	Laminated 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). Insulating glass units for installation in windows, doors, curtain walling, roofs and partitions.
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: 03.06.2024 — 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 in accordance with 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.

Christoph Seehauser	Dr. Torsten Mielecke	Patrick Wortner
Deputy Head Sustainability	Chairman of Expert Committee ift-EPD and PCR	External verifier

Related declaration holders/manufacturers of SANCO Group:

P.P.H. "Glass-product"
Lisi Ogon, ul. Przy Lesie 6
86-065 Łochowo
Poland
www.glass-product.pl

Glas-Tech S.A.
Ul. Rabowicka 17
62-020 SWARZĘDZ
Poland
www.glas-tech.pl

Opolglass Sp. z o.o
Ul. Składowa 6
45-125 Opole
Poland
www.opolglass.com.pl

Smits Isolatieglas B.V.
Handelseweg 43
5423 SB Gemert
The Netherlands

Thermopor Glas GmbH
Am Buschfeld 9
52399 Merzenich
Germany
www.thermopor-glas.de

Uniglass Polska
Mala Kraska 11A
18-400 Lomza
Poland
www.uniglasspolska.pl

Vitroszlif Spółka z o.o.
Ul. Bór 67/73a
42-200 Częstochowa
Poland
www.vitroszlif.com.pl

WEHA-THERM GmbH & Co. KG
Industriestraße 7
94116 Hutthurm
Germany
www.wehatherm.de

WWGLASS Sp. z.o.o. Sp. k
Ul. Handlowa 18
84-241 Gościcino
Poland
www.wwglass.pl

1 General Product Information

Product definition

The EPD relates to the product group "flat glass" and applies to:

1 m² Laminated safety glass and insulating glass unit (double and triple structure)
made by declaration holders/manufacturers of SANCO Group

The functional unit is obtained by summing up:

Product group (PG)[1]	Declared unit	Density[2]
PG 3: Laminated safety glass, LSG	1 m²	2.34 g/cm³
PG 4: Insulating glass unit double structure, IGU double	1 m²	0.66 g/cm³
PG 5: Insulating glass unit triple structure, IGU triple	1 m²	0.29 g/cm³

(1) The product groups PG 1 and PG 2 are described in more detail in M-EPD-FEG-GB-001000.
(2) Product weight based on 1 m² and the respective structure (total thickness glass + film (PVB density 1.07 kg/m²*mm) or spacer "A" (calculation according to footnote(4)))

Table 1 Product groups

Assessed product	Weight per unit area[3]	Thickness
LSG	31.63 kg/m²	14 mm (6FG - 1.52PBV - 6FG)
IGU double	21.21 kg/m²	8 + A mm (4FG - A - 4FG)[4]
IGU triple	31.34 kg/m²	12 + 2*A mm (4FG - A - 4FG - A - 4FG)[4]

(3) Due to the averaging and the data basis, a deviation from standard area weights is possible.
(4) A - Distance over the determined average data; due to the data basis, it is not possible to specify spatial dimensions (width, height), which is why an average distance "A" of unknown dimension is modeled. Spacers in a size range of 0.6 cm - 2.4 cm (IGU double) and 1.20 cm - 4.80 cm (IGU triple) were taken into account. To calculate the density, the worst case of 2.4 cm (IGU double) or 4.80 cm (IGU triple) was assumed for "A".

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 - 2023.

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

- Separating foils in LSG that differ from PVB
- Coated float glass(1)
- Fire protection glass
- Installations in the cavity of insulating glass units
- Gas fillings deviating from argon/air in the cavity between panes of insulating glass units

(1) This model EPD only covers uncoated float glass. For the correct calculation of a insulating glass unit with coated float glass, a separate EPD of a coated float glass must be calculated as shown in the calculation example (see page 31).

Product description

Laminated safety glass

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 mostly consist of polyvinyl butyral (PVB).

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

- LSG: 6 mm FG, 1.52 mm PVB foil, 6 mm FG

Insulating glass unit

Glass unit consisting of two or several glass panes separated from each other by one or several cavities containing an air or gas filling. The edges of the panes are hermetically sealed (air/gas and moisture proof) using e.g. organic sealing compounds.

The configuration of the insulating glass units presented in this EPD is as follows:

- Double structure: 2*4 mm FG, A mm spacer
- Triple structure: 3*4 mm FG, two A mm spacers

Laminated safety glasses and insulating glass units with different structures in terms of the types of glass used (FG, TSG, HS TSG, HSG, LSG) or intermediate layers (for LSG) or glass thicknesses can be evaluated in accordance with this LCA. An example of the calculation procedure can be found after the overall results table on pages 30 and 31.

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

Product manufacture

Laminated safety glass (LSG)

For the manufacture of LSG, an intermediate layer (plastic film, usually PVB) is placed between the panes of glass and these are pressed together in an autoclave under the action of heat and pressure.

Insulating glass unit

Glass panes are positioned the desired distance apart using one or several spacer profiles made from aluminium, stainless steel or plastic/metal combinations, or containing organic materials, and are

joined and sealed in a gas-proof manner using two sealing planes, following the filling of the cavities with inert gas (generally argon).
As only argon is considered for the gas filling in the cavity between the panes, the LCA is also only permissible for insulating glass units with argon or air filling in the cavity.

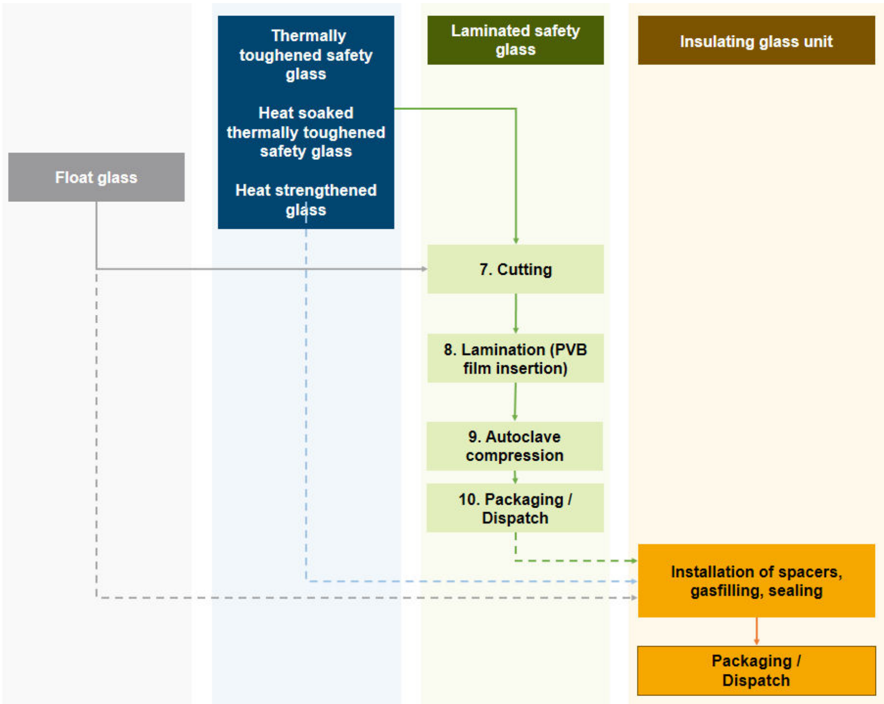


Illustration 1 Manufacturing process

The coating process for float glass is not covered in this LCA. For the correct calculation of an insulating glass unit with coated float glass, a separate EPD of a coated float glass must be calculated as shown in the calculation example (see page 31).

Application

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).
Insulating glass units for installation in windows, doors, curtain walling, roofs and partitions.

Test evidence / reports

The following verification is held by WEHA-THERM GmbH & Co. KG:

- Product quality according to EN 1863-1:2011 and EN 1288-3:2000 (Testing of heat strengthened soda lime silicate glass)

For information on further and updated verifications (including other national approvals) refer to the manufacturer.

Quality assurance

The following quality assurance systems are in place:

Smits Isolatieglas B.V.

- NL KIWA/KOMO - BRL 2202 and NL KIWA/KOMO - BRL 2207

Thermopor Glas GmbH und WEHA-THERM GmbH & Co. KG

- ift-Rosenheim: 691+692 IGU (QM327)
- RAL-GZ 520

Detailed information on the individual certificates should be requested from the relevant declaration holder/manufacturer.

RAL quality assurance can be specified.
See https://www.ral-guetezeichen.de/gz-einzelansicht/?gz=gz_520

Additional information

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

Laminated safety glass fulfill the following building-physical performance characteristics:

	Laminated safety glass
Resistance	EN 14449
Failure pattern	EN 14449
Residual loadbearing capacity	yes

Insulating glass unit fulfill the following building-physical performance characteristics:

Characteristics	Designation	Product standard	Unit
Thermal transmittance	U_g value	EN 1279	W/(m²*K)
Total energy transmittance	g value	EN 1279	%
Light transmittance	τ_V	EN 1279	%
Sound reduction index	R_W value	EN 1279	dB

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 7).

Declarable substances

For all declarations holders/manufacturers the product contains no substances from the REACH candidate list (declarations of 2024).

All relevant safety data sheets are available from the corresponding manufacturer.

3 Construction process stage

Processing recommendations, installation

Laminated safety glass can be processed into insulating glass unit. It can also be used separately; depending on the application, other processes such as cutting, polishing or drilling may be applied.

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 of laminated safety glass and insulating glass unit of the declaration holder/manufacturer 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

Laminated safety glass and insulating glass unit are sent 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.

This EPD shows the end-of-life modules based on EN 17074 (Market situation).
Glass and metal are recycled to certain parts. Plastics are thermally recycled. 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 Laminated safety glass and insulating glass unit. 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.
Individual evaluations of the environmental impacts for the balanced PVB film of LSG and the respective spacers "A" of the insulating glass units over the entire product life cycle are given. 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 - 2023. 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	LSG	IGU double	IGU triple
Number and location	3x Germany	2x Germany 1x Poland	2x Germany 1x Poland
Market share	0.90 %	1.46 %	

Table 3 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 section 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 seven 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 Laminated safety glass and insulating glass unit.

For float glass, additional specific data for production at the sub-supplier were taken into account (M-EPD-FEG-GB-001000, PG 1).
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 using 28-34 t truck (Euro 0-6 Mix), Diesel, 22 t payload, for round trip total: 50 % capacity utilization 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 Laminated safety glass and insulating glass unit 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 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 not used.

Inputs

The following manufacturing-related inputs were included in the LCA per 1 m² Laminated safety glass and insulating glass unit (double and triple structure):

Energy
For the input material natural gas, "Natural gas mix RER", for the input material propane, "Propane RER" and for the input material liquefied petroleum gas (LPG), "Liquefied petroleum gas (LPG) 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 of 46.34 l (LSG), 8.73 l (IGU double) or 13.06 l (IGU triple) per m² 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 chart below shows the share of raw materials/pre-products in percent.

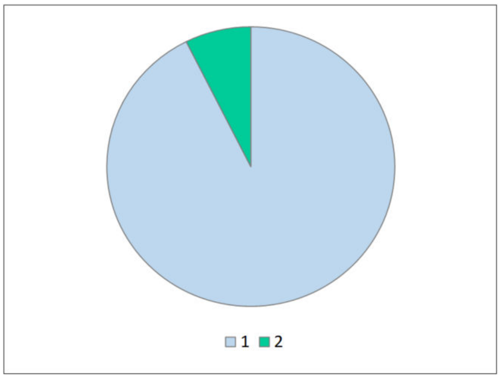


Illustration 2 Percentage of individual materials per declared unit (LSG)

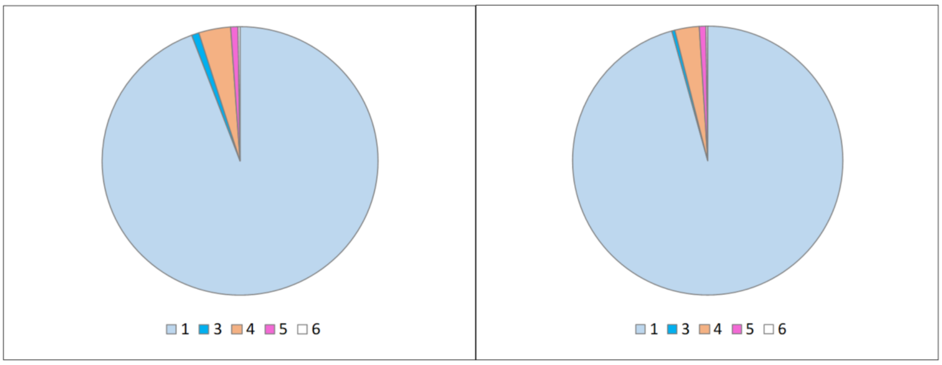


Illustration 3 Percentage of individual materials per declared unit (IGU double and IGU triple)

In addition, the balanced material mix of the spacers for IGU double and IGU triple is shown as a percentage for each declared unit. For the material mix, spacers in a size range of 0.6 cm - 2.4 cm (IGU double) and 1.20 cm - 4.80 cm (IGU triple) were taken into account.

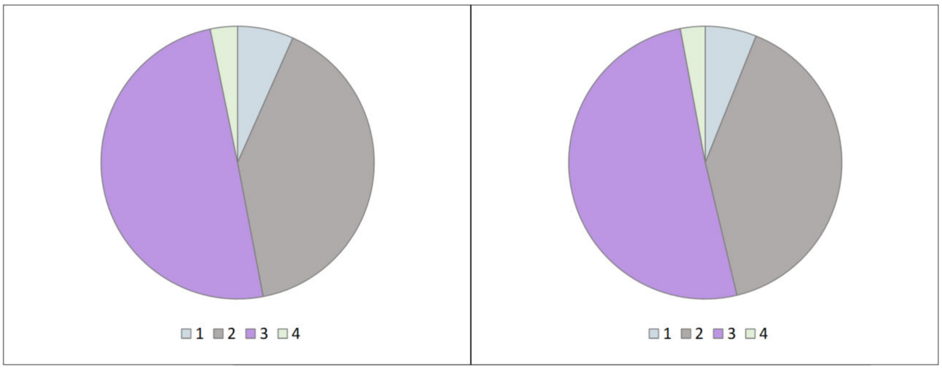


Illustration 4 Percentage of spacer material mix per declared unit (IGU double and IGU triple)

No.	Material	Mass in %		
		LSG	IGU double	IGU triple
1	Float glass	92.60	94.31	95.71
2	PVB-interlayer	7.40	-	-
3	Gas filling (Argon)	-	0.87	0.38
4	Sealant	-	3.74	2.91
5	Spacer	-	0.86	0.79
6	Desiccant (Zeolite)	-	0.23	0.21

Table 4 Percentage of individual materials per declared unit

In the case of purchased flat glass (float glass, thermally toughened safety glass, heat soaked thermally toughened safety glass, heat strengthened glass and laminated safety glass), float glass was uniformly recognised in the balance sheet.

No.	Material mix spacers	Mass in % per 1 m²	
		IGU double	IGU triple
1	Aluminium	6.64	6.07
2	Stainless steel	40.38	40.20
3	Plastic (PVC)	49.79	50.78
4	Glass fibre	3.22	2.94

Table 5 Percentage of spacer material mix per declared unit

Ancillary materials and consumables

There are 401 g (LSG), 16 g (IGU double) or 20 g (IGU triple) of ancillary materials and consumables.

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

No.	Material	Mass in g		
		LSG	IGU double	IGU triple
1	PE film	7.59	34.09	30.24
2	Wood	63.66	119.10	153.95
3	Cardboard	-	18.68	15.89
4	Upholstery material (XPS)/polystyrene	2.13	0.52	0.40
5	PET strapping	2.59	6.22	5.78
6	Cork spacer plates	1.58	22.43	28.99
7	Corrugated board spacer	13.29	-	-
8	PVC spacer	-	0.18	0.23
9	PUR spacer	-	0.16	0.21
10	Steel brackets	-	0.37	0.48
11	Adhesive tape (PET/silicone)	-	1.25	1.23
12	Reusable steel frame	1,081.42	746.94	859.60

Table 6 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		
		LSG	IGU double	IGU triple
1	In the corresponding packaging	0.11	0.26	0.32

Table 7 Biogenic carbon content of the packaging at the factory gate

Outputs

The following manufacturing-related outputs were included in the LCA per 1 m² laminated safety glass or insulating glass unit (double and triple structure):

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

Waste water
The production process generates 38.65 l (LSG), 8.73 l (IGU double) or 13.06 l (IGU triple) of waste water.

6.3 Impact assessment

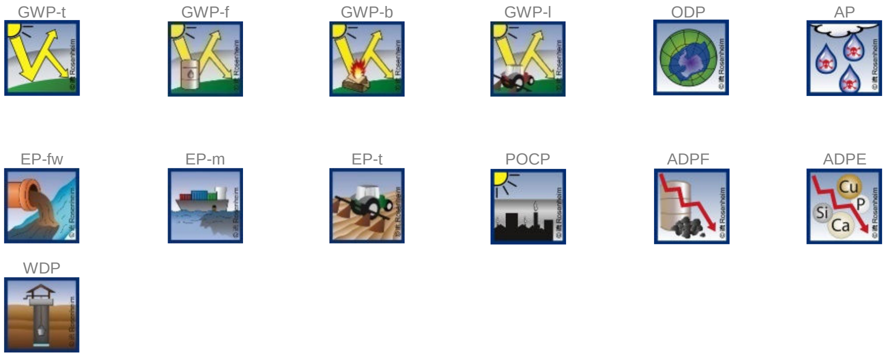
Aim

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:

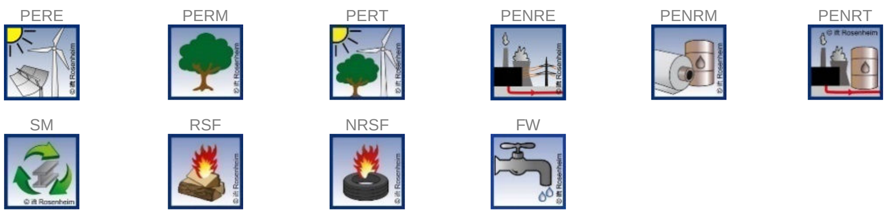
- Climate change - total (GWP-t)
- Climate change - fossil (GWP-f)
- Climate change - biogenic (GWP-b)
- Climate change - land use & land use change (GWP-l)
- Ozone depletion (ODP)
- Acidification (AP)
- Eutrophication freshwater (EP-fw)
- Eutrophication salt water (EP-m)
- Eutrophication land (EP-t)
- 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)

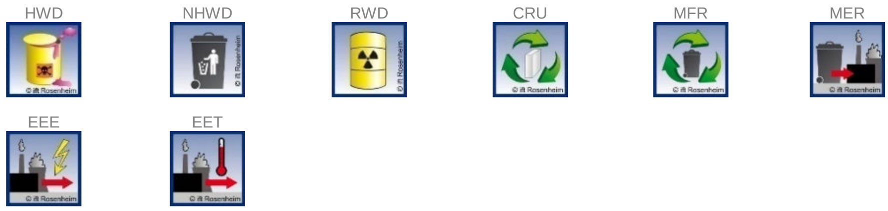


Waste

The waste generated during the production of 1 m² Laminated safety glass and insulating glass unit (double and triple structure) 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:

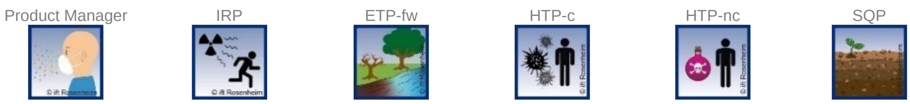
- Disposed hazardous waste (HWD)
- Non-hazardous waste disposed (NHWD)
- Radioactive waste disposed (RWD)
- Components for re-use (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)



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 laminated safety glass LSG (6FG - 1.52PVB - 6FG)																
	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	65.40	4.09	0.16	0.00	4.83E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.38	2.02	0.42	-3.44
GWP-f	kg CO_2 equivalent	65.16	4.10	4.29E-02	0.00	4.81E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.38	2.02	0.43	-3.42
GWP-b	kg CO_2 equivalent	0.21	-4.36E-02	0.12	0.00	2.23E-05	0.00	0.00	0.00	0.00	0.00	0.00	-4.08E-03	4.78E-03	-1.10E-02	-1.32E-02
GWP-l	kg CO_2 equivalent	2.38E-02	3.73E-02	1.34E-06	0.00	3.64E-07	0.00	0.00	0.00	0.00	0.00	0.00	3.50E-03	6.84E-05	1.34E-03	-4.72E-04
ODP	kg CFC-11-eq.	1.69E-07	5.24E-13	2.44E-14	0.00	6.20E-15	0.00	0.00	0.00	0.00	0.00	0.00	4.91E-14	1.04E-11	1.10E-12	-9.17E-12
AP	mol H^+-eq.	0.18	4.99E-03	3.43E-05	0.00	4.94E-06	0.00	0.00	0.00	0.00	0.00	0.00	6.85E-04	1.61E-03	3.07E-03	-2.06E-02
EP-fw	kg P-eq.	1.01E-04	1.47E-05	6.89E-09	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	1.38E-06	2.13E-06	8.71E-07	-2.42E-06
EP-m	kg N-eq.	3.61E-02	1.73E-03	1.03E-05	0.00	1.69E-06	0.00	0.00	0.00	0.00	0.00	0.00	2.76E-04	4.15E-04	7.92E-04	-6.00E-03
EP-t	mol N-eq.	0.50	2.03E-02	1.47E-04	0.00	1.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	3.15E-03	4.99E-03	8.72E-03	-6.83E-02
POCP	kg NMVOC-eq.	0.11	4.39E-03	2.82E-05	0.00	8.19E-06	0.00	0.00	0.00	0.00	0.00	0.00	6.15E-04	1.10E-03	2.39E-03	-1.20E-02
ADPF*[2]	MJ	971.32	54.86	6.01E-02	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.15	12.01	5.76	-53.27
ADPE*[2]	kg Sb equivalent	2.33E-06	2.65E-07	2.25E-10	0.00	1.38E-10	0.00	0.00	0.00	0.00	0.00	0.00	2.48E-08	8.74E-08	1.99E-08	-1.05E-07
WDP*[2]	m^3 world-eq. deprived	5.83	4.88E-02	2.20E-02	0.00	1.16E-02	0.00	0.00	0.00	0.00	0.00	0.00	4.56E-03	0.27	4.75E-02	-0.21
Resource management																
PERE	MJ	138.79	3.99	1.65	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.37	7.06	0.94	-6.20
PERM	MJ	1.26	0.00	-1.26	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	140.05	3.99	0.39	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.37	7.06	0.94	-6.20
PENRE	MJ	927.81	55.12	0.39	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.16	25.02	36.10	-53.27
PENRM	MJ	33.59	0.00	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.00	-23.34	0.00
PENRT	MJ	961.40	55.12	0.14	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.16	15.01	12.76	-53.27
SM*[3]	kg	7.65	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	0.19	4.38E-03	5.17E-04	0.00	2.88E-04	0.00	0.00	0.00	0.00	0.00	0.00	4.10E-04	9.11E-03	1.46E-03	-7.35E-03
Categories of waste																
HWD	kg	1.76E-06	1.70E-10	1.17E-12	0.00	1.78E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.60E-11	-4.87E-10	1.25E-10	-5.92E-09
NHWD	kg	2.65	8.40E-03	7.10E-03	0.00	1.24E-04	0.00	0.00	0.00	0.00	0.00	0.00	7.87E-04	3.97E-02	28.86	-0.41
RWD	kg	3.62E-02	1.03E-04	3.00E-06	0.00	3.62E-07	0.00	0.00	0.00	0.00	0.00	0.00	9.66E-06	1.86E-03	6.57E-05	-1.58E-03
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	6.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	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	2.30	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	0.00	0.00
EET	MJ	4.19	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.31	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 **M** - 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 laminated safety glass LSG (6FG - 1.52PVB - 6FG)															
	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Additional environmental impact indicators																
PM	Disease incidence	2.95E-06	3.52E-08	2.50E-10	0.00	3.43E-11	0.00	0.00	0.00	0.00	0.00	0.00	4.68E-09	1.23E-08	3.77E-08	-1.20E-07
IRP*1	kBq U235-eq.	5.83	1.53E-02	4.65E-04	0.00	4.02E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.44E-03	0.31	7.59E-03	-0.26
ETP-fw*2	CTUe	2155.66	39.00	3.07E-02	0.00	5.33E-02	0.00	0.00	0.00	0.00	0.00	0.00	3.65	5.27	3.15	-57.19
HTP-c*2	CTUh	5.18E-06	7.98E-10	2.29E-12	0.00	1.54E-12	0.00	0.00	0.00	0.00	0.00	0.00	7.48E-11	1.87E-10	4.84E-10	-4.03E-10
HTP-nc*2	CTUh	6.12E-04	4.26E-08	1.65E-10	0.00	7.41E-11	0.00	0.00	0.00	0.00	0.00	0.00	4.13E-09	5.14E-09	5.32E-08	-3.25E-08
SQP*2	dimensionless	179.05	23.01	1.70E-02	0.00	2.33E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.15	4.68	1.40	-4.35

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 Designated secondary material (SM) for laminated safety glass results from cullet used in primary glass production (see PG 1 Float glass in M-EPD-FEG-GB-001000)

Table 8 Overall results table for laminated safety glass LSG

Results per 1 m² and 1.52 mm PVB foil (individual evaluation)

	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	14.35	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97E-02	1.48	2.17E-02	-0.33
GWP-f	kg CO_2 equivalent	14.35	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.98E-02	1.48	2.22E-02	-0.32
GWP-b	kg CO_2 equivalent	-1.51E-03	-2.16E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.10E-04	3.53E-04	-5.68E-04	-2.39E-03
GWP-l	kg CO_2 equivalent	1.10E-03	1.85E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.79E-04	1.15E-05	6.90E-05	-1.95E-05
ODP	kg CFC-11-eq.	1.69E-07	2.60E-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.52E-15	7.54E-13	5.66E-14	-2.18E-12
AP	mol H^+-eq.	2.73E-02	2.48E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.52E-05	4.89E-04	1.57E-04	-3.73E-04
EP-fw	kg P-eq.	5.94E-06	7.31E-07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.10E-08	1.70E-07	4.47E-08	-4.53E-07
EP-m	kg N-eq.	5.24E-03	8.57E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-05	1.47E-04	4.07E-05	-1.13E-04
EP-t	mol N-eq.	5.52E-02	1.00E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61E-04	2.20E-03	4.49E-04	-1.21E-03
POCP	kg NMVOC-eq.	3.05E-02	2.17E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.16E-05	3.84E-04	1.23E-04	-3.16E-04
ADPF*[2]	MJ	275.11	2.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.98	0.30	-5.84
ADPE*[2]	kg Sb equivalent	7.80E-09	1.31E-08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28E-09	6.14E-09	1.02E-09	-2.04E-08
WDP*[2]	m^3 world-eq. deprived	0.32	2.42E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34E-04	0.15	2.44E-03	-2.65E-02
Resource management																
PERE	MJ	1.21	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.92E-02	0.47	4.82E-02	-1.49
PERM	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
PERT	MJ	1.21	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.92E-02	0.47	4.82E-02	-1.49
PENRE	MJ	231.79	2.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	13.98	30.63	-5.84
PENRM	MJ	33.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.00	-23.33	0.00
PENRT	MJ	265.12	2.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	3.98	7.30	-5.84
SM	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
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	7.50E-03	2.17E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11E-05	3.80E-03	7.48E-05	-1.21E-03
Categories of waste																
HWD	kg	5.01E-12	8.46E-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.22E-13	-2.19E-11	6.45E-12	-3.99E-10
NHWD	kg	2.47E-04	4.17E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.04E-05	3.16E-02	1.48	-2.72E-03
RWD	kg	2.60E-03	5.12E-06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.97E-07	1.07E-04	3.38E-06	-3.96E-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	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	0.00	0.00
EET	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	4.31	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

	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Results per 1 m² and 1.52 mm PVB foil (individual evaluation)																
Additional environmental impact indicators																
PM	Disease incidence	1.80E-07	1.74E-09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.41E-10	2.85E-09	1.94E-09	-3.17E-09
IRP*1	kBq U235-eq.	0.26	7.63E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.41E-05	1.70E-02	3.90E-04	-6.58E-02
ETP-fw*2	CTUe	26.05	1.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.40	0.16	-1.13
HTP-c*2	CTUh	1.24E-09	3.97E-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.85E-12	2.42E-11	2.48E-11	-6.22E-11
HTP-nc*2	CTUh	1.84E-08	2.12E-09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12E-10	1.14E-09	2.73E-09	-2.00E-09
SQP*2	dimensionless	0.67	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.35	7.19E-02	-0.98

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 Individual evaluation of the PVB foil of the LSG

Note: The values shown in Table 9 are limited to the environmental impacts caused by the use of PVB raw materials across all modules. Raw material-related environmental impacts in A1, transportation costs due to the amount of material used in A2, waste recycling in A3, etc. Expenses for the lamination process and other expenses are not considered here and are included in the overall results table for the LSG included in the balance sheet in Table 8.

Results per 1 m² insulating glass unit IGU double (4FG - A - 4FG)

	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	39.60	2.76	0.40	0.00	4.83E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.17	0.28	-2.38
GWP-f	kg CO_2 equivalent	39.77	2.77	0.14	0.00	4.81E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.17	0.29	-2.37
GWP-b	kg CO_2 equivalent	-0.21	-2.95E-02	0.25	0.00	2.23E-05	0.00	0.00	0.00	0.00	0.00	0.00	-2.71E-03	3.16E-03	-7.35E-03	-8.72E-03
GWP-l	kg CO_2 equivalent	4.41E-02	2.52E-02	3.64E-06	0.00	3.64E-07	0.00	0.00	0.00	0.00	0.00	0.00	2.33E-03	4.45E-05	8.94E-04	-3.62E-04
ODP	kg CFC-11-eq.	7.94E-07	3.55E-13	6.08E-14	0.00	6.20E-15	0.00	0.00	0.00	0.00	0.00	0.00	3.26E-14	6.90E-12	7.32E-13	-6.38E-12
AP	mol H^+-eq.	0.11	3.38E-03	7.58E-05	0.00	4.94E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.55E-04	1.02E-03	2.04E-03	-1.41E-02
EP-fw	kg P-eq.	7.64E-05	9.96E-06	1.69E-08	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	9.18E-07	1.40E-06	5.80E-07	-1.69E-06
EP-m	kg N-eq.	2.19E-02	1.17E-03	2.22E-05	0.00	1.69E-06	0.00	0.00	0.00	0.00	0.00	0.00	1.83E-04	2.60E-04	5.28E-04	-4.05E-03
EP-t	mol N-eq.	0.32	1.37E-02	3.25E-04	0.00	1.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	2.09E-03	3.08E-03	5.80E-03	-4.61E-02
POCP	kg NMVOC-eq.	6.22E-02	2.96E-03	6.12E-05	0.00	8.19E-06	0.00	0.00	0.00	0.00	0.00	0.00	4.08E-04	6.89E-04	1.59E-03	-8.19E-03
ADPF*[2]	MJ	553.02	37.18	0.15	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	3.42	7.94	3.84	-36.68
ADPE*[2]	kg Sb equivalent	2.53E-05	1.79E-07	5.56E-10	0.00	1.38E-10	0.00	0.00	0.00	0.00	0.00	0.00	1.65E-08	5.79E-08	1.33E-08	-1.16E-06
WDP*[2]	m^3 world-eq. deprived	3.14	3.29E-02	5.03E-02	0.00	1.16E-02	0.00	0.00	0.00	0.00	0.00	0.00	3.03E-03	0.16	3.16E-02	-0.16
Resource management																
PERE	MJ	79.02	2.70	3.37	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.25	4.68	0.62	-4.46
PERM	MJ	2.56	0.00	-2.56	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	81.59	2.70	0.81	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.25	4.68	0.62	-4.46
PENRE	MJ	529.17	37.31	1.28	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	3.43	14.80	19.83	-36.68
PENRM	MJ	18.44	0.00	-0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.27	-12.30	0.00
PENRT	MJ	547.62	37.31	0.41	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	3.43	9.52	7.53	-36.68
SM*[3]	kg	5.60	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	0.12	2.96E-03	1.19E-03	0.00	2.88E-04	0.00	0.00	0.00	0.00	0.00	0.00	2.73E-04	5.66E-03	9.69E-04	-5.65E-03
Categories of waste																
HWD	kg	1.30E-06	1.15E-10	2.54E-12	0.00	1.78E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.06E-11	-3.24E-10	8.35E-11	-3.98E-09
NHWD	kg	1.69	5.68E-03	1.95E-02	0.00	1.24E-04	0.00	0.00	0.00	0.00	0.00	0.00	5.23E-04	2.26E-02	19.11	-0.28
RWD	kg	1.36E-02	6.97E-05	7.03E-06	0.00	3.62E-07	0.00	0.00	0.00	0.00	0.00	0.00	6.42E-06	1.24E-03	4.37E-05	-1.11E-03
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	6.70	0.00	3.71E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.03	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	0.69	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.00	0.00
EET	MJ	1.28	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	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 insulating glass unit IGU double (4FG - A - 4FG)																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	2.09E-06	2.38E-08	5.92E-10	0.00	3.43E-11	0.00	0.00	0.00	0.00	0.00	0.00	3.11E-09	7.88E-09	2.51E-08	-8.54E-08
IRP*[1]	kBq U235-eq.	2.11	1.04E-02	1.08E-03	0.00	4.02E-05	0.00	0.00	0.00	0.00	0.00	0.00	9.58E-04	0.21	5.06E-03	-0.18
ETP-fw*[2]	CTUe	2185.56	26.39	7.79E-02	0.00	5.33E-02	0.00	0.00	0.00	0.00	0.00	0.00	2.43	3.48	2.09	-38.71
HTP-c*[2]	CTUh	3.94E-06	5.40E-10	5.60E-12	0.00	1.54E-12	0.00	0.00	0.00	0.00	0.00	0.00	4.97E-11	1.22E-10	3.22E-10	-3.54E-10
HTP-nc*[2]	CTUh	4.49E-04	2.89E-08	4.29E-10	0.00	7.41E-11	0.00	0.00	0.00	0.00	0.00	0.00	2.74E-09	3.30E-09	3.54E-08	-2.22E-08
SQP*[2]	dimensionless	181.87	15.47	4.07E-02	0.00	2.33E-03	0.00	0.00	0.00	0.00	0.00	0.00	1.43	3.09	0.93	-3.06

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 insulating glass unit results from cullet used in primary glass production (see PG 1 Float glass in M-EPD-FEG-GB-001000)

Table 10 Overall results table of insulating glass unit IGU double

Results per spacer "A" related to 1 m² IGU double structure 4FG - A - 4FG (individual evaluation)

	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	0.73	2.27E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.21E-03	8.99E-02	2.43E-03	-8.18E-02
GWP-f	kg CO_2 equivalent	0.73	2.28E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.21E-03	8.98E-02	2.48E-03	-8.19E-02
GWP-b	kg CO_2 equivalent	1.45E-03	-2.42E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.35E-05	3.36E-05	-6.36E-05	1.63E-04
GWP-l	kg CO_2 equivalent	5.21E-04	2.07E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.02E-05	8.42E-07	7.74E-06	-4.70E-05
ODP	kg CFC-11-eq.	3.08E-12	2.91E-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.82E-16	7.23E-14	6.33E-15	-2.13E-13
AP	mol H^+-eq.	3.41E-03	2.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.94E-06	3.22E-05	1.77E-05	-3.61E-04
EP-fw	kg P-eq.	1.15E-06	8.18E-08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.94E-09	1.57E-08	5.01E-09	-6.00E-08
EP-m	kg N-eq.	4.51E-04	9.59E-06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.59E-06	9.49E-06	4.56E-06	-4.89E-05
EP-t	mol N-eq.	4.97E-03	1.12E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81E-05	1.38E-04	5.02E-05	-5.39E-04
POCP	kg NMVOC-eq.	1.68E-03	2.43E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.54E-06	2.48E-05	1.38E-05	-1.51E-04
ADPF*2	MJ	12.73	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.96E-02	8.96E-02	3.32E-02	-1.13
ADPE*2	kg Sb equivalent	1.04E-05	1.47E-09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43E-10	5.95E-10	1.15E-10	-1.09E-06
WDP*2	m^3 world-eq. deprived	0.11	2.70E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.63E-05	9.54E-03	2.73E-04	-1.73E-02
Resource management																
PERE	MJ	2.69	2.22E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16E-03	4.67E-02	5.40E-03	-0.27
PERM	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
PERT	MJ	2.69	2.22E-02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16E-03	4.67E-02	5.40E-03	-0.27
PENRE	MJ	10.34	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98E-02	0.81	1.72	-1.13
PENRM	MJ	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.56	-1.30	0.00
PENRT	MJ	12.19	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98E-02	0.26	0.42	-1.13
SM	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
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	5.43E-03	2.43E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.35E-06	2.41E-04	8.37E-06	-7.07E-04
Categories of waste																
HWD	kg	1.29E-07	9.48E-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.20E-14	-2.63E-12	7.22E-13	-4.58E-11
NHWD	kg	7.82E-02	4.67E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.52E-06	1.90E-03	0.17	-7.21E-03
RWD	kg	3.98E-04	5.73E-07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56E-08	1.13E-05	3.78E-07	-4.73E-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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56E-02	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00
EET	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	0.26	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 spacer "A" related to 1 m² IGU double structure 4FG - A - 4FG (individual evaluation)

	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Additional environmental impact indicators																
PM	Disease incidence	4.46E-08	1.95E-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.69E-11	1.96E-10	2.17E-10	-5.03E-09
IRP*[1]	kBq U235-eq.	6.39E-02	8.54E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.29E-06	1.85E-03	4.37E-05	-8.96E-03
ETP-fw*[2]	CTUe	5.99	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11E-02	3.77E-02	1.81E-02	-0.56
HTP-c*[2]	CTUh	1.42E-07	4.43E-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30E-13	1.90E-12	2.78E-12	-8.47E-11
HTP-nc*[2]	CTUh	9.42E-09	2.37E-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.38E-11	7.90E-11	3.06E-10	-5.51E-10
SQP*[2]	dimensionless	1.58	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24E-02	3.32E-02	8.05E-03	-0.13

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 11 Individual evaluation of spacer "A" of the IGU double

Note: The values shown in Table 11 are limited to the environmental impacts across all modules caused by the raw material use of the balanced spacer "A" material mix (see Table 5). Raw material-related environmental impacts in A1, transportation costs due to the amount of material used in A2, waste recycling in A3, etc.). Sealants, desiccants and gas filling (argon) as well as assembly processes are not considered here and are included in the overall results table of the balanced IGU double in Table 10.

	Results per 1 m^2 insulating glass unit IGU triple (4FG - A - 4FG - A - 4FG)															
	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	57.01	4.05	0.45	0.00	4.83E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.38	1.50	0.42	-3.46
GWP-f	kg CO_2 equivalent	57.20	4.06	0.13	0.00	4.81E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.38	1.50	0.43	-3.45
GWP-b	kg CO_2 equivalent	-0.26	-4.31E-02	0.31	0.00	2.23E-05	0.00	0.00	0.00	0.00	0.00	0.00	-4.03E-03	4.68E-03	-1.09E-02	-1.24E-02
GWP-l	kg CO_2 equivalent	6.46E-02	3.69E-02	3.72E-06	0.00	3.64E-07	0.00	0.00	0.00	0.00	0.00	0.00	3.46E-03	6.47E-05	1.33E-03	-5.31E-04
ODP	kg CFC-11-eq.	7.38E-07	5.19E-13	6.60E-14	0.00	6.20E-15	0.00	0.00	0.00	0.00	0.00	0.00	4.85E-14	1.02E-11	1.09E-12	-8.96E-12
AP	mol H^+-eq.	0.16	4.94E-03	8.68E-05	0.00	4.94E-06	0.00	0.00	0.00	0.00	0.00	0.00	6.76E-04	1.44E-03	3.03E-03	-2.10E-02
EP-fw	kg P-eq.	1.03E-04	1.46E-05	1.85E-08	0.00	1.01E-08	0.00	0.00	0.00	0.00	0.00	0.00	1.37E-06	2.08E-06	8.61E-07	-2.39E-06
EP-m	kg N-eq.	3.21E-02	1.72E-03	2.54E-05	0.00	1.69E-06	0.00	0.00	0.00	0.00	0.00	0.00	2.72E-04	3.64E-04	7.83E-04	-6.03E-03
EP-t	mol N-eq.	0.47	2.00E-02	3.71E-04	0.00	1.77E-05	0.00	0.00	0.00	0.00	0.00	0.00	3.11E-03	4.23E-03	8.62E-03	-6.87E-02
POCP	kg NMVOC-eq.	8.82E-02	4.34E-03	6.97E-05	0.00	8.19E-06	0.00	0.00	0.00	0.00	0.00	0.00	6.07E-04	9.66E-04	2.37E-03	-1.22E-02
ADPF*[2]	MJ	777.11	54.34	0.16	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.08	11.73	5.69	-53.27
ADPE*[2]	kg Sb equivalent	3.99E-05	2.63E-07	6.07E-10	0.00	1.38E-10	0.00	0.00	0.00	0.00	0.00	0.00	2.46E-08	8.57E-08	1.98E-08	-1.58E-06
WDP*[2]	m^3 world-eq. deprived	4.65	4.82E-02	5.79E-02	0.00	1.16E-02	0.00	0.00	0.00	0.00	0.00	0.00	4.51E-03	0.22	4.69E-02	-0.22
Resource management																
PERE	MJ	110.60	3.95	4.18	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.37	6.94	0.93	-6.22
PERM	MJ	3.18	0.00	-3.18	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	113.78	3.95	0.99	0.00	3.26E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.37	6.94	0.93	-6.22
PENRE	MJ	747.43	54.60	1.18	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.10	20.41	25.94	-53.34
PENRM	MJ	23.03	0.00	-0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-6.67	-15.57	0.00
PENRT	MJ	770.45	54.60	0.40	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	5.10	13.74	10.37	-53.34
SM*[3]	kg	8.27	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	0.17	4.33E-03	1.37E-03	0.00	2.88E-04	0.00	0.00	0.00	0.00	0.00	0.00	4.04E-04	7.80E-03	1.44E-03	-7.98E-03
Categories of waste																
HWD	kg	1.92E-06	1.69E-10	2.93E-12	0.00	1.78E-11	0.00	0.00	0.00	0.00	0.00	0.00	1.57E-11	-4.82E-10	1.24E-10	-5.87E-09
NHWD	kg	2.52	8.32E-03	1.98E-02	0.00	1.24E-04	0.00	0.00	0.00	0.00	0.00	0.00	7.77E-04	2.85E-02	28.47	-0.42
RWD	kg	1.96E-02	1.02E-04	7.96E-06	0.00	3.62E-07	0.00	0.00	0.00	0.00	0.00	0.00	9.54E-06	1.83E-03	6.49E-05	-1.55E-03
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	9.42	0.00	4.79E-04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.04	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	0.96	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.00	0.00
EET	MJ	1.79	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	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 insulating glass unit IGU triple (4FG - A - 4FG - A - 4FG)															
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	3.06E-06	3.48E-08	6.58E-10	0.00	3.43E-11	0.00	0.00	0.00	0.00	0.00	0.00	4.62E-09	1.13E-08	3.73E-08	-1.26E-07
IRP*[1]	kBq U235-eq.	3.10	1.52E-02	1.23E-03	0.00	4.02E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.42E-03	0.30	7.50E-03	-0.26
ETP-fw*[2]	CTUe	2986.10	38.61	8.35E-02	0.00	5.33E-02	0.00	0.00	0.00	0.00	0.00	0.00	3.60	5.15	3.11	-57.68
HTP-c*[2]	CTUh	5.80E-06	7.90E-10	6.27E-12	0.00	1.54E-12	0.00	0.00	0.00	0.00	0.00	0.00	7.38E-11	1.79E-10	4.78E-10	-5.02E-10
HTP-nc*[2]	CTUh	6.63E-04	4.23E-08	4.68E-10	0.00	7.41E-11	0.00	0.00	0.00	0.00	0.00	0.00	4.08E-09	4.75E-09	5.25E-08	-3.27E-08
SQP*[2]	dimensionless	257.14	22.75	4.54E-02	0.00	2.33E-03	0.00	0.00	0.00	0.00	0.00	0.00	2.12	4.58	1.38	-4.30

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 insulating glass unit results from cullet used in primary glass production (see PG 1 Float glass in M-EPD-FEG-GB-001000)

Table 12 Overall results table of insulating glass unit IGU triple

Results per spacer "A" related to 1 m² IGU triple structure 4FG - A - 4FG - A - 4FG (individual evaluation)

	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	0.98	3.12E-02	0.00	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.00	3.02E-03	0.12	3.33E-03	-0.11
GWP-f	kg CO_2 equivalent	0.98	3.12E-02	0.00	0.00	0.00	0.00	1.03	0.00	0.00	0.00	0.00	3.03E-03	0.12	3.41E-03	-0.11
GWP-b	kg CO_2 equivalent	2.01E-03	-3.31E-04	0.00	0.00	0.00	0.00	1.83E-03	0.00	0.00	0.00	0.00	-3.21E-05	4.60E-05	-8.70E-05	2.21E-04
GWP-l	kg CO_2 equivalent	7.11E-04	2.83E-04	0.00	0.00	0.00	0.00	9.70E-04	0.00	0.00	0.00	0.00	2.76E-05	1.16E-06	1.06E-05	-6.40E-05
ODP	kg CFC-11-eq.	4.21E-12	3.98E-15	0.00	0.00	0.00	0.00	4.04E-12	0.00	0.00	0.00	0.00	3.87E-16	9.92E-14	8.66E-15	-2.90E-13
AP	mol H^+-eq.	4.57E-03	3.80E-05	0.00	0.00	0.00	0.00	4.20E-03	0.00	0.00	0.00	0.00	5.40E-06	4.45E-05	2.42E-05	-4.85E-04
EP-fw	kg P-eq.	1.58E-06	1.12E-07	0.00	0.00	0.00	0.00	1.65E-06	0.00	0.00	0.00	0.00	1.09E-08	2.15E-08	6.85E-09	-8.12E-08
EP-m	kg N-eq.	6.05E-04	1.31E-05	0.00	0.00	0.00	0.00	5.74E-04	0.00	0.00	0.00	0.00	2.17E-06	1.31E-05	6.24E-06	-6.53E-05
EP-t	mol N-eq.	6.68E-03	1.53E-04	0.00	0.00	0.00	0.00	6.40E-03	0.00	0.00	0.00	0.00	2.47E-05	1.91E-04	6.86E-05	-7.21E-04
POCP	kg NMVOC-eq.	2.28E-03	3.33E-05	0.00	0.00	0.00	0.00	2.17E-03	0.00	0.00	0.00	0.00	4.84E-06	3.43E-05	1.89E-05	-2.01E-04
ADPF*²	MJ	17.38	0.42	0.00	0.00	0.00	0.00	16.50	0.00	0.00	0.00	0.00	4.06E-02	0.12	4.54E-02	-1.51
ADPE*²	kg Sb equivalent	1.42E-05	2.02E-09	0.00	0.00	0.00	0.00	1.27E-05	0.00	0.00	0.00	0.00	1.96E-10	8.16E-10	1.57E-10	-1.48E-06
WDP*²	m³ world-eq. deprived	0.15	3.71E-04	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	3.59E-05	1.31E-02	3.73E-04	-2.35E-02
Resource management																
PERE	MJ	3.60	3.04E-02	0.00	0.00	0.00	0.00	3.35	0.00	0.00	0.00	0.00	2.95E-03	6.40E-02	7.38E-03	-0.36
PERM	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
PERT	MJ	3.60	3.04E-02	0.00	0.00	0.00	0.00	3.35	0.00	0.00	0.00	0.00	2.95E-03	6.40E-02	7.38E-03	-0.36
PENRE	MJ	14.02	0.42	0.00	0.00	0.00	0.00	16.50	0.00	0.00	0.00	0.00	4.07E-02	1.13	2.40	-1.51
PENRM	MJ	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.78	-1.81	0.00
PENRT	MJ	16.61	0.42	0.00	0.00	0.00	0.00	16.50	0.00	0.00	0.00	0.00	4.07E-02	0.36	0.59	-1.51
SM	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
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	m³	7.22E-03	3.33E-05	0.00	0.00	0.00	0.00	6.65E-03	0.00	0.00	0.00	0.00	3.22E-06	3.32E-04	1.15E-05	-9.45E-04
Categories of waste																
HWD	kg	1.81E-07	1.30E-12	0.00	0.00	0.00	0.00	1.81E-07	0.00	0.00	0.00	0.00	1.26E-13	-3.59E-12	9.87E-13	-6.17E-11
NHWD	kg	0.10	6.38E-05	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	6.20E-06	2.63E-03	0.23	-9.31E-03
RWD	kg	5.33E-04	7.84E-07	0.00	0.00	0.00	0.00	4.88E-04	0.00	0.00	0.00	0.00	7.61E-08	1.55E-05	5.17E-07	-6.25E-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	0.00	0.00	0.00	0.00	0.00	0.00	3.46E-02	0.00	0.00	0.00	0.00	0.00	3.46E-02	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	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00
EET	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.35	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 spacer "A" related to 1 m² IGU triple structure 4FG - A - 4FG - A - 4FG (individual evaluation)

	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Additional environmental impact indicators																
PM	Disease incidence	5.99E-08	2.68E-10	0.00	0.00	0.00	0.00	5.40E-08	0.00	0.00	0.00	0.00	3.68E-11	2.70E-10	2.96E-10	-6.79E-09
IRP*1	kBq U235-eq.	8.48E-02	1.17E-04	0.00	0.00	0.00	0.00	7.58E-02	0.00	0.00	0.00	0.00	1.13E-05	2.52E-03	5.98E-05	-1.18E-02
ETP-fw*2	CTUe	8.19	0.30	0.00	0.00	0.00	0.00	7.83	0.00	0.00	0.00	0.00	2.87E-02	5.17E-02	2.47E-02	-0.76
HTP-c*2	CTUh	1.94E-07	6.06E-12	0.00	0.00	0.00	0.00	1.94E-07	0.00	0.00	0.00	0.00	5.89E-13	2.61E-12	3.81E-12	-1.15E-10
HTP-nc*2	CTUh	1.27E-08	3.24E-10	0.00	0.00	0.00	0.00	1.29E-08	0.00	0.00	0.00	0.00	3.25E-11	1.09E-10	4.19E-10	-7.35E-10
SQP*2	dimensionless	2.15	0.17	0.00	0.00	0.00	0.00	2.22	0.00	0.00	0.00	0.00	1.69E-02	4.54E-02	1.10E-02	-0.18

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 13 Individual evaluation of spacer "A" of IGU triple

Note: The values shown in Table 13 are limited to the environmental impacts across all modules caused by the raw material use of the balanced spacer "A" material mix (see Table 5). Raw material-related environmental impacts in A1, transportation costs due to the amount of material used in A2, waste recycling in A3, etc.). Sealants, desiccants and gas filling (argon) as well as assembly processes are not considered here and are included in the overall results table of the balanced IGU triple in Table 12.

Calculation example for laminated safety glass

Based on the modeled structure, both the type of glass (FG and TSG, heat soaked TSG and HSG or LSG) and the thickness of the individual components (pane, PVB foil) can be calculated individually.

E.g., conversion of modeled laminated safety glass

- Structure (6 mm FG, 1.52 mm PVB, 6 mm FG) on
- Exemplary structure (6 mm FG, 1.52 mm PVB, **4 mm TSG**)

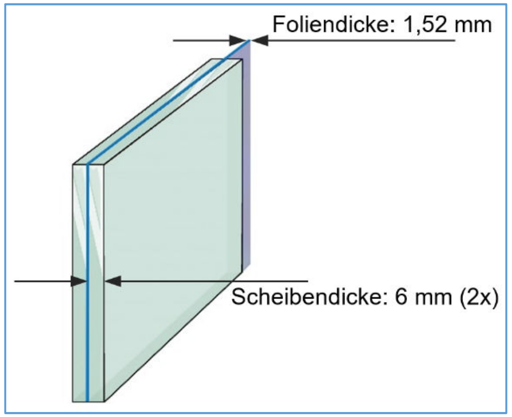


Illustration 5 Laminated safety glass
(© Bundesverband Flachglas e. V.)

Conversion for the **environmental impact category GWP-t (A1-A3)**

		GWP-t (A1-A3)	
Laminated safety glass LSG (6FG - 1.52PVB - 6FG)		65.40	kg CO_2 equivalent
- 6 mm FG	6x	3.06	kg CO_2 equivalent
+ 4 mm TSG	4x	4.74	kg CO_2 equivalent
Laminated safety glass LSG (6FG - 1.52PVB - **4LSG**)		**66.00**	**kg CO_2 equiv.**

For the example calculation, the values for FG (PG 1) as well as TSG, HS TSG und HSG (PG 2) from M-EPD-FEG-GB-00100 (Tables 9 and 10) and the values for LSG from this model EPD (see Table 8) are used in each case. The M-EPD-FEG-GB-00100 is available on the website of ift Rosenheim (https://www.ift-rosenheim.de/erstellte-epds; Filter on product group (EPD): Glass, Type: Muster-EPD) **and in the ÖKOBAUDAT for download.**

The procedure shown for converting the environmental impacts from the modeled structure to the desired structure must be **carried out individually for each life cycle module and each environmental impact category (except B2 and B4)** in order to obtain a complete overall results table for the desired structure!

Note: B2 is independent of thickness and only refers to 1 m² of surface. B2 is identical for each glass product/structure per 1 m².
B4 is the sum of all A and C modules plus module D and is to be calculated at the end for the values obtained for the individual structure.

If another film is to be used instead of the PVB film (e.g. SentryGlas®), the results of the individual evaluation of the PVB foil (see Table 9) can be subtracted from the results of the modelled laminated safety glass structure (see Table 8) in order to then add the values of the desired film per 1 m². Calculated expenses of the lamination process remain unaffected and are included in the overall results table of the balanced LSG structure.
For the use of coated float glass, values from a separate EPD for coated float glass must be used, as the values from M-EPD-FEG-GB-00100 (Table 9) only cover uncoated float glass.

Calculation example for insulating glass unit

Based on the modeled structure, both the type of glass (FG, as well as TSG, HS TSG and HSG or LSG) and the thickness of the individual components (panes, PVB foil if necessary) can be calculated individually.
The size of the modeled distance "A" is not specified and therefore not scalable.

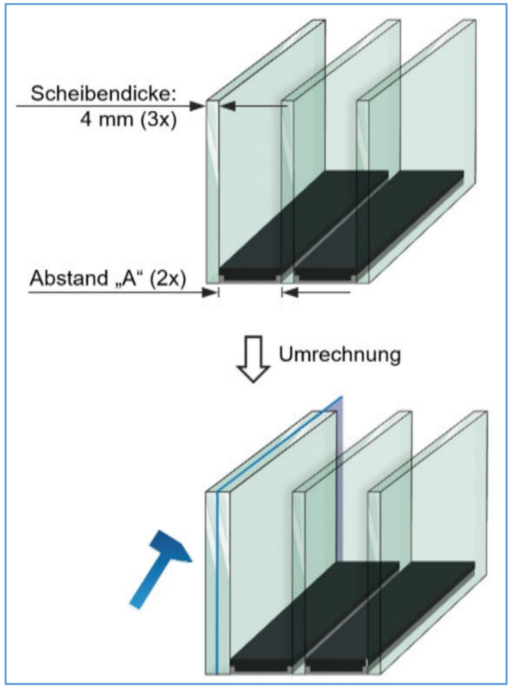


Illustration 6 Insulating glass unit
(© Bundesverband Flachglas e. V.)

E.g., conversion of modeled insulating glass unit IGU triple

- Structure (4 mm FG - A - 4 mm FG - A - 4 mm FG) on
- Exemplary structure (4 mm FG - A - **4 mm TSG** - A - **LSG (6FG-2PVB-4TSG)**)

Conversion for the **environmental impact category GWP-t (A1-A3)**

		GWP-t (A1-A3)	
IGU triple structure (4FG - A - 4FG - A - 4FG)		57.01	kg CO_2 equivalent
- 2*(4 mm FG)	8x	3.06	kg CO_2 equivalent
+ 4 mm TSG	4x	4.74	kg CO_2 equivalent
+ LSG (6FG - 1.52PVB - 4TSG) see calculation example page 29	1x	66.00	kg CO_2 equivalent
IGU triple structure (4FG - A - 4TSG - LSG (6FG - 1.52PVB - 4TSG)		**117.49**	**kg CO_2 equiv.**

For the example calculation, the values for FG (PG 1) as well as TSG, HS TSG und HSG (PG 2) from M-EPD-FEG-GB-00100 (Tables 9 and 10) and the values for IGU triple from this model EPD (see Table 12) are used in each case. The M-EPD-FEG-GB-00100 is available on the website of ift Rosenheim (https://www.ift-rosenheim.de/erstellte-epds; Filter on product group (EPD): Glass, Type: Muster-EPD) **and in the ÖKOBAUDAT for download.**

The procedure shown for converting the environmental impacts from the modeled structure to the desired structure must be **carried out individually for each life cycle module and each environmental impact category (except B2 and B4)** in order to obtain a complete overall results table for the desired structure!

Note: B2 is independent of thickness and only refers to 1 m² of surface. B2 is identical for each glass product/structure per 1 m².
B4 is the sum of all A and C modules plus module D and is to be calculated at the end for the values obtained for the individual structure.

If a different spacer is to be calculated instead of the modeled spacer "A", the results of the individual evaluation of the spacer "A" (see Table 11 and Table 13) can be subtracted from the results of the modeled insulating glass unit (see Table 10 and Table 12) in order to then add the values of the desired spacer per 1 m².

Calculated expenses for the assembly process remain unaffected by this and are included in the overall results table for the balanced insulating glass units (Table 10 and Table 12). Scaling/replacement of the sealants, desiccants and gas filling of the cavity is not possible, but can be neglected due to marginal environmental effects.

For the use of coated float glass, values from a separate EPD for coated float glass must be used, as the values from M-EPD-FEG-GB-00100 (Table 9) only cover uncoated float glass.

In the case of a recalculation of a laminated safety glass or a insulating glass unit with coated float glass, the values for uncoated float glass must first be subtracted from the results of the modeled glasses, as shown in the calculation examples, so that the values for coated float glass can then be added to a separate EPD.

E.g., conversion of modeled laminated safety glass

- Structure (6 mm FG, 1.52 mm PVB, 6 mm FG) on
- Exemplary structure (6 mm FG, 1.52 mm PVB, **4 mm FG_{coated}**)

Conversion for the **environmental impact category GWP-t (A1-A3)**

		GWP-t (A1-A3)	
Laminated safety glass LSG (6FG - 1.52PVB - 6FG)		65.40	kg CO_2 equivalent
- 6 mm FG	6x	3.06	kg CO_2 equivalent
+ 4 mm FG_{coated}	4x	x.xx	kg CO_2 equivalent
Laminated safety glass LSG (6FG - 1.52PVB - FG_{coated})		**xx.xx**	**kg CO_2 equiv.**

At this point, the values from the corresponding results table of the desired EPD for coated float glass for the selected environmental impact category GWP-t (A1-A3) are to be used.

6.4 Interpretation, LCA presentation and critical review

Evaluation

The environmental impacts of

- Laminated safety glass LSG (PG 3)
- Insulating glass unit IGU double structure (PG 4)
- Insulating glass unit IGU triple structure (PG 5)

differ considerably from each other. The differences lie primarily in the varying use of float glass and the other use of different pre-products and raw materials. This also means significantly different product weights. This was to be expected in particular due to the different glass thicknesses and different numbers of panes per product group.

In terms of production, the environmental impact of laminated safety glass is mainly due to the amount of float glass used, followed by the use of PVB foil. Marginal shares are attributable to electricity requirements. The use of float glass also dominates the environmental impact of insulating glass units. Marginal shares of the environmental impact are attributable to electricity requirements and the use of polysulphide and polyisobutylene as sealants in the spacers.
For the utilisation phase, an identical amount of environmental impact is attributable exclusively to cleaning during the 30-year service life and does not represent a significant proportion of the total environmental impact.

In scenario C4, only marginal expenditures for the physical pretreatment and the landfill operation are to be expected, as all product groups are predominantly inert substances for disposal.
For glass recycling (downcycling to container glass), 8 % for laminated safety glass as well as each approx. 9 % for insulating glass unit double and triple structure of the life cycle environmental impacts of the core indicators without WDP in scenario D can be credited. For both insulating glass units, round 1 % is still accounted for by recycling of aluminum and stainless steel.

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. Modeling of deviating superstructures for LSG, IGU double and triple
4. Specification of a size-unspecific average spacer "A" with a defined material mix (see Table 5)

5. Selection of other, more suitable "LCA for Experts" datasets
6. Amendment of background data in "LCA for Experts" (version update)
7. Update of modeling basis due to revision of EN 15804+A1 to EN 15804+A2
8. Use of a safety margin of 30 % on all results
9. 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:

10. 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.
11. Consequently, renaming of the EPD to EPD "Laminated safety glass and insulating glass unit (double and triple structure)" including changed declaration number to M-EPD-VMG and resetting of the sequence number to "-001000" in each case.
12. Addition of separate results tables for PVB foil (LSG, PG 3) and cavity (IGU double and triple, PG 4 and PG 5) as well as a more detailed description for converting the environmental impacts of modelled superstructures to desired superstructures

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

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

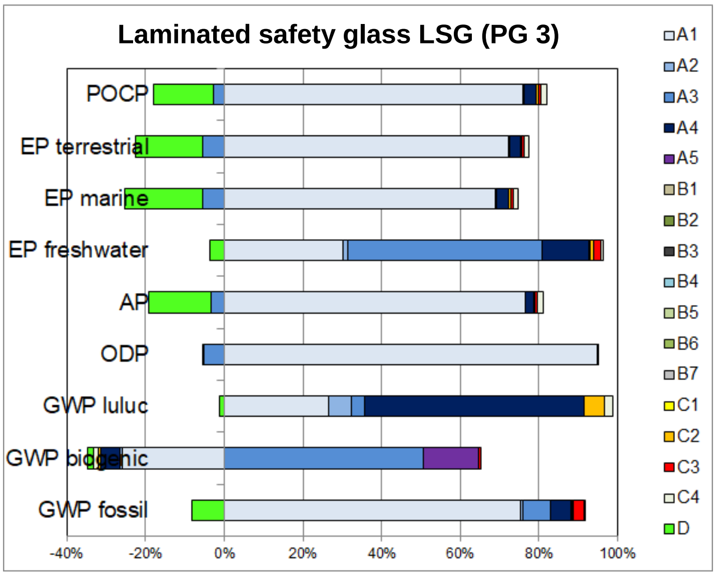


Illustration 7 Percentage of the modules in selected environmental impact categories (LSG)

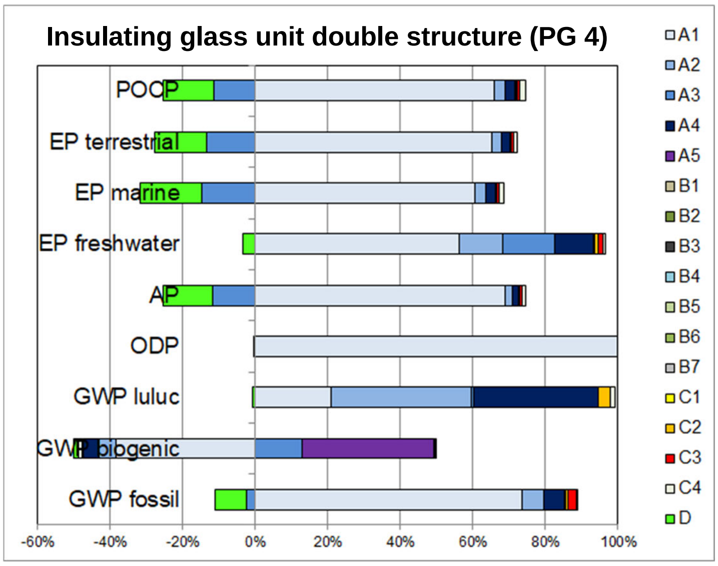


Illustration 8 Percentage of the modules in selected environmental impact categories (IGU double)

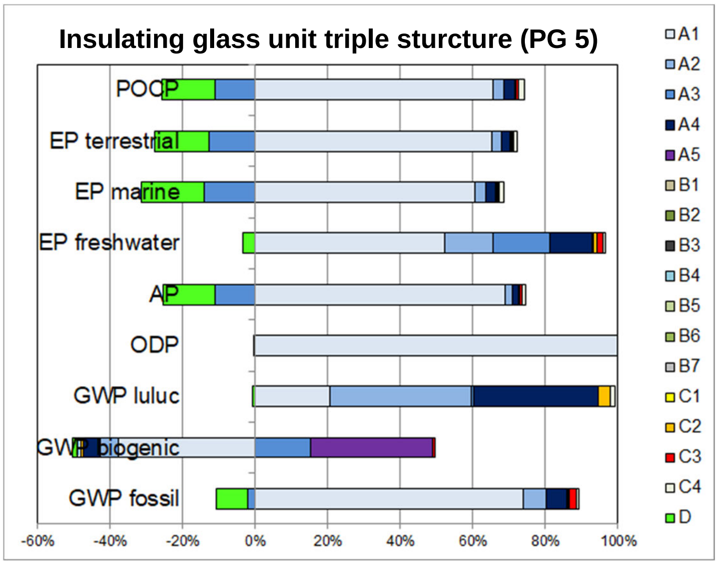


Illustration 9 Percentage of the modules in selected environmental impact categories (IGU triple)

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
2	20.02.2024	Adjustment flow chart	Pscherer	-

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9 Annex

Description of life cycle scenarios for Laminated safety glass and insulating glass unit (double and triple structure)

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

Table 14 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]
LSG	**32.78**	**2.34**	**< 1**
IGU double	**22.16**	**0.66[3]**	**< 1**
IGU triple	**32.45**	**0.29[3]**	**< 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

[3] Explanation see footnotes Table 2

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 the declaration holder/manufacturer.

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 the declaration holder/manufacturer.

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 the declaration holder/manufacturer.

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	LSG, IGU double and IGU triple	LSG	IGU double	IGU triple
		B4.1	B4.2	B4.2	B4.2
Core indicators					
GWP-t	kg CO_2 equivalent	**0.00**	69.04	42.10	60.33
GWP-f	kg CO_2 equivalent	**0.00**	68.71	42.03	60.24
GWP-b	kg CO_2 equivalent	**0.00**	0.27	-2.02E-03	-9.75E-03
GWP-l	kg CO_2 equivalent	**0.00**	6.55E-02	7.22E-02	0.11
ODP	kg CFC-11-eq.	**0.00**	1.69E-07	7.94E-07	7.38E-07
AP	mol H^+-eq.	**0.00**	0.17	0.11	0.15
EP-fw	kg P-eq.	**0.00**	1.18E-04	8.76E-05	1.19E-04
EP-m	kg N-eq.	**0.00**	3.33E-02	2.00E-02	2.93E-02
EP-t	mol N-eq.	**0.00**	0.47	0.30	0.44
POCP	kg NMVOC-eq.	**0.00**	0.11	5.97E-02	8.44E-02
ADPF	MJ	**0.00**	995.89	568.86	800.85
ADPE	kg Sb equivalent	**0.00**	2.62E-06	2.44E-05	3.87E-05
WDP	m^3 world-eq. deprived	**0.00**	6.02	3.26	4.80
Resource management					
PERE	MJ	**0.00**	146.60	86.19	120.75
PERM	MJ	**0.00**	0.00	0.00	0.00
PERT	MJ	**0.00**	146.60	86.19	120.75
PENRE	MJ	**0.00**	996.32	569.14	801.31
PENRM	MJ	**0.00**	7.11E-15	0.00	-3.55E-15
PENRT	MJ	**0.00**	996.32	569.14	801.31
SM	kg	**0.00**	7.65	5.60	8.27
RSF	MJ	**0.00**	0.00	0.00	0.00
NRSF	MJ	**0.00**	0.00	0.00	0.00
FW	m^3	**0.00**	0.20	0.13	0.18
Categories of waste					
HWD	kg	**0.00**	1.75E-06	1.30E-06	1.91E-06
NHWD	kg	**0.00**	31.16	20.57	30.63
RWD	kg	**0.00**	3.66E-02	1.39E-02	2.01E-02
Output material flows					
CRU	kg	**0.00**	0.00	0.00	0.00
MFR	kg	**0.00**	15.59	12.73	18.46
MER	kg	**0.00**	0.00	0.00	0.00
EEE	MJ	**0.00**	4.41	2.28	2.79
EET	MJ	**0.00**	8.91	4.64	5.68
Additional environmental impact indicators					
PM	Disease incidence	**0.00**	2.92E-06	2.06E-06	3.02E-06
IRP	kBq U235-eq.	**0.00**	5.90	2.15	3.17
ETPfw	CTUe	**0.00**	2149.56	2181.33	2978.97
HTPc	CTUh	**0.00**	5.18E-06	3.94E-06	5.80E-06

HTPnc	CTUh	**0.00**	6.12E-04	4.49E-04	6.63E-04
SQP	dimensionless	**0.00**	205.96	199.78	283.71

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 the declaration holder/manufacturer.

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 the collection point with 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
LSG	31.63	31.63
IGU double	21.21	21.21
IGU triple	31.35	31.35

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** **Based on EN 17213*:** • **Plastics (PVB foil, sealants, spacer components including glass fibre content) 100 % thermal recycling,** • **Metals (aluminium, stainless steel) 100% recycled,** • **Remainder to landfill/disposal.** *Assumption made due to primary installation in windows and doors.
C3.2	Current market situation (according to research project)	Share for recirculation of materials Based on the research project: • 90% glass in melt • Plastics (PVB foil, sealants, spacer components including glass fibre content) 100 % thermal recycling, • Metals (aluminum, stainless steel) 90 % recycled, • Remainder to landfill/disposal.

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	LSG		IGU double		IGU triple	
		C3.1	C3.2	**C3.1**	C3.2	**C3.1**	C3.2
Collection process, collected separately	kg	**9.49**	30.05	**6.31**	19.98	**9.37**	29.67
Collection process, collected as mixed construction waste	kg	**21.10**	1.58	**14.72**	1.05	**21.86**	1.56
Recovery system, for re-use	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Recovery system, for recycling	kg	**9.00**	25.65	**6.03**	17.17	**9.04**	25.80
Recovery system, for energy recovery	kg	**0.49**	1.54	**0.27**	0.85	**0.31**	0.99
Disposal	kg	**21.10**	4.43	**14.73**	3.01	**21.88**	4.49

C3 Disposal	Unit	LSG		IGU double		IGU triple	
		C3.1	C3.2	**C3.1**	C3.2	**C3.1**	C3.2
Core indicators							
GWP-t	kg CO_2 equivalent	**2.02**	6.40	**1.17**	3.72	**1.50**	4.73
GWP-f	kg CO_2 equivalent	**2.02**	6.38	**1.17**	3.71	**1.50**	4.72
GWP-b	kg CO_2 equivalent	**4.78E-03**	1.51E-02	**3.16E-03**	1.00E-02	**4.68E-03**	1.48E-02
GWP-l	kg CO_2 equivalent	**6.84E-05**	2.17E-04	**4.45E-05**	1.40E-04	**6.47E-05**	2.05E-04
ODP	kg CFC-11-eq.	**1.04E-11**	3.30E-11	**6.90E-12**	2.18E-11	**1.02E-11**	3.24E-11
AP	mol H^+-eq.	**1.61E-03**	5.10E-03	**1.02E-03**	3.22E-03	**1.44E-03**	4.56E-03
EP-fw	kg P-eq.	**2.13E-06**	6.73E-06	**1.40E-06**	4.45E-06	**2.08E-06**	6.58E-06
EP-m	kg N-eq.	**4.15E-04**	1.31E-03	**2.60E-04**	8.24E-04	**3.64E-04**	1.15E-03
EP-t	mol N-eq.	**4.99E-03**	1.59E-02	**3.08E-03**	9.75E-03	**4.23E-03**	1.34E-02
POCP	kg NMVOC-eq.	**1.10E-03**	3.48E-03	**6.89E-04**	2.18E-03	**9.66E-04**	3.06E-03
ADPF	MJ	**12.01**	38.09	**7.94**	25.09	**11.73**	37.18
ADPE	kg Sb equivalent	**8.74E-08**	2.77E-07	**5.79E-08**	1.83E-07	**8.57E-08**	2.72E-07
WDP	m^3 world-eq. deprived	**0.27**	0.86	**0.16**	0.52	**0.22**	0.69
Resource management							
PERE	MJ	**7.06**	22.36	**4.68**	14.82	**6.94**	21.97
PERM	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**7.06**	22.36	**4.68**	14.82	**6.94**	21.97
PENRE	MJ	**25.02**	79.27	**14.80**	46.79	**20.41**	64.65
PENRM	MJ	**-10.00**	-31.67	**-5.27**	-16.70	**-6.67**	-21.13
PENRT	MJ	**15.01**	47.59	**9.52**	30.10	**13.74**	43.52
SM	kg	**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
NRSF	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
FW	m^3	**9.11E-03**	2.89E-02	**5.66E-03**	1.79E-02	**7.80E-03**	2.47E-02
Categories of waste							
HWD	kg	**-4.87E-10**	-1.54E-09	**-3.24E-10**	-1.03E-09	**-4.82E-10**	-1.53E-09
NHWD	kg	**3.97E-02**	0.13	**2.26E-02**	7.18E-02	**2.85E-02**	9.00E-02
RWD	kg	**1.86E-03**	5.89E-03	**1.24E-03**	3.91E-03	**1.83E-03**	5.81E-03

Output material flows							
CRU	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
MFR	kg	**9.00**	25.60	**6.03**	17.20	**9.04**	25.80
MER	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**1.88**	5.95	**1.03**	3.26	**1.21**	3.83
EET	MJ	**4.31**	13.70	**2.36**	7.47	**2.77**	8.78
Additional environmental impact indicators							
PM	Disease incidence	**1.23E-08**	3.89E-08	**7.88E-09**	2.50E-08	**1.13E-08**	3.59E-08
IRP	kBq U235-eq.	**0.31**	0.98	**0.21**	0.65	**0.30**	0.96
ETPfw	CTUe	**5.27**	16.64	**3.48**	11.04	**5.15**	16.38
HTPc	CTUh	**1.87E-10**	5.90E-10	**1.22E-10**	3.87E-10	**1.79E-10**	5.67E-10
HTPnc	CTUh	**5.14E-09**	1.63E-08	**3.30E-09**	1.05E-08	**4.75E-09**	1.51E-08
SQP	dimensionless	**4.68**	14.82	**3.09**	9.80	**4.58**	14.56

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	LSG		IGU double		IGU triple	
		C4.1	C4.2	**C4.1**	C4.2	**C4.1**	C4.2
Core indicators							
GWP-t	kg CO_2 equivalent	**0.42**	8.46E-02	**0.28**	5.74E-02	**0.42**	8.57E-02
GWP-f	kg CO_2 equivalent	**0.43**	8.66E-02	**0.29**	5.88E-02	**0.43**	8.76E-02
GWP-b	kg CO_2 equivalent	**-1.10E-02**	-2.21E-03	**-7.35E-03**	-1.50E-03	**-1.09E-02**	-2.24E-03
GWP-l	kg CO_2 equivalent	**1.34E-03**	2.69E-04	**8.94E-04**	1.82E-04	**1.33E-03**	2.72E-04
ODP	kg CFC-11-eq.	**1.10E-12**	2.20E-13	**7.32E-13**	1.50E-13	**1.09E-12**	2.22E-13
AP	mol H^+-eq.	**3.07E-03**	6.14E-04	**2.04E-03**	4.16E-04	**3.03E-03**	6.21E-04
EP-fw	kg P-eq.	**8.71E-07**	1.74E-07	**5.80E-07**	1.18E-07	**8.61E-07**	1.77E-07
EP-m	kg N-eq.	**7.92E-04**	1.59E-04	**5.28E-04**	1.08E-04	**7.83E-04**	1.60E-04
EP-t	mol N-eq.	**8.72E-03**	1.74E-03	**5.80E-03**	1.18E-03	**8.62E-03**	1.77E-03
POCP	kg NMVOC-eq.	**2.39E-03**	4.78E-04	**1.59E-03**	3.25E-04	**2.37E-03**	4.85E-04
ADPF	MJ	**5.76**	1.15	**3.84**	0.78	**5.69**	1.17
ADPE	kg Sb equivalent	**1.99E-08**	3.99E-09	**1.33E-08**	2.70E-09	**1.98E-08**	4.04E-09
WDP	m^3 world-eq. deprived	**4.75E-02**	9.50E-03	**3.16E-02**	6.45E-03	**4.69E-02**	9.62E-03
Resource management							
PERE	MJ	**0.94**	0.19	**0.62**	0.13	**0.93**	0.19
PERM	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**0.94**	0.19	**0.62**	0.13	**0.93**	0.19
PENRE	MJ	**36.10**	3.32	**19.83**	1.92	**25.94**	2.61
PENRM	MJ	**-23.34**	-1.67	**-12.30**	-0.88	**-15.57**	-1.11
PENRT	MJ	**12.76**	1.65	**7.53**	1.05	**10.37**	1.50
SM	kg	**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

NRSF	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
FW	m³	**1.46E-03**	2.91E-04	**9.69E-04**	1.98E-04	**1.44E-03**	2.95E-04
Categories of waste							
HWD	kg	**1.25E-10**	2.51E-11	**8.35E-11**	1.70E-11	**1.24E-10**	2.54E-11
NHWD	kg	**28.86**	5.77	**19.11**	3.91	**28.47**	5.84
RWD	kg	**6.57E-05**	1.31E-05	**4.37E-05**	8.92E-06	**6.49E-05**	1.33E-05
Output material flows							
CRU	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
MFR	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
MER	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
EET	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Additional environmental impact indicators							
PM	Disease incidence	**3.77E-08**	7.55E-09	**2.51E-08**	5.12E-09	**3.73E-08**	7.64E-09
IRP	kBq U235-eq.	**7.59E-03**	1.52E-03	**5.06E-03**	1.03E-03	**7.50E-03**	1.53E-03
ETPfw	CTUe	**3.15**	0.63	**2.09**	0.43	**3.11**	0.64
HTPc	CTUh	**4.84E-10**	9.67E-11	**3.22E-10**	6.57E-11	**4.78E-10**	9.80E-11
HTPnc	CTUh	**5.32E-08**	1.06E-08	**3.54E-08**	7.22E-09	**5.25E-08**	1.08E-08
SQP	dimensionless	**1.40**	0.28	**0.93**	0.19	**1.38**	0.28

D Benefits and loads from beyond the system boundaries

No.	Scenario	Description[1]
D1	**Recycling potential (current market situation according to EN 17074)**	**Glass recyclate from C3 excluding the cullet used in A3 replace 60% of glass; Aluminium scrap from C3 excluding the secondary material used in A3 replaces 70.2% of aluminium; Stainless steel scrap from C3 excluding the secondary material used in A3 replaces 70.2% of stainless steel. 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; Aluminium scrap from C3 excluding the secondary material used in A3 replaces 70.2% of aluminium; Stainless steel scrap from C3 excluding the secondary material used in A3 replaces 70.2% of stainless steel. Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).

[1] Applied value correction factor over 70.2 % according to metal-specific data set, 60 % according to standard data set for other materials.

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	LSG		IGU double		IGU triple	
		D1	D2	**D1**	D2	**D1**	D2
Core indicators							
GWP-t	kg CO_2 equivalent	**-3.44**	-9.84	**-2.38**	-6.68	**-3.46**	-9.77
GWP-f	kg CO_2 equivalent	**-3.42**	-9.80	**-2.37**	-6.65	**-3.45**	-9.73
GWP-b	kg CO_2 equivalent	**-1.32E-02**	-3.80E-02	**-8.72E-03**	-2.40E-02	**-1.24E-02**	-3.45E-02
GWP-l	kg CO_2 equivalent	**-4.72E-04**	-1.34E-03	**-3.62E-04**	-1.02E-03	**-5.31E-04**	-1.51E-03
ODP	kg CFC-11-eq.	**-9.17E-12**	-2.63E-11	**-6.38E-12**	-1.74E-11	**-8.96E-12**	-2.46E-11
AP	mol H^+-eq.	**-2.06E-02**	-5.87E-02	**-1.41E-02**	-4.00E-02	**-2.10E-02**	-5.97E-02
EP-fw	kg P-eq.	**-2.42E-06**	-6.92E-06	**-1.69E-06**	-4.63E-06	**-2.39E-06**	-6.63E-06
EP-m	kg N-eq.	**-6.00E-03**	-1.71E-02	**-4.05E-03**	-1.15E-02	**-6.03E-03**	-1.72E-02
EP-t	mol N-eq.	**-6.83E-02**	-0.19	**-4.61E-02**	-0.13	**-6.87E-02**	-0.20
POCP	kg NMVOC-eq.	**-1.20E-02**	-3.43E-02	**-8.19E-03**	-2.32E-02	**-1.22E-02**	-3.45E-02
ADPF	MJ	**-53.27**	-152.60	**-36.68**	-102.90	**-53.27**	-149.80
ADPE	kg Sb equivalent	**-1.05E-07**	-3.00E-07	**-1.16E-06**	-3.28E-06	**-1.58E-06**	-4.49E-06
WDP	m^3 world-eq. deprived	**-0.21**	-0.59	**-0.16**	-0.44	**-0.22**	-0.63
Resource management							
PERE	MJ	**-6.20**	-17.78	**-4.46**	-12.18	**-6.22**	-17.08
PERM	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
PERT	MJ	**-6.20**	-17.78	**-4.46**	-12.18	**-6.22**	-17.08
PENRE	MJ	**-53.27**	-152.60	**-36.68**	-102.90	**-53.34**	-149.80
PENRM	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
PENRT	MJ	**-53.27**	-152.60	**-36.68**	-102.90	**-53.34**	-149.80
SM	kg	**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
NRSF	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
FW	m^3	**-7.35E-03**	-2.11E-02	**-5.65E-03**	-1.56E-02	**-7.98E-03**	-2.23E-02
Categories of waste							
HWD	kg	**-5.92E-09**	-1.69E-08	**-3.98E-09**	-1.13E-08	**-5.87E-09**	-1.67E-08
NHWD	kg	**-0.41**	-1.18	**-0.28**	-0.81	**-0.42**	-1.20
RWD	kg	**-1.58E-03**	-4.54E-03	**-1.11E-03**	-3.02E-03	**-1.55E-03**	-4.26E-03
Output material flows							
CRU	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
MFR	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
MER	kg	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
EEE	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
EET	MJ	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Additional environmental impact indicators							
PM	Disease incidence	**-1.20E-07**	-3.43E-07	**-8.54E-08**	-2.42E-07	**-1.26E-07**	-3.59E-07
IRP	kBq U235-eq.	**-0.26**	-0.75	**-0.18**	-0.50	**-0.26**	-0.71
ETPfw	CTUe	**-57.19**	-163.10	**-38.71**	-109.90	**-57.68**	-163.80
HTPc	CTUh	**-4.03E-10**	-1.16E-09	**-3.54E-10**	-9.87E-10	**-5.02E-10**	-1.41E-09
HTPnc	CTUh	**-3.25E-08**	-9.31E-08	**-2.22E-08**	-6.27E-08	**-3.27E-08**	-9.24E-08
SQP	dimensionless	**-4.35**	-12.46	**-3.06**	-8.33	**-4.30**	-11.83

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
Glas Trösch GmbH
SANCO Beratung
Reuthebogen 7-9
86720 Nördlingen, Germany

Related Declaration holders
Related declaration holders on page 3

Notes
This EPD is mainly based on the work and findings of Institut für Fenstertechnik e.V., Rosenheim (ift Rosenheim) and specifically on ift-Guideline NA-01/3 “Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen” (Guidance on preparing Type III Environmental Product Declarations).

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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