AGC GLASS EUROPE

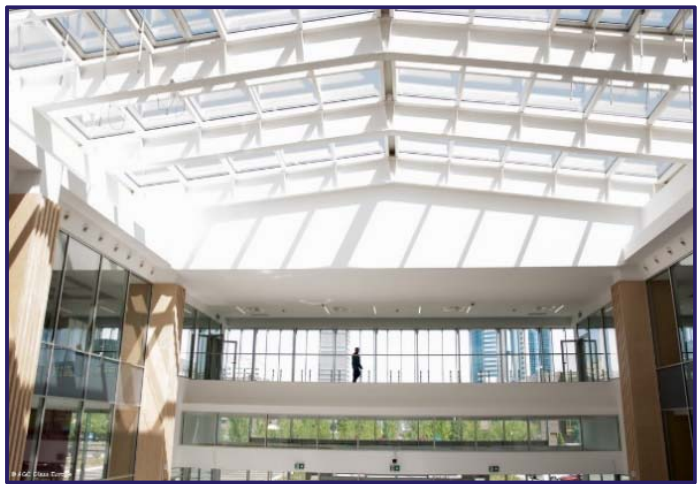
ENVIRONMENTAL AND HEALTH PRODUCT DECLARATION

Planibel

(Clear, Clearlite, Clearvision, Linea Azzurra, Coloured)

In accordance with ISO 14025, EN 15804+A1 and its French national complement NF EN15804/CN

28 May 2018



1. Warning

Information from this declaration are provided under AGC Glass Europe responsibility according to the standards EN 15804+A1 and the French national complement NF EN15804/CN.

Any total or partial use of the information provided in this document shall at least be accompanied by an explicit reference to this EPD as well as its issuer. The latter can provide the original document upon request.

EN 15804+A1 from CEN has been used as Product Category Rules (PCR).

2. Reading guide

Environmental impacts results, resource use indicators as well as waste and output flows are presented in **scientific writing with three significant digits**.

All positive values (plus sign) refer to environmental impacts, while negative values (minus sign) reflect environmental benefits. This approach applies to all modules, including module D. Hence, if module D is higher than zero, an additional impact must be added to other life cycle stages.

3. Comparability of EPD for construction products

Environmental product declarations may not be comparable if they do not comply with EN15804+A1.

Chapter *5.3 Comparability of EPD construction products* from EN15804+A1 norm defines the required conditions under which the construction products can be compared, on the basis of the information provided by the EPD:

A comparison of the environmental performance of construction products, based on their EPDs, shall be based on the use of the products and their impacts on the building, and shall account for the entire life cycle of the product (i.e. include all information modules).

4. General information

<table>
<tr><td>Name and address of the manufacturer</td><td>AGC Glass Europe
Avenue Jean Monnet 4
B-1348 Louvain-la-Neuve
sustainability@eu.agc.com</td></tr>
<tr><td>Production sites</td><td>This EPD is representative for float glass sold by AGC Glass Europe / AGC Interpane in France. AGC Glass Europe operates 10 production sites in Europe providing float glass to French and European market. Results from this EPD reflects data collected from all these sites.</td></tr>
<tr><td rowspan="2">Type of EPD</td><td>☐ Cradle to factory gate
☒ Cradle to grave</td></tr>
<tr><td>☐ Collective
☒ Individual</td></tr>
<tr><td>Verifier name</td><td>Thomas Peverelli (EVEA)</td></tr>
<tr><td>Program operator</td><td>FDES INIES
www.inies.fr
Environmental and health reference data for building
<table>
<tr><th>Responsable du programme</th><th>Gestionnaire du programme</th></tr>
<tr><td>Conseil de Surveillance Inies Base (CSIB)
11 rue Francis de Pressensé
93571 Saint-Denis la Plaine Cedex</td><td>Association Française de Normalisation (AFNOR)
Département Construction et Cycle de l’Eau (DCE)
11 rue Francis de Pressensé
93571 Saint-Denis la Plaine Cedex</td></tr>
</table></td></tr>
<tr><td>Publication date</td><td>May 2018</td></tr>
<tr><td>Expiration date</td><td>May 2023</td></tr>
<tr><td>Commercial references</td><td>Planibel Clear
Planibel Clearlite
Planibel Clearvision
Planibel Coloured
Planibel Linea Azzurra (only covered through extrapolation rules since not available in the 4mm reference dimensions)</td></tr>
</table>

5. Functional unit and product description

5.1. Description of the functional unit

The functional unit is to ensure 1m² of facade glazing with (extra) clear glass over 30 years.

Note: The reference service life of the product is set to 30 years. This period does not reflect real product lifetime, which is generally defined by building refurbishment. This period reflect a standard duration of use considered in glazing EPDs.

RSL does not refer to product guarantee neither.

5.2. Product description

AGC Planibel range covered by this EPD is a float glass of 4 mm (reference thickness) clear, extra-clear or tinted:

- Planibel Clear
- Planibel Clearlite
- Planibel Clearvision
- Planibel Linea Azzurra, *only though extrapolation rules since not available in 4mm thickness*
- Planibel Coloured

Other structures are considered in the underlying calculations for 2, 3, 5, 6, 8, 10, 12, 15, 19, 22, 25 mm and including thermal toughening and heat soak treatment of the aforementioned glass thicknesses.
This product is defined by the standard EN 572-9:2004 "*Glass in building. Basic soda lime silicate products. Evaluation of conformity*".

Planibel range of products also complies with the following standards:

- EN 572-1 – Glass in building. Basic soda-lime silicate glass products. Definitions and general physical and mechanical properties
- EN 572-2 – Glass in building. Basic soda lime silicate glass products. Float glass.

All Planibel products are CE marked in accordance with EN 572-9 and are produced in ISO 9001 and ISO 14001 certified factories.
More information available on www.yourglass.com.

5.3. Description of the product usage

Float glass is meant to be used for building facades and construction projects. It can also be used in a wide range of other construction applications. In that case, glass can be delivered with technical properties fitting with specific use requirements.

Table 1 : Product characteristics

Product specification	Symbol	Value
Thermal transmission (according to EN 673)	U_g (W/m².K)	5.7
Light Transmission (EN 410)	Tv (%)	max 92
Light Reflection (EN 410)	ρv (%)	8
Solar factor	g (%)	max 91
Direct airborne sound insulation (EN 12578)	Rw (C;Ctr) (dB)	30 (-2;-4)
Reaction to fire (EN 13501-1)		A1
Resistance to fire (EN 13501-2)		No performance declared
Burglar resistance (EN 356)		No performance declared
Bullet resistance (EN 1063)		No performance declared
Resistance to explosion (EN 13541)		No performance declared

Float glass has no specific properties as regards fire resistance or impacts (break-in, fire arms, explosion). No performance is declared for these aspects.

5.4. Other technical features not included in the functional unit

Not applicable.

5.5. Description of the product main components and/or material

Despite differences as regards properties and functionality from one product range to the other, float glass always has a similar baseline composition. They can be defined as products resulting from the mixture of three main raw material categories: forming materials, intermediate materials, colouring agents.

Silica sand and glass cullet work as vitrifying material, sodium carbonate is used to decrease silica melting point, limestone is a stabilizer that gives glass its chemical resistance. Others agents are used to improve mechanical characteristics and resistance to external conditions as well as for its colour.

Table 2 : Generic float glass composition

Product composition	average %
Forming materials	**62%**
* Silica sand	
* External cullet	
Intermediate materials	**37%**
* Sodium carbonate	
* Dolomite	
* Limestone	
* Feldspar	
* Sodium sulphate	
Colouring agents	**1%**
* Iron oxides and other metallic oxides	
Product mass	10 kg / m^2
Packaging	100g
* Metallic stillage	
* Interleaving powder	

Primary data used as input and output as well as transport data have been collected among AGC Glass Europe 10 float glass production sites.

5.6. Substances from REACH candidate list

Planibel float glass does not contain any substance from REACH candidate list according to REACH regulation (more than 0.1%)

5.7. Reference service life description

The reference service life (RSL) of float glass is 30 years.

Table 3 : Reference conditions of product use justifying RSL

Parameter	Value
Reference service life	30 years
Declared product properties (when leaving the production site) and finishing	These properties are defined in float glass definition standard EN 572-9:2004 *Glass in building. Basic soda lime silicate products. Evaluation of conformity*
Theoretical application parameters (if imposed by the producer), including references to the appropriate use practices	These information are detailed in the standard NF DTU 39:2006 *Building works – Glazing and Mirror Glass Works*, which defines the specifications for the implementation of glazing and installation of glazing products (new construction, renovation, refurbishment, maintenance) performed on site in all types of buildings.
Alleged quality of the construction work, when the installation is made in accordance with the manufacturer's instructions	
Exterior environment (for exterior applications), e.g. weather resistance, pollutants, UV and wind exposure, building orientation, shade, temperature	
Interior environment (for interior applications), e.g. temperature, humidity, chemicals exposure	
Use conditions, e.g. usage frequency, mechanical exposure	
Maintenance, e.g. required frequency, type and quality and replacement of replaceable components	

6. Life cycle stages

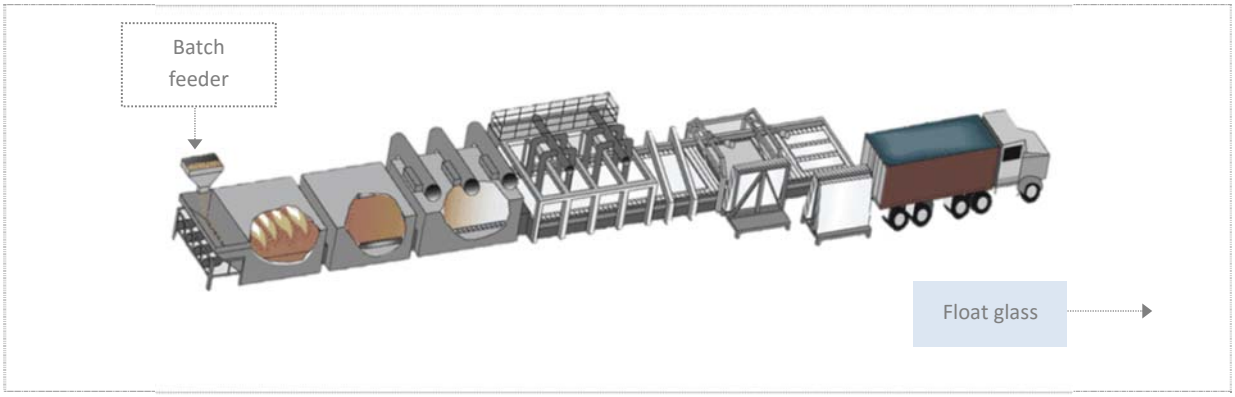
This EPD is a cradle to grave study including module D, benefits beyond the system boundaries.

Life cycle stages regarding product installation (A5) and product use (B1-B7) are modelled based on Glass in building product category rules prEN17074:2017.

6.1. Production stage, modules A1-A3

Module A1-A3 covers the production and transport of raw materials, float glass production sites consumptions and emissions as well as impacts from energy use and waste treatment.
Float glass production process involves the following steps:

- Batch preparation
- Raw materials melting within the glass furnace. Raw materials are heated up to 1600°C in order to melt them and ensure the required chemical reaction (decarbonation).
- Glass is then poured on a molten tin bath called "float", giving to the glass its flat shape. Tin bath is used for its high density (6500 kg/m³), which is much higher than the one of glass (2500kg/m³).
- The glass ribbon is then cooled down in a controlled atmosphere and at a controlled temperature to ensure that the outgoing glass has the required properties. It is then cut in large panes of 3.21m by 6m called PLF (Plateau Largeur de Fabrication).



6.2. Construction process stage, modules A4-A5

Transport distance to construction sites (module A4) considers the weighted average distance between the 10 AGC floats and Paris.
As regards installation on site (module A5), no ancillary materials is considered for the glass to be installed in accordance with prEN17074:2017.
No breakage during transport and installation has been considered, following prEN17074:2017.

1. Transport to the construction site

Transport to construction site considers an average distance of 1150 km. This value reflects the weighted average distance between the 10 AGC floats and Paris. Float glass is transported by road in diesel trucks of 24.7 tonnes net load.

Table 4 : Transport to construction site

Parameter	Value	Unit
Vehicle description	25	Tonne | Diesel truck - EURO 5 – cargo, 40 t gross payload
Distance to construction site	1150	km
Utilisation rate (including empty return)	50%	%
Volumetric mass	2500	kg/m^3
Coefficient of utilisation of the volume capacity	0.6	

Average load and utilisation rate correspond to the use of “inloaders” trucks dedicated to glass transportation. These trucks are loaded at full capacity when leaving factories but have no possibility to transport other goods than glass when traveling back. The utilisation rate of 50% reflects thus a 100% utilisation for the outbound journey and an utilisation rate of 0% for the inbound journey.

2. Installation on site

No ancillary materials is considered for the glass to be installed in accordance with prEN17074:2017.

Packaging end of life is accounted in module A3 as detailed in prEN17074:2017 product category rule.

6.3. Use stage, modules B1-B7

1. Description

The only module from the use stage considered is B2 “maintenance”. This stage corresponds to glass cleaning with water and detergent.

Repair (B3), replacement (B4) and refurbishment (B5) are not considered. Under normal conditions of use, float glass does not need any of these operations.

Finally, float glass does not emit any substances neither to the air nor to water during its use (B1).

2. Maintenance parameters

Following prEN17074:2017, the average annual water consumption is 0.2 litres per square meter of glass (i.e. 6 litres/m² over the whole life cycle) and an annual consumption of detergents of 10 g/m² (300 g/m² over the whole life cycle). The majority of this water (75%) is considered as discharged to sewer grid and further treated in a wastewater treatment plant. The remaining 25% is considered as evaporated.

Table 5 : Glass maintenance

Parameter (whole life cycle)	Value	Unit
Water consumption for maintenance	6	litres
Detergent consumption	300	g
Waste water discharge to WWTP	4.5	litres

6.4. End of life stage, modules C1-C4

No mechanical operation is considered as regards dismantling and demolition (module C1).
End of life includes:

- C2: transport to waste treatment site ;
- C3: waste treatment ;
- C4: landfilling of demolition wastes.

End of life scenario is based on worst case scenario, considering that 100% of the float glass is sent to landfill for inert material in the end of life.

Table 6 : End of life scenarios

Parameter	Value	Unit
Waste glass sent to landfill	100	%
Transport to landfill (truck)	30	km
Waste glass recycled	0	%

All glass wastes are transported by diesel truck with a net payload of 22 tonnes.

6.5. Benefits and loads beyond the system boundaries (module D)

As the end of life scenario is a worst case (100% landfill), module D consist in additional impacts corresponding to the benefits from the use of secondary materials at production stage (A1-A3).
As no float glass is sent to recycling in the end of life, the benefits accounted in A1-A3 is offset by additional impacts of the same value accounted in module D. In the end of life formula, these impacts are referred as *IV - IS*.
This additional impact is calculated as the sum of:

- An additional production of virgin raw materials (silica sand, sodium carbonate, dolomite etc.).
- An additional energy consumption due to the substitution of cullet by virgin raw materials. Cullet requires 25% less energy than virgin raw materials to melt. The higher energy consumption from virgin raw materials also means higher CO_2 emissions from fossil fuel combustion.
- An additional CO2 emissions due to decarbonation of virgin raw materials used instead of cullet. Indeed, cullet does not go to decarbonation as opposed to virgin raw materials.

7. Information regarding life cycle assessment calculation

PCR used	NF EN 15804+A1 NF EN 15804/CN prEN 17074 :2017
System boundaries	Cradle to gate including module D
Allocations	Mass allocation Geographical representativeness: 10 AGC European float glass production sites. Distribution in France. Time representativeness: input/output primary data as well as transport data from 2016 GaBi 8.6.0.20 software and database service pack 35 have been used for secondary data and calculation of the LCI and LCIA.

8. Life cycle assessment results

8.1. Description of the system boundary

	Product stage	Construction process stage		Use stage							End of life				Benefits and loads beyond the system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B4 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction /demolition	C2 Transport	C3 Waste processing	C4 Disposal	D
Module declared	X	X	X	NR	X	NR	NR	NR	NR	NR	NR	X	X	X	X

X: included in the LCA *NR: Not relevant for the product studied*

8.2. Environmental impact indicators

The life cycle impact assessment methods recommend by EN 15804+A1 were used. The impact indicators are presented in the following tables for the different AGC float glass thicknesses available.

Environmental impacts of 4 mm float glass

Environmental impacts	Production stage	Construction process		Use stage							End of life stage				Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B4 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction /demolition	C2 Transport	C3 Waste processing	C4 Disposal	D
Global warming potential *(kg CO_2 eq./FU)*	1.16E+01	8.88E-01	NR	NR	6.87E-03	NR	NR	NR	NR	NR	NR	5.06E-02	0	1.59E-01	5.94E-01
Ozone depletion *(kg CFC-11 eq./FU)*	1.13E-08	2.42E-14	NR	NR	2.69E-09	NR	NR	NR	NR	NR	NR	1.40E-15	0	3.60E-14	7.36E-10
Acidification of land and water *(kg SO_2 eq./FU)*	4.95E-02	2.15E-03	NR	NR	2.32E-04	NR	NR	NR	NR	NR	NR	2.98E-04	0	9.34E-04	1.11E-03
Eutrophication *(kg PO_4 eq./FU)*	7.36E-03	5.22E-04	NR	NR	1.65E-04	NR	NR	NR	NR	NR	NR	7.53E-05	0	1.28E-04	2.12E-04
Photochemical ozone creation *(kg C_2H_4 eq./FU)*	3.16E-03	2.14E-04	NR	NR	9.54E-05	NR	NR	NR	NR	NR	NR	2.36E-05	0	7.32E-05	8.58E-05
Depletion of abiotic resources-elements *(kg Sb eq./FU)*	1.27E-05	6.61E-08	NR	NR	1.77E-07	NR	NR	NR	NR	NR	NR	3.82E-09	0	2.19E-08	6.18E-08
Depletion of abiotic resources-fossil fuels *(MJ/FU)*	1.52E+02	1.20E+01	NR	NR	3.88E-01	NR	NR	NR	NR	NR	NR	6.96E-01	0	2.06E+00	5.82E+00

Resource use	Production stage	Construction process		Use stage							End of life stage				Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B4 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction /demolition	C2 Transport	C3 Waste processing	C4 Disposal	D
Renewable primary energy as energy carrier *(MJ/FU)*	5.63E+00	6.66E-01	NR	NR	1.33E+00	NR	NR	NR	NR	NR	NR	3.85E-02	0	2.64E-01	1.15E-01
Renewable primary energy resources used as raw materials *(MJ/FU)*	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Total use of renewable primary energy resources *(MJ/FU)*	5.63E+00	6.66E-01	NR	NR	1.33E+00	NR	NR	NR	NR	NR	NR	3.85E-02	0	2.64E-01	1.15E-01
Non-renewable primary energy resources as energy carrier *(MJ/FU)*	1.60E+02	1.21E+01	NR	NR	6.18E-01	NR	NR	NR	NR	NR	NR	6.98E-01	0	2.14E+00	5.93E+00
Non-renewable primary energy resources used as raw materials *(MJ/FU)*	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Total use of non-renewable primary energy resources *(MJ/FU)*	1.60E+02	1.21E+01	NR	NR	6.18E-01	NR	NR	NR	NR	NR	NR	6.98E-01	0	2.14E+00	5.93E+00
Use of secondary material *(kg/FU)*	8.90E-01	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Use of renewable secondary fuels *(MJ/FU)*	2.01E-20	6.52E-29	NR	NR	2.63E-24	NR	NR	NR	NR	NR	NR	3.77E-30	0	3.24E-23	1.87E-21
Use of non-renewable secondary fuels *(MJ/FU)*	2.36E-19	9.90E-28	NR	NR	3.09E-23	NR	NR	NR	NR	NR	NR	5.72E-29	0	3.80E-22	2.20E-20
Use of net fresh water *(m^3/FU)*	2.23E-02	1.23E-03	NR	NR	8.52E-03	NR	NR	NR	NR	NR	NR	7.10E-05	0	4.08E-04	1.33E-03

Wastes	Production stage	Construction process		Use stage							End of life stage				Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B4 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction /demolition	C2 Transport	C3 Waste processing	C4 Disposal	D
Hazardous waste disposed *(kg/FU)*	3.51E-07	6.99E-07	NR	NR	1.74E-10	NR	NR	NR	NR	NR	NR	4.04E-08	0	3.67E-08	1.64E-08
Non-hazardous waste disposed *(kg/FU)*	2.37E-01	1.01E-03	NR	NR	7.68E-03	NR	NR	NR	NR	NR	NR	5.85E-05	0	1.00E+01	1.93E-02
Radioactive waste disposed *(kg/FU)*	3.26E-03	1.65E-05	NR	NR	3.18E-06	NR	NR	NR	NR	NR	NR	9.56E-07	0	3.09E-05	2.78E-05

Output flows	Production stage	Construction process		Use stage							End of life stage				Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B4 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction /demolition	C2 Transport	C3 Waste processing	C4 Disposal	D
Components for re-use (kg/FU)	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Materials for recycling (kg/FU)	1.93E-01	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Materials for energy recovery (kg/FU)	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Exported electrical energy (MJ/FU)	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0
Exported thermal energy (MJ/FU)	0	0	NR	NR	0	NR	NR	NR	NR	NR	NR	0	0	0	0

9. Additional information

9.1. Release of hazardous substances into indoor air, soil and water during the use stage

9.1.1. Indoor air

- **VOC and formaldehyde emissions**

Not applicable

- **Reaction to fungal and bacterial growth**

Not tested. Glass is a mineral inert material. It is not by itself a medium for micro-organisms growth.

- **Natural radioactive emissions from construction products**

Not tested.

- **Emission of particulates and fibres emissions**

Not tested.

9.1.2. Water and soil

Not tested. The product is not in contact with water intended for human consumption.

9.2. Product contribution to indoor wellbeing

9.2.1. Product characteristics regarding hygrothermal comfort

The relevant technical characteristics are given for a 4 mm float glass:

- Thermal coefficient U_g = 5,8 W/(m².K), according to EN 673 ;
- Direct energy transmission : 84 % ;
- Energy reflection : 8 % ;
- Solar factor: 86 %.

Source: CE marking

9.2.2. Product characteristics regarding acoustics

A 4 mm float glass has a direct airborne sound insulation R_w (C; C_{tr}) = 30 (-2 ; -4) dB.

This characteristic can be improved by using thicker or asymmetric glass panes. For example, a 12 mm float glass has a direct airborne sound insulation R_w (C; C_{tr}) = 35 (-2 ; -3) dB.

Source: CE marking

9.2.3. Product characteristics regarding visual comfort

The relevant technical characteristics are given for a 4 mm float glass:

- Light transmission: 90 % ;
- Light reflection: 8 % ;
- Direct energy transmission : 84 % ;
- Energy reflection : 8 % ;
- Solar factor: 86 %.

Source: CE marking

9.2.4. Product characteristics as regarding odours

Not tested. Glass is a mineral inert material, not able to release any odour during its use.

9.3. Extrapolation rules

Indicators from the EPD are proportional to product mass and thus to glass thickness. In case of similar product with other thicknesses than those available in the EPD, results can be calculated by considering an extrapolation based on mass or thickness. Both approach provides similar results.

More information available on www.yourglass.com

And in the « Sustainability » section of our environmental website www.agc-glass.eu/en/sustainability