Environmental Product Declaration

In compliance with ISO 14025 and EN 15804:2012+A2:2019/AC: 2021 for

Insulated Glass

EPD Program	Title	Details
International Climate Intelligence System 71-75 Shelton Street Covent Garden London, WC2H 9JQ United Kingdom info@climateintell.com	Registration #	ICIS-202407-30
	Date of Publication	09.07.2024
	Validity	08.07.2029
	Date of Revision	-

The most recent data needs to be provided through an EPD, which may be updated when circumstances change. Thereby the claimed validity is contingent upon ongoing validation at www.climateintell.com

INTERNATIONAL CLIMATE INTELLIGENCE SYSTEM EPD

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EPD VERIFIED

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1.0 PROGRAM INFORMATION

Program	International Climate Intelligence System 71-75 Shelton Street Covent Garden London, WC2H 9JQ United Kingdom info@climateintell.com
Product Group Classification	UN CPC 3711
Product Category Rules (PCR)	PCR 2020:17 Construction products (EN 15804:2012+A2:2019/AC:2021) Version 1.2.5 dated 01.11.2022. EN 17074:2019 Glass in building - Environmental product declaration - Product category rules for flat glass products. EN standard EN 15804 serves as the Core Product Category Rules (PCR)
Registration Number	ICIS-202407-30
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Validity Date	08.07.2029
Geographical Scope	United Arab Emirates

2.0 INTRODUCTION

This report contains the environmental performance of the manufacturing process of Insulated Glass by Emirates Glass LLC. This Environmental Product Declaration (EPD) has been developed using the Life Cycle Assessment (LCA) methodology. The environmental impact values calculated are expressed to 1 square meter of Insulated Glass.

The assessed life cycle includes all phases in the manufacturing process of Insulated Glass in a "cradle to gate with options" scope. This LCA covers transportation of Raw materials, production, distribution of final product to the customer and end of life stages.

This EPD has been conducted according to the program operator regulations and it has been verified in accordance with the International Climate Intelligence System. The EPD regulation is a system for the international use of Type III Environmental Declarations, according to ISO 14025:2006. Not only the system, but also its applications, is described in the Programmer's Product Category Rules (PCR). This report has been made following the specifications given in the European standard EN 15804:2012+A2:2019/AC:2021.

3.0 COMPANY INFORMATION

Emirates Glass LLC, a subsidiary of Dubai Investments PJSC, is one of the largest processors of flat architectural glass in the Middle East. Established in 1998 in Al Quoz Industrial Area in Dubai, Emirates Glass is the leading supplier of sputter-coated energy saving glass across the Gulf, with presence in markets across the globe.

Emirates Glass is part of Glass LLC, the first glass holding company in the Middle East wholly owned by Dubai Investments. The other companies in Glass LLC are Emirates Float Glass, Lumiglass Industries, Saudi American Glass and Emirates Insolaire.

Vision

To be the most esteemed in the glass industry for delivering top-class, innovative glass products in a timely manner, with the best quality and in an increasingly strengthened, widened and respected presence on the world map.

Mission

As a pioneer in architectural glass coatings in the UAE, our Mission is to increase market penetration in the Gulf and beyond through a flexible approach to diversification and product development in line with Dubai Investments' mission to facilitate further investments and a platform for continuous growth.

Certifications

Emirates Glass has achieved the below certifications:

- ISO 9001:2015 – Quality Management System (21.1086.026)
- ISO 14001:2015 – Environmental Management System (21.1087.026)
- ISO 45001:2018 – Occupational Health & Safety Management System (21.1088.026)

4.0 PRODUCT INFORMATION

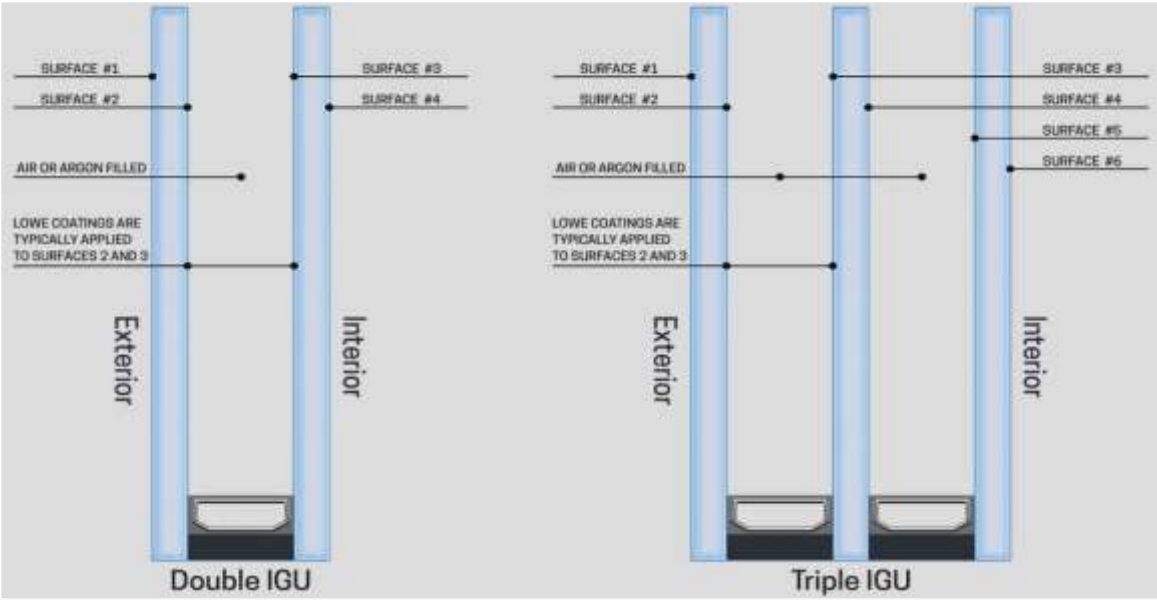
4.1 Analyzed Product

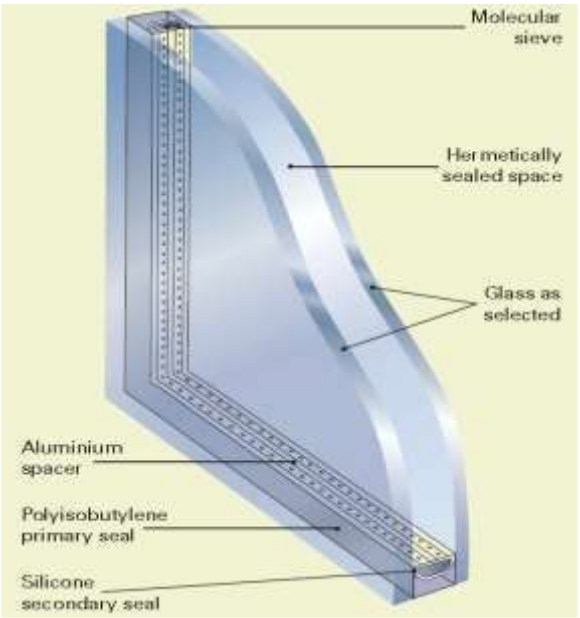
The assessed system in this Environmental Product Declaration (EPD) comprises the full life cycle of Insulated Glass by Emirates Glass in its factory in Dubai, UAE. Assembly consisting of double or triple panes of glass separated by one or more spacers and hermetically sealed along the periphery.

According to the needs of the clients, ordinary transparent glass, tinted glass, heat-reflective coated glass, Low-E glass, laminated glass, toughened glass, thermoformed glass, and other types of glasses can all be used as the substrate of insulated glass.

Product Configuration

A typical IGU configuration is shown in below figure.





Typical Double Glaze Unit

Each configuration comprises;

Double Glazing:

- Outer pane – **Monolithic** comprising either 4mm, 5mm, 6mm, 8mm, 10mm, 12mm, 15mm; **Laminated** comprising 8.76mm, 9.52mm, 13.52mm, 17.52mm, 21.52mm, 25.52mm
- Air space – 10mm, 12mm, 14mm, 16mm, 18mm, 20mm, 22mm, 24mm, 26mm
- Inner pane – **Monolithic** comprising either 4mm, 5mm, 6mm, 8mm, 10mm, 12mm, 15mm; **Laminated** comprising 8.76mm, 9.52mm, 13.52mm, 17.52mm, 21.52mm, 25.52mm

Triple Glazing:

- Outer pane – **Monolithic** comprising either 4mm, 5mm, 6mm, 8mm, 10mm, 12mm, 15mm; **Laminated** comprising 8.76mm, 9.52mm, 13.52mm, 17.52mm, 21.52mm, 25.52mm
- Air space – 10mm, 12mm, 14mm, 16mm, 18mm, 20mm, 22mm, 24mm, 26mm
- Middle pane – **Monolithic** comprising either 4mm, 5mm, 6mm, 8mm, 10mm, 12mm, 15mm; **Laminated** comprising 8.76mm, 9.52mm, 13.52mm, 17.52mm, 21.52mm, 25.52mm
- Air space – 10mm, 12mm, 14mm, 16mm, 18mm, 20mm, 22mm, 24mm, 26mm
- Inner pane – **Monolithic** comprising either 4mm, 5mm, 6mm, 8mm, 10mm, 12mm, 15mm; **Laminated** comprising 8.76mm, 9.52mm, 13.52mm, 17.52mm, 21.52mm, 25.52mm

Other Materials;

Primary sealant and Secondary sealant (Silicone). Glass types for the above combination can be coated or uncoated depending on the project requirements. Spacers used are either Aluminum mill-finish, Aluminium Anodized, Stainless steel, Warm edge (Stainless Steel + Polypropylene/Polyurethane).

4.2 Product Details

Product Specifications	Details
Brand Name	Emicool –Insulated Glass Unit
Glass Type	Double glazed unit and triple glazed unit with tempered, annealed, coated, laminated, printed and other glass combinations.
Thickness	18 mm to 100mm
Light transmission %	10 – 80%
External reflection %	5 – 50%

Internal reflection %	5 – 30%
Solar Heat Gain Coefficient	0.10 to 0.80
U-value	0.6 W/m^{2}K to 3 W/m^{2}K (Depending on coating type, air gap, inert gas requirement, other factors)
UV reduction	Less than 1% (depending on the glass type)
Shapes	Round, Rectangular, Oval and Irregular
Desiccant type	3A molecular sieve
Spacer types	Aluminum anodized, Mill finish, Painted
Primary Sealant	Polyisobutylene
Secondary Sealant	2 part silicone sealant

4.3 Product Specifications

Standard
EN1279

4.4 Product Application

Used for installation as bonded glazing for doors, windows and curtain walling with possible permanent shear load on edge sealant with or without direct UV radiation exposure. Insulated glass has the characteristics of sun shading, noise reduction, heat reduction, sound insulation, anti-frost, energy saving, and environmental protection functions, which meets the requirements of buildings for glass doors and windows.

5.0 LCA INFORMATION

5.1 Declared Unit

The Declared Unit of the Life Cycle Assessments is 1 square meter 1mm thickness of Insulated glass Double pane and triple pane based on the weighted average as table below;

Type	Thickness (mm)	Mass (Kg)*
Insulated Uncoated Double Pane	8	20
Insulated Uncoated Triple Pane	12	30
Insulated Coated Double Pane	8	20
Insulated Coated Triple Pane	12	30
Insulated Laminated Double Pane	8	20
Insulated Laminated Triple Pane	12	30
*There will be marginal difference due to Spacer and rest of the materials used in IGU Process		

Scaling Factor

Emirates Glass IGUs are available in various product configurations depending on project specifications.

Each configuration includes a two layer of Monolithic/float glass (Double IGU) and three layers of varying thicknesses of support lite glass, middle lite glass, and cover lite glass (Triple IGU). Depending on the application for the product, the glass may also be laminated or coated. The glasses are the components of the product with varying thicknesses. These LCA studies examined impacts of a weighted average of the support lite, middle lite, and cover lite glass production volumes separately from the standard components in order to create a scaling factor that can be used to determine the impacts for any configuration.

Impacts for specific configurations of IGU product can be calculated by adding the impacts for the standard components to the total sum of the glass thicknesses that has been multiplied by the per millimeter impact for the additional lites. The calculation of the scaling factor is shown below. The impacts for the selected impact categories specified by the PCR per millimeter of the additional lites were determined by dividing the impact result by the total mm of additional lites in the weighted average product thickness.

Service Life

Reference service life of 30 years is used for this EPD, as prescribed in EN 17074:2019.

5.2 Time representativeness

Manufacturing facility specific data from Emirates Glass are based on 1 year average for process data (Reference year July 2022 to Jun 2023). The following rules for time scope of data were applied - < 10 years for background data and < 2 years for manufacturer's data.

5.3 LCA Software and Database

Version 3.16.0.1 of software Air.e LCA™ with Ecoinvent™ 3.9.1 database has been used for LCA modeling and impacts calculations.

5.4 System Boundaries

This EPD covers all product stages from "cradle to gate with options", i.e this LCA covers Production stage A1-A3, Transportation A4, End of life stages C1-C4 and Resource recovery stage D according to EN 15804 + A2/AC:2021.

The procedures that are not controlled by the company, but are included in this environmental study, are:

- The extraction and production of fuels.
- The production of electricity.
- The production of the machinery, buildings, and vehicles.

All related direct and indirect environmental impacts related to these elements have been calculated and were included in the LCAs in this EPD.

Upstream Processes (**A1: Raw Material Supply**): Production of the product starts with mainly raw material production and transportation from different parts of the world and some locally sourced. 'Raw material supply' includes raw material extraction before production.

Core Processes (**A2: Transportation**): Transport is relevant for delivery of raw materials to the plant and the transport of materials within the plant. Glass is transported from UAE (Abu Dhabi, Dubai & Sharjah) 90.30%, Italy 5.64%, China 3.87%, Saudi Arabia 0.72%, Belgium 0.088% and Germany 0.025%. In our case, the modelling included each raw material's road and sea distances (average values).

Manufacturing (module A3): The manufacturing process starts with washing the glass panes. After the panes have been washed and inspected, the mounting spacer frame is installed and the unit is assembled at the gas press. Finally, the unit is sealed at the sealing unit.

- Glass Selection

- Cutting and Cleaning
- Spacer Selection and Preparation
- Spacer Application
- Desiccant Placement
- Glass Assembly
- Secondary Sealing
- Air Space Venting
- Gas Filling (Optional)
- Final Inspection and Quality Control

Transport (module A4): To create a scenario of the A4 phase, all the products sold from Oct 2022 to Sept 2023 has been analyzed as representative of the international transport. The transport means 3.5-7.5t & >32t trucks, Euro 6.

Scenario Details	Description
Vehicle used for transport	3.5-7.5t & >32t trucks, Euro 6.
Vehicle capacity	3.5 -7.5 tons and 32 tons
Fuel type and consumption	Diesel, 0.38 liters per km
Capacity utilization	100% as assumed in Ecoinvent
Bulk transportation	Mass of the transported product.

Dismantling/demolition (module C1)

The glass installed in various sites are demolished manually, hence the environmental impacts of Module C1 are negligible.

Transportation of demolished items (module C2)

With the recent goals set by the UAE on glass recycling, it is assumed that 75% of the demolished glass is sent for sorting and recycling whereas the remaining 25% is sent to a landfill. At a collection rate of 100%, the transports are carried out by a <32 ton truck at an average distance of 50 kms to the recycling center and landfill site. This is a conservative assumption.

Type	Capacity utilization	Type of vehicle	Average distance
Truck	75%	Euro 3.5-7.5t	50 km

Waste processing (module C3)

Glass must be mechanically separated from other material surrounding them prior to recycling so that the glass can be made available to a downstream product system as secondary material. Hence, the environmental impacts of sorting of glass is considered in module C3.

Disposal (module C4)

25% of the demolished glass is assumed to be landfilled and the corresponding environmental impacts are considered in module C4.

Reuse, Recycling, and Recovering Potential (module D)

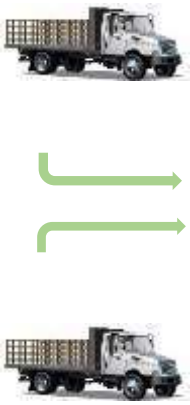
Module D represents the recycling benefits of the used glass and packaging materials.

Manufacturing and System Boundaries Diagram

	Production Stage			Construction Process Stage		Use Stage							End of Life Stage				Resource Recovery Stage
	Raw Materials	Transport	Manufacturing	Transport	Construction Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-construction Demolition	Transport	Waste Processing	Disposal	Reuse Recovery Recycling Potential
Module	**A1**	**A2**	**A3**	**A4**	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	**X**	**X**	**X**	**X**	ND	ND	ND	ND	ND	ND	ND	ND	**X**	**X**	**X**	**X**	**X**
Geography	GLO	GLO	UAE	UAE	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data	GWP > 90%				-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	One Product				-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	One manufacturing center				-	-	-	-	-	-	-	-	-	-	-	-	-

X = Included, ND=Module not declared, NR= Module not relevant

Modules from A5 to B7 are not included (X refers to considered stage; N refers to not relevant stage and ND to not declared stage).

Scope of this Life Cycle Assessment 'Cradle to Gate with Options'					
A1 Raw Materials Production	**A2 Transport raw materials**	**A3 Manufacture**	**A4 Distribution**	**End of use Stage (C1-C4)**	**Recovering and Recycling (D)**
					
Raw Materials and Chemicals	Transport from supplier by Road & Sea	Washing, PVB Application, Overlaying, Loading	Transport to customers by trucks	Demolition, transport, disposal.	Reuse, recovery and recycling potential

5.5 Content Declaration

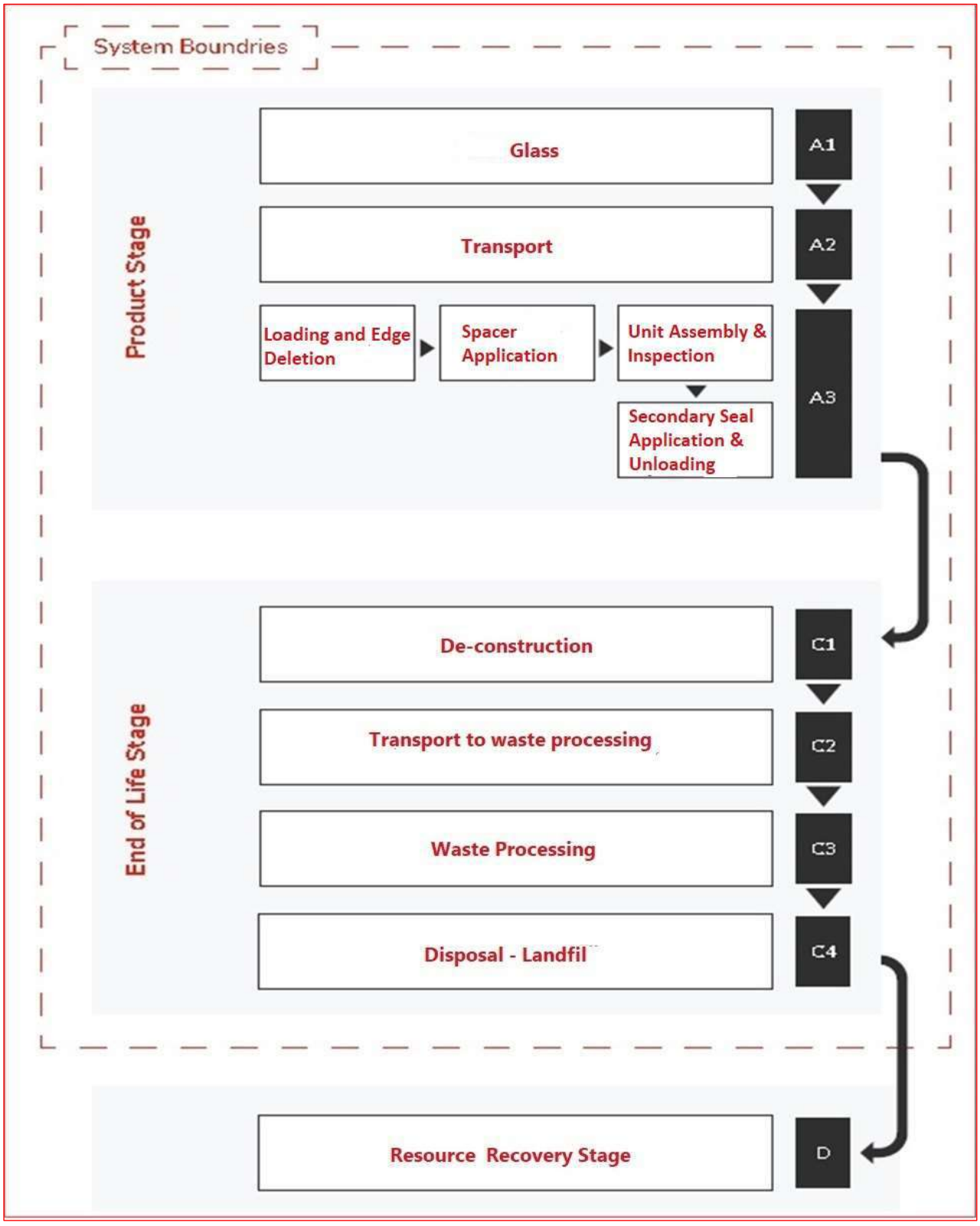
Product Components	Content %	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Glass	93	0	0
Aluminium	0.3	0	0
Silicone	0.7	0	0
Argon	1.0	0	0
Masking Film	2.0	0	0
Spacer	0.03	0	0
Others	2.97	0	0
Total	**100**	**0**	**0**

The percentages are given for a above insulated glass; the % may vary depending on the glazing configuration.

Packaging Materials			
Packaging Materials	**Weight Kg**	**Weight % (Versus the Product)**	**Weight biogenic carbon, kg C/kg**
Wood*	0.14	3.4	0
Plastic Strap	0.02	0.4	0

Steel Strap	0.08	3.1	0
Styro Foam	0.14	2.1	0
Total	0.38	9.0	0
*Biogenic carbon content is not presents since the packaging weights less than a 5% over the product's weight.			

5.6 The following diagram is a more detailed description of the modules.



5.7 Substances listed in the "Candidate List of SVHC"

During the life cycle of the product, no hazardous substances listed in the "Candidate List of substances of very high concern (SVHC) for authorization" has been used in a percentage higher than 0.1% of the weight of the product.

5.8 More information

Cut-off rules: more than 99% of the materials and energy consumption have been included. The Polluter Pays Principle and the Modularity Principle have been followed.

Allocations: The allocation of common inputs and outputs is based on the general allocation rule what represents the proportion of production of every specific product in overall production expressed in square meter. Generic process data for production of input materials were used.

Electricity: A specific dataset with the Life Cycle Inventory (LCI) corresponding to the electricity mix in Dubai, United Arab Emirates, has been used for this LCA.

Calculation Rules: Datasets from Ecoinvent 3.9.1 with emission factors for raw materials and generic chemicals have been characterized to adjust them to the characteristics of manufacturing of suppliers or counties where suppliers are located. Specific datasets with the emissions factors corresponding to the fuel combustion of production plant and machinery have been developed for these LCAs. Indirect emissions due to diesel production and transportation are also included in the environmental impact. Minor components are not directly related to the product, with less than 1% impact, such as office supplies, has been excluded from the assessment.

All transports of components have been included in the LCA considering real distances travelled by materials used for production. It is estimated in a global scale according to Ecoinvent™ criteria. As exact port locations are not known in detail, transport distances have been calculated from a one of the ports in the country of origin to the factory. Operation in port has also been excluded. Road distances calculated using Google Maps. Maritime distances calculated using Marine Traffic Voyage Planner.

By Products Assignment: There are no by-products in this Environmental Product Declaration. Hence no allocation had to be applied.

6.0 ENVIRONMENTAL PERFORMACE

6.1 Potential Environment Impacts

This EPD tables the;

- All environmental performance indicators of the declared unit 1 square meter of Insulated Glass Double pane thickness 8mm that weight 20 kg (comprising one pane of 4 mm Monolithic glass, 12 mm spacer along with filler materials and one pane of 4 mm Monolithic glass).
- All environmental performance indicators of the declared unit 1 square meter Insulated Glass Triple pane thickness 12mm that weight 30 kg (comprising one pane of 4 mm Monolithic glass, 12 mm spacer along with filler materials and one pane of 4 mm Monolithic glass and 12 mm spacer along with filler materials and 4 mm Monolithic glass.

Additionally, to scale the impacts of different type of glass and combination of thickness, the core environmental performance indicators of the different type of glass;

- 1 square meter of Insulated Glass Double pane thickness 8mm that weight 20 kg (comprising one pane of 4 mm coated glass, 12 mm spacer along with filler materials and one pane of 4 mm coated glass.
- 1 square meter Insulated Glass Triple pane thickness 12mm that weight 30 kg (comprising one pane of 4 mm coated glass, 12 mm spacer along with filler materials and one pane of 4 mm coated glass and 12 mm spacer along with filler materials and 4 mm coated glass.
- 1 square meter of Insulated Glass Double pane thickness 8mm that weight 20 kg (comprising one pane of 4 mm laminated glass, 12 mm spacer along with filler materials and one pane of 4 mm laminated glass.
- 1 square meter Insulated Glass Triple pane thickness 12mm that weight 30 kg (comprising one pane of 4 mm laminated glass, 12 mm spacer along with filler materials and one pane of 4 mm laminated glass and 12 mm spacer along with filler materials and 4 mm laminated glass.
- 12mm spacer along with filler materials to convert into 1mm

During the assessment it was not evident to distinguish the differences in the consumption of electricity, water and raw material during the manufacturing. Hence, the calculation is based on total production vs total consumption against manufacturing of the product. Environmental impacts are calculated using the EF-3.1, (ILCD).

Table 1: Insulated Glass – Double Pane Monolithic Glass 8 mm

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding thresholds values, safety margins or risks.

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	1.69E+01	5.14E-01	2.84E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	4.25E-01	8.42E-02	-1.60E+01
Climate change (GWP) – biogenic	kg CO2e	1.46E-01	2.11E-05	1.30E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.26E-01	4.14E-02	-1.39E-01
Climate change (GWP) – LULUC	kg CO2e	4.10E-02	8.62E-05	2.31E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	3.89E-03	2.58E-04	-4.04E-02
Climate change (GWP) – total	kg CO2e	1.71E+01	5.14E-01	2.85E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	5.55E-01	1.26E-01	-1.62E+01
Ozone depletion	kg CFC11e	1.91E-06	2.50E-08	1.22E-06	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.07E-07	8.92E-03	-1.69E+00
Acidification	mol H+e	1.25E-01	4.23E-03	2.20E-01	1.10E-04	ND	ND	0.00E+00	2.00E-05	3.23E-03	5.40E-04	-1.18E-01
Eutrophication, aquatic freshwater	kg PO4e	1.36E-02	1.21E-05	1.73E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.54E-04	1.89E-05	-1.30E-02
Eutrophication, aquatic freshwater	Kg P eq	4.42E-03	3.93E-06	5.63E-03	0.00E+00	ND	ND	0.00E+00	0.00E+00	5.02E-05	6.15E-06	-4.24E-03
Eutrophication, aquatic marine	kg Ne	3.06E-02	1.07E-03	4.29E-02	5.38E-05	ND	ND	0.00E+00	1.10E-05	1.06E-03	2.40E-04	-2.95E-02
Eutrophication, terrestrial	mol Ne	3.41E-01	1.20E-02	4.74E-01	6.10E-04	ND	ND	0.00E+00	1.20E-04	1.09E-02	2.51E-03	-3.28E-01
Photochemical ozone formation	kg NMVOCe	1.10E-01	3.09E-03	1.39E-01	1.60E-04	ND	ND	0.00E+00	3.25E-05	6.36E-03	1.87E-03	-1.05E-01
Abiotic depletion, minerals & metals	kg Sbe	2.12E-04	1.73E-07	2.03E-04	0.00E+00	ND	ND	0.00E+00	0.00E+00	3.92E-06	3.57E-07	-2.04E-04
Abiotic depletion of fossil resources	MJ	2.73E+02	1.70E+00	3.40E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	6.45E+00	6.17E+05	-2.51E+02
Water use	m3e depr.	1.09E+01	3.83E-03	7.80E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	2.14E-01	6.26E-03	-1.01E+01

EN 15804+ A2 disclaimers for Abiotic depletion and Water use indicators and all optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. "Reading example: 1.57E-03 = 1.57*10-3 = 0.00157"

Additional Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	2.32E-06	4.57E-09	2.59E-06	5.72E-10	ND	ND	0.00E+00	1.13E-10	2.67E-06	8.86E-07	-2.25E-06
Ionizing radiation, human health	kBq U235e	1.02E+00	7.29E-03	8.55E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.09E-01	4.53E-03	-9.84E-01
Eco-toxicity (freshwater)	CTUe	1.39E+02	4.70E-01	2.05E+02	9.20E-04	ND	ND	0.00E+00	1.80E-04	5.73E+00	1.37E+00	-1.28E+02
Human toxicity, cancer effects	CTUh	1.13E-07	6.33E-11	2.42E-08	1.06E-11	ND	ND	0.00E+00	2.15E-12	3.56E-08	1.18E-08	-1.13E-07
Human toxicity, non-cancer effects	CTUh	2.16E-07	6.75E-10	3.60E-07	2.03E-10	ND	ND	0.00E+00	4.22E-11	6.66E-09	1.29E-09	-2.05E-07
Land use related impacts/soil quality	Dimensionless	8.89E+03	2.13E-01	8.64E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.02E+01	1.78E+00	-8.89E+03

EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	1.70E+01	5.14E-01	2.84E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	4.29E-01	8.45E-02	-1.60E+01

This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013) This indicator Is almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of Natural Resources

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	1.22E+03	1.07E-02	1.84E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	9.79E-01	3.91E-02	-1.21E+03
Renewable PER used as materials	MJ	5.28E-02	4.74E-05	7.39E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	5.76E-04	5.84E-05	-5.06E-02
Total use of renewable PER	MJ	1.22E+03	1.07E-02	1.85E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	9.80E-01	3.92E-02	-1.21E+03

Non-renew. PER used as energy	MJ	2.73E+02	1.70E+00	3.40E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	6.45E+00	6.17E-01	-2.51E+02
Non-renew. PER used as materials	MJ	4.00E-05	2.83E-08	6.90E-05	0.00E+00	ND	ND	0.00E+00	0.00E+00	8.49E-07	1.73E-07	-3.83E-05
Total use of non-renewable PER	MJ	2.73E+02	1.70E+00	3.40E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	6.45E+00	6.17E-01	-2.51E+02
Use of secondary materials	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renew. secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m3	0.00E+00	0.00E+00	2.11E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

End of Life - Waste

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	Kg	0.00E+00	0.00E+00	5.42E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste	Kg	0.00E+00	0.00E+00	1.40E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	2.26E+06	0.00E+00
Radioactive waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

End of Life - Outflows

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.67E+06
Materials for recycling	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2: Insulated Glass – Triple Pane Monolithic Glass 12 mm

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding thresholds values, safety margins or risks.

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	1.99E+01	6.05E-01	5.11E+01	3.62E-01	ND	ND	0.00E+00	6.28E-02	4.56E-01	8.45E-02	-1.87E+01
Climate change (GWP) – biogenic	kg CO2e	1.72E-01	2.49E-05	2.42E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.27E-01	4.14E-02	-1.62E-01
Climate change (GWP) – LULUC	kg CO2e	4.82E-02	1.01E-04	5.56E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	4.45E-03	2.59E-04	-4.75E-02
Climate change (GWP) – total	kg CO2e	2.01E+01	6.05E-01	5.14E+01	3.62E-01	ND	ND	0.00E+00	6.28E-02	5.87E-01	1.26E-01	-1.89E+01
Ozone depletion	kg CFC11e	2.25E-06	2.94E-08	7.95E-07	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.22E-07	8.95E-09	-1.99E-06
Acidification	mol H+e	1.47E-01	4.97E-03	3.90E-01	1.30E-04	ND	ND	0.00E+00	2.00E-05	3.52E-03	5.40E-04	-1.38E-01
Eutrophication, aquatic freshwater	kg PO4e	1.60E-02	1.42E-05	3.63E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.72E-04	1.93E-05	-1.53E-02
Eutrophication, aquatic freshwater	Kg P eq	5.20E-03	4.63E-06	1.18E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	5.62E-05	6.27E-06	-4.97E-03
Eutrophication, aquatic marine	kg Ne	3.60E-02	1.26E-03	7.38E-02	6.32E-05	ND	ND	0.00E+00	1.10E-05	1.13E-03	2.41E-04	-3.44E-02
Eutrophication, terrestrial	mol Ne	4.01E-01	1.41E-02	8.19E-01	7.10E-04	ND	ND	0.00E+00	1.20E-04	1.15E-02	2.51E-03	-3.83E-01
Photochemical ozone formation	kg NMVOCe	1.29E-01	3.64E-03	2.37E-01	1.88E-04	ND	ND	0.00E+00	3.26E-05	6.49E-03	1.87E-03	-1.23E-01
Abiotic depletion, minerals & metals	kg Sbe	2.49E-04	2.03E-07	3.05E-04	0.00E+00	ND	ND	0.00E+00	0.00E+00	4.51E-06	3.87E-07	-2.39E-04
Abiotic depletion of fossil resources	MJ	3.21E+02	2.00E+00	6.19E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	7.27E+00	6.20E-01	-2.94E+02
Water use	m3e depr.	1.28E+01	4.51E-03	1.24E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	2.50E-01	6.53E-03	-1.19E+01

EN 15804+ A2 disclaimers for Abiotic depletion and Water use indicators and all optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. "Reading example: 1.57E-03 = 1.57*10-3 = 0.00157"

Additional Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	2.73E-06	5.38E-09	4.43E-06	6.73E-10	ND	ND	0.00E+00	1.13E-10	2.68E-06	8.86E-07	-2.64E-06
Ionizing radiation, human health	kBq U235e	1.20E+00	8.57E-03	2.53E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.26E-01	4.56E-03	-1.16E+00
Eco-toxicity (freshwater)	CTUe	1.63E+02	5.53E-01	3.29E+02	1.08E-03	ND	ND	0.00E+00	1.80E-04	6.03E+00	1.38E+00	-1.50E+02
Human toxicity, cancer effects	CTUh	1.33E-07	7.44E-11	3.33E-08	1.24E-11	ND	ND	0.00E+00	2.15E-12	3.56E-08	1.18E-08	-1.32E-07
Human toxicity, non-cancer effects	CTUh	2.54E-07	7.94E-10	4.99E-07	2.39E-10	ND	ND	0.00E+00	4.22E-11	7.20E-09	1.30E-09	-2.41E-07
Land use related impacts/soil quality	Dimensionless	1.05E+04	2.50E-01	1.50E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.11E+01	1.79E+00	-1.05E+04

EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	2.00E+01	6.05E-01	5.11E+01	3.62E-01	ND	ND	0.00E+00	6.27E-02	4.29E-01	8.45E-02	-1.60E+01

This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013) This indicator Is almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of Natural Resources

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	1.43E+03	1.26E-02	4.30E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.13E+00	3.95E-02	-1.43E+03
Renewable PER used as materials	MJ	6.21E-02	5.58E-05	1.83E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	6.49E-02	5.91E-05	-5.93E-02
Total use of renewable PER	MJ	1.43E+03	1.27E-02	4.32E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.19E+00	3.96E-02	-1.43E+03

Non-renew. PER used as energy	MJ	3.21E+02	2.00E+00	6.19E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	7.27E+00	6.20E-01	-2.94E+02
Non-renew. PER used as materials	MJ	4.70E-05	3.33E-02	1.23E-04	0.00E+00	ND	ND	0.00E+00	0.00E+00	9.11E-07	1.73E-07	-4.47E-05
Total use of non-renewable PER	MJ	3.21E+02	2.03E+00	6.19E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	7.27E+00	6.20E-01	-2.94E+02
Use of secondary materials	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renew. secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m3	0.00E+00	0.00E+00	2.11E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

End of Life - Waste

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	Kg	0.00E+00	0.00E+00	5.42E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste	Kg	0.00E+00	0.00E+00	1.40E+05	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	1.92E+06	0.00E+00
Radioactive waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

End of Life - Outflows

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.65E+06
Materials for recycling	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 3: Insulated Glass – Double Pane Coated Glass 8 mm

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	1.70E+01	5.14E-01	2.84E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	4.25E-01	8.42E-02	-1.61E+01
Climate change (GWP) – biogenic	kg CO2e	1.47E-01	2.11E-05	1.30E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.26E-01	4.14E-02	-1.39E-01
Climate change (GWP) – LULUC	kg CO2e	4.11E-03	8.62E-05	2.31E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	3.89E-03	2.58E-04	-4.05E-02
Climate change (GWP) – total	kg CO2e	1.72E+01	5.14E-01	2.85E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	5.55E-01	1.26E-01	-1.62E+01
Ozone depletion	kg CFC11e	1.91E-06	2.50E-08	1.22E-06	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.07E-07	8.92E-03	-1.69E-06
Acidification	mol H+e	1.26E-01	4.23E-03	2.20E-01	1.10E-04	ND	ND	0.00E+00	2.00E-05	3.23E-03	5.40E-04	-1.19E-01
Eutrophication, aquatic freshwater	kg PO4e	1.37E-02	1.21E-05	1.73E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.54E-04	1.89E-05	-1.31E-02
Eutrophication, aquatic freshwater	Kg P eq	4.47E-03	3.93E-06	5.63E-03	0.00E+00	ND	ND	0.00E+00	0.00E+00	5.02E-05	6.15E-06	-4.28E-03
Eutrophication, aquatic marine	kg Ne	3.08E-02	1.07E-03	4.29E-02	5.38E-05	ND	ND	0.00E+00	1.10E-05	1.06E-03	2.40E-04	-2.96E-02
Eutrophication, terrestrial	mol Ne	3.42E-01	1.20E-02	4.74E-01	6.10E-04	ND	ND	0.00E+00	1.20E-04	1.09E-02	2.51E-03	-3.29E-01
Photochemical ozone formation	kg NMVOCe	1.10E-01	3.09E-03	1.39E-01	1.60E-04	ND	ND	0.00E+00	3.25E-05	6.36E-03	1.87E-03	-1.06E-01
Abiotic depletion, minerals & metals	kg Sbe	2.16E-04	1.73E-07	2.03E-04	0.00E+00	ND	ND	0.00E+00	0.00E+00	3.92E-06	3.57E-07	-2.07E-04
Abiotic depletion of fossil resources	MJ	2.74E+02	1.70E+00	3.40E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	6.45E+00	6.17E+05	-2.52E+02
Water use	m3e depr.	1.10E+01	3.83E-03	7.80E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	2.14E-01	6.26E-03	-1.01E+01

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	1.71E+01	5.14E-01	2.84E+01	3.07E-01	ND	ND	0.00E+00	6.27E-02	4.29E-01	8.45E-02	-1.60E+01

Table 4: Insulated Glass – Triple Pane Coated Glass 12 mm

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	2.00E+01	6.05E-01	5.11E+01	3.62E-01	ND	ND	0.00E+00	6.28E-02	4.56E-01	8.45E-02	-1.87E+01
Climate change (GWP) – biogenic	kg CO2e	1.73E-01	2.49E-05	2.42E-01	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.27E-01	4.14E-02	-1.63E-01
Climate change (GWP) – LULUC	kg CO2e	4.84E-02	1.01E-04	5.56E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	4.45E-03	2.59E-04	-4.76E-02
Climate change (GWP) – total	kg CO2e	2.03E+01	6.05E-01	5.14E+01	3.62E-01	ND	ND	0.00E+00	6.28E-02	5.87E-01	1.26E-01	-1.89E+01
Ozone depletion	kg CFC11e	2.25E-06	2.94E-08	7.95E-07	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.22E-07	8.95E-09	-1.99E-06
Acidification	mol H+e	1.48E-01	4.97E-03	3.90E-01	1.30E-04	ND	ND	0.00E+00	2.00E-05	3.52E-03	5.40E-04	-1.38E-01
Eutrophication, aquatic freshwater	kg PO4e	1.61E-02	1.42E-05	3.63E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	1.72E-04	1.93E-05	-1.54E-02
Eutrophication, aquatic freshwater	Kg P eq	5.26E-03	4.63E-06	1.18E-02	0.00E+00	ND	ND	0.00E+00	0.00E+00	5.62E-05	6.27E-06	-5.01E-03
Eutrophication, aquatic marine	kg Ne	3.62E-02	1.26E-03	7.38E-02	6.32E-05	ND	ND	0.00E+00	1.10E-05	1.13E-03	2.41E-04	-3.46E-02
Eutrophication, terrestrial	mol Ne	4.03E-01	1.41E-02	8.19E-01	7.10E-04	ND	ND	0.00E+00	1.20E-04	1.15E-02	2.51E-03	-3.84E-01
Photochemical ozone formation	kg NMVOCe	1.30E-01	3.64E-03	2.37E-01	1.88E-04	ND	ND	0.00E+00	3.26E-05	6.49E-03	1.87E-03	-1.23E-01
Abiotic depletion, minerals & metals	kg Sbe	2.54E-04	2.03E-07	3.05E-04	0.00E+00	ND	ND	0.00E+00	0.00E+00	4.51E-06	3.87E-07	-2.42E-04
Abiotic depletion of fossil resources	MJ	3.22E+02	2.00E+00	6.19E+02	0.00E+00	ND	ND	0.00E+00	0.00E+00	7.27E+00	6.20E-01	-2.95E+02
Water use	m3e depr.	1.29E+01	4.51E-03	1.24E+01	0.00E+00	ND	ND	0.00E+00	0.00E+00	2.50E-01	6.53E-03	-1.19E+01

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	2.01E+01	6.05E-01	5.11E+01	3.62E-01	ND	ND	0.00E+00	6.28E-02	4.60E-01	8.47E-02	-1.88E+01

Table 5: Insulated Glass – Double Pane Laminated Glass 17.52 mm

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	1.73E+01	0.00E+00	3.13E+01	7.41E-01	ND	ND	0.00E+00	6.30E-02	6.98E-01	8.63E-02	-1.63E+01
Climate change (GWP) – biogenic	kg CO2e	1.46E-01	0.00E+00	1.30E-01	1.33E-06	ND	ND	0.00E+00	0.00E+00	1.30E-01	4.14E-02	-1.39E-01
Climate change (GWP) – LULUC	kg CO2e	4.21E-02	0.00E+00	2.32E-02	5.41E-06	ND	ND	0.00E+00	0.00E+00	8.77E-03	2.71E-04	-4.14E-02
Climate change (GWP) – total	kg CO2e	1.75E+01	0.00E+00	3.14E+01	7.41E-01	ND	ND	0.00E+00	6.30E-02	8.37E-01	1.28E-01	-1.65E+01
Ozone depletion	kg CFC11e	1.91E-06	0.00E+00	1.30E-06	1.57E-09	ND	ND	0.00E+00	0.00E+00	2.33E-07	9.16E-09	-1.70E-06
Acidification	mol H+e	1.28E-01	0.00E+00	2.23E-07	5.10E-04	ND	ND	0.00E+00	2.00E-05	5.79E-03	5.50E-04	-1.20E-01
Eutrophication, aquatic freshwater	kg PO4e	1.39E-02	0.00E+00	1.74E-02	7.58E-07	ND	ND	0.00E+00	0.00E+00	3.15E-04	2.22E-05	-1.33E-02
Eutrophication, aquatic freshwater	Kg P eq	4.54E-03	0.00E+00	5.66E-03	2.47E-07	ND	ND	0.00E+00	0.00E+00	1.03E-04	7.22E-06	-4.34E-03
Eutrophication, aquatic marine	kg Ne	3.10E-02	0.00E+00	4.37E-02	1.91E-04	ND	ND	0.00E+00	1.10E-05	1.60E-03	2.43E-04	-2.98E-02
Eutrophication, terrestrial	mol Ne	3.45E-01	0.00E+00	4.83E-01	2.15E-03	ND	ND	0.00E+00	1.20E-04	1.62E-02	2.53E-03	-3.32E-01
Photochemical ozone formation	kg NMVOCe	1.11E-01	0.00E+00	1.46E-01	5.63E-04	ND	ND	0.00E+00	3.27E-05	7.55E-03	1.87E-03	-1.06E-01
Abiotic depletion, minerals & metals	kg Sbe	2.12E-04	0.00E+00	2.04E-04	1.08E-08	ND	ND	0.00E+00	0.00E+00	9.11E-06	6.19E-07	-2.04E-04
Abiotic depletion of fossil resources	MJ	2.76E+02	0.00E+00	3.91E+02	1.07E+05	ND	ND	0.00E+00	0.00E+00	1.36E+01	6.44E+05	-2.55E+02
Water use	m3e depr.	1.10E+01	0.00E+00	8.02E+00	2.41E-04	ND	ND	0.00E+00	0.00E+00	5.24E-01	8.62E-03	-1.02E+01

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	1.74E+01	0.00E+00	3.13E+01	7.41E-01	ND	ND	0.00E+00	6.30E-02	7.06E-01	8.66E-02	-1.64E+01

Table 6: Insulated Glass – Triple Pane Laminated Glass 26.28 mm

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	2.04E+01	0.00E+00	5.45E+01	8.71E-01	ND	ND	0.00E+00	6.30E-02	7.77E-01	8.70E-02	-1.90E+01
Climate change (GWP) – biogenic	kg CO2e	1.72E-01	0.00E+00	2.42E-01	1.56E-06	ND	ND	0.00E+00	0.00E+00	1.31E-01	4.14E-02	-1.63E-01
Climate change (GWP) – LULUC	kg CO2e	4.95E-02	0.00E+00	5.58E-02	6.37E-06	ND	ND	0.00E+00	0.00E+00	1.02E-02	2.75E-04	-4.86E-02
Climate change (GWP) – total	kg CO2e	2.06E+01	0.00E+00	5.48E+01	8.71E-01	ND	ND	0.00E+00	6.30E-02	9.18E-01	1.29E-01	-1.93E+01
Ozone depletion	kg CFC11e	2.25E-06	0.00E+00	8.86E-07	1.84E-09	ND	ND	0.00E+00	0.00E+00	2.70E-07	9.23E-09	-1.99E-06
Acidification	mol H+e	1.50E-01	0.00E+00	3.93E-01	6.10E-04	ND	ND	0.00E+00	2.00E-05	6.53E-03	5.50E-04	-1.40E-01
Eutrophication, aquatic freshwater	kg PO4e	1.64E-02	0.00E+00	3.64E-02	8.92E-07	ND	ND	0.00E+00	0.00E+00	3.62E-04	2.31E-05	-1.56E-02
Eutrophication, aquatic freshwater	Kg P eq	5.34E-03	0.00E+00	1.19E-02	2.90E-07	ND	ND	0.00E+00	0.00E+00	1.18E-04	7.53E-06	-5.10E-03
Eutrophication, aquatic marine	kg Ne	3.65E-02	0.00E+00	7.48E-02	2.25E-04	ND	ND	0.00E+00	1.11E-05	1.76E-03	2.44E-04	-3.49E-02
Eutrophication, terrestrial	mol Ne	4.06E-01	0.00E+00	8.29E-01	2.52E-03	ND	ND	0.00E+00	1.20E-04	1.78E-02	2.54E-03	-3.88E-01
Photochemical ozone formation	kg NMVOCe	1.31E-01	0.00E+00	2.45E-01	6.62E-04	ND	ND	0.00E+00	3.27E-05	7.89E-03	1.88E-03	-1.25E-01
Abiotic depletion, minerals & metals	kg Sbe	2.50E-04	0.00E+00	3.06E-04	1.28E-08	ND	ND	0.00E+00	0.00E+00	1.06E-05	6.95E-07	-2.39E-04
Abiotic depletion of fossil resources	MJ	3.25E+02	0.00E+00	6.79E+02	1.26E-01	ND	ND	0.00E+00	0.00E+00	1.57E+01	6.51E-01	-2.98E+02
Water use	m3e depr.	1.29E+01	0.00E+00	1.26E+01	2.83E-04	ND	ND	0.00E+00	0.00E+00	6.14E-01	9.31E-03	-1.19E+01

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	2.04E+01	0.00E+00	5.45E+01	8.71E-01	ND	ND	0.00E+00	6.30E-02	7.87E-01	8.72E-02	-1.91E+01

Table 7: Aluminium Spacer 12mm with filler materials

Core Environmental Impact Indicators

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change (GWP) – fossil	kg CO2e	9.20E-01	2.92E-02	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change (GWP) – biogenic	kg CO2e	5.88E-03	2.57E-06	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change (GWP) – LULUC	kg CO2e	1.13E-03	1.05E-05	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change (GWP) – total	kg CO2e	9.27E-01	2.92E-02	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ozone depletion	kg CFC11e	2.16E-07	8.10E-04	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acidification	mol H+e	6.03E-03	5.00E-04	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, aquatic freshwater	kg PO4e	6.76E-04	1.47E-06	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, aquatic freshwater	Kg P eq	2.20E-04	4.78E-07	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, aquatic marine	kg Ne	9.65E-04	1.25E-04	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, terrestrial	mol Ne	1.01E-02	1.38E-03	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Photochemical ozone formation	kg NMVOCe	3.95E-03	3.59E-04	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Abiotic depletion, minerals & metals	kg Sbe	6.62E-06	2.10E-08	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Abiotic depletion of fossil resources	MJ	2.05E+01	2.07E+05	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Water use	m3e depr.	8.03E-01	4.66E-04	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Environmental impacts – GWP-GHG

Impact Category	Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG	kg CO2e	9.21E-01	2.92E-02	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic Carbon Content

Details	Unit	A1-A3
Biogenic carbon content in product	Kg C	0
Biogenic carbon content in accompanying packaging	Kg C	0

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2. "Reading example: 1.57E-03 = 1.57*10-3 = 0.00157"

Disclaimer: "According to the EN 15804:2012+A2:2019 standard, the LCIA results are relative expressions translating impacts into environmental themes such as climate change, ozone depletion, etc. (midpoint impact categories). Thus, the LCIA results do not predict impacts on category endpoints such as impact on the extinction of species or human health. In addition, the results do not provide information about the exceeding of thresholds, safety margins or risks".

6.2 Interpretation of LCA Study Results

In general terms, as it is shown in the table of core environmental impact indicators, A1-A3 modules have the higher impact, representing above 80% of the whole impact. A4 module has a less impact. C2 and C4 module has little impact too, representing at most 0.16% and 0.01% respectively of the whole impact. Refer the below table 1 for more detailed explanations.

Concluding, the study provides fair understanding of environmental impacts during the various life cycle stages of insulated glass production. It also identifies the hot spots in the value chain where improvement activities can be prioritized and accordingly actions can be planned. The scope covers the ecological information to be divided into raw material production (A1), transportation (A2), manufacturing (A3), delivery (A4), product dismantling (C1), transport of dismantled product to site (C2), waste processing (C3), waste disposal (C4) as well as the end of life stage recycling (D) considerations.

6.3 Calculation of the Scaling Factor and Examples

The calculation of the scaling factors is shown below. The impacts of the selected impact categories specified by the PCR per millimeter of the additional glass/different types of glass was determined by dividing the impact result by the total mm of type of glass in the weighted average product and shown in the tables 1 to 7.

The following table provides the summary of A1-A3 stages of GWP-GHG per 1mm thickness value.

Table-8 Double Glazing, 1mm thickness impact values

Type of Glass	A1	A2	A3	A1-A3	8mm	1mm
Double Glazing (Double Pane)						
Monolithic Glass 8mm (kg CO2e)	1.70E+01	5.14E-01	2.84E+01	4.59E+01	45.90	5.74
Coated Glass 8mm (kg CO2e)	1.71E+01	5.14E-01	2.84E+01	4.60E+01	46.00	5.75
Laminated Glass 8mm (kg CO2e)	1.74E+01	0.00E+00	3.13E+01	4.87E+01	48.70	6.08

Table-9 Triple Glazing 1mm thickness impact values

Triple Glazing (Triple Pane)	A1	A2	A3	A1-A3	12mm	1mm
Monolithic Glass 12mm (kg CO2e)	2.00E+01	6.05E-01	5.11E+01	7.17E+01	71.70	5.98
Coated Glass 12mm (kg CO2e)	2.01E+01	6.05E-01	5.11E+01	7.19E+01	71.90	5.99
Laminated Glass 12mm (kg CO2e)	2.04E+01	0.00E+00	5.45E+01	7.50E+01	75.00	6.25

Table-10 Spacer & Filler Materials, 1mm with filler material impact values

Triple Glazing (Triple Pane)	A1	A2	A3	A1-A3	12mm	1mm
Aluminium Spacer 12mm with filler materials (kg CO2e)	9.20E-01	2.91E-02	0.00E+00	9.50E-01	0.95	0.08

Table-11 Coating impact values (Coating Layer)

Coating Layer	One m^2 and standard value
2780mg, mass% on the final product 0.02%, low emissivity coating, Magnetron Sputter Coating	0.95 kg CO2e

Conversion Formula – Double Glazing

Impact Value = [Outer pane (Monolithic Glass 1mm x Desired Thickness mm) + [Spacer Size x 0.08] + [Inner pane (Laminated Glass 1mm x Desired Thickness mm)]

Calculation Example1

Double Glazing outer pane monolithic 8mm, Air Space 14mm and Inner pane laminated glass 8.76mm.

Step1 - Outer pane value of monolithic glass (refer table 8) = 5.74x8mm =45.92

Step2 – Spacer value (refer table 10) = 14 x 0.08 = 1.12

Step3 - Inner pane value of laminated glass (refer table 8) = 6.08x8.76mm =53.26

For total thickness of 30.76mm thickness glass (including 14mm Spacer) = 45.92+1.12+53.26 = 100.30 (kg CO2e) i.e 1.00E+02 Kg Co2e.

Final GWP-GHG of (A1-A3 stages) 1 square meter of 30.76 thickness Double IGU is 1.00E+02 kg Co2e.

Calculation Example 2

Double Glazing Outer pane laminated 8.76mm, Air Space 12mm and Inner pane monolithic 8mm.

Step1 - Outer pane value of laminated glass (refer table 8) = 6.08x8.76mm =53.26

Step2 – Spacer value (refer table 10) = 12 x 0.08 = 0.96

Step3 – Inner Pane value of monolithic glass (refer table 8) = 5.74x8mm =45.92

For total thickness of 28.76mm thickness glass (including 12m Spacer) = 53.26+0.96+45.92= 100.14 (kg CO2e) i.e 1.00E+02 Kg Co2e.

Final GWP-GHG of (A1-A3 stages) 1 square meter of 28.76 thickness Double IGU is 1.00E+02 kg Co2e.

Conversion Formula – Triple Glazing

Impact Value = [Outer pane (Monolithic Glass 1mm x Desired Thickness mm)] + [Spacer size x 0.08] + [Middle Pane (Monolithic Glass 1mm x Desired Thickness mm) + [Spacer size x 0.08] + [Inner pane (Monolithic Glass 1mm x Desired Thickness mm).

Calculation Example1

Triple Glazing Outer pane monolithic glass 6mm, Air Space 14mm and Middle pane monolithic glass 6mm, Air Space 14mm and Inner pane monolithic 8mm.

Step1 - Outer pane value of monolithic glass (refer table 9) = 5.98x6mm =35.88

Step2 – Spacer value (refer table 10) = 14 x 0.08 = 1.12

Step3 - Middle pane value of monolithic glass (refer table 9) = 5.98x6mm =35.88

Step4 – Spacer value (refer table 10) = 14 x 0.08 = 1.12

Step5 – Inner Pane value of monolithic glass (refer table 9) = 5.98x8mm =47.84

For total thickness of 48mm thickness glass (including 14mm Spacer)= 35.88+1.12+35.88+1.12+47.84 = 121.84 (kg CO2e) i.e 1.22E+02 Kg Co2e.

Final GWP-GHG of (A1-A3 stages) 1 square meter of 48 thickness Triple IGU is 1.22E+02 kg Co2e.

Calculation Example 2

Triple Glazing Outer pane coated glass 8mm, Air Space 16mm and Middle pane coated glass 8mm, Air Space 16mm and Inner pane monolithic 6mm.

Step1 - Outer pane value of coated glass (refer table 9) = 5.99x8mm =47.92

Step2 – Spacer value (refer table 10) = 16 x 0.08 = 1.28

Step3 - Middle pane value of coated glass (refer table 9) = 5.99x8mm =47.92

Step4 – Spacer value (refer table 10) = 16 x 0.08 = 1.28

Step5 – Inner Pane value of monolithic glass (refer table 9) = 5.98x6mm =35.88

For total thickness of 54mm thickness glass (including 16mm(x2) Spacer) = 47.92+1.28+47.92 +1.28+35.88= 134.28 (kg CO2e) i.e 1.34E+02 Kg Co2e.

Final GWP-GHG of (A1-A3 stages) 1 square meter of 54mm thickness Triple IGU is 1.34E+02 kg Co2e.

7.0 MANDATORY STATEMENTS

Explanatory material can be obtained from EPD owner and/or LCA author. The verifier and The Program Operator do not make any claim or present any responsibility about the legality of the product. The EPD owner has the sole ownership, liability, and responsibility for the EPD. The LCA Author shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; have equivalent content declarations; and be valid at the time of comparison.

8.0 ADDITIONAL INFORMATION

8.1 Action against Erosion, Environmental Restoration, and Landscaping of the work.

Application of measures to prevent erosion, restore the environment, and landscape the job includes restoring all elements immediately connected to it. The restoration of other related items indirectly is also suggested, including auxiliary facilities and landfill lands.

We recycle as many waste materials as possible. We follow a Just-in-Time manufacturing strategy to increase efficiency, reduce wastage and eliminate the need for excess storage.

8.2 Information related to Sector EPD

This is not a sector EPD.

8.3 Differences versus previous versions

This is the first version of the EPD.

9.0 VERIFICATION

Diffusion Institution	International Climate Intelligence System 71-75 Shelton Street Covent Garden London, WC2H 9JQ United Kingdom
Registration Number	ICIS-202407-30
Date of Publication	09.07.2024
Valid until	08.07.2029
Geographical Scope	United Arab Emirates
Product category rules (PCR): PCR 2020:17 Construction products (EN 15804:2012+A2:2019/AC:2021) Version 1.2.5 dated 01.11.2022. EN 17074:2019 Glass in building - Environmental product declaration - Product category rules for flat glass products. EN standard EN 15804 serves as the Core Product Category Rules (PCR)	
PCR review was conducted by: International Climate Intelligence System.	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 14040: ☐ EPD Process Certification (internal) ☒ EPD Verification (external)	
Third party verifier: Mr.Luis Manuel, San Adrián, Spain Accredited by: International Climate Intelligence System	

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Verifier Details	Name: Mr.Luis Manuel Location: San Adrián, Spain Accredited by: International Climate Intelligence System

11.0 REFERENCES

LCA Report: Life Cycle Inventory of Insulated Glass by Emirates Glass LLC.

Software: Air.e LCA Version 3.14.0.15 www.solidforest.com

Main database: Ecoinvent 3.9.1 www.ecoinvent.org

Geographical scope of the EPD: United Arab Emirates

ISO 14040:2006 “Environmental management -- life cycle assessment -- principles and framework”;

ISO 14044:2006 “Environmental management -- life cycle assessment -- requirements and guidelines”;

ISO 14020:2000 “Environmental Labels and declarations - General Principles

ISO 14025:2006 “Environmental labels and declarations -- type III environmental declarations -- principles and procedures”.

EN 15804+A2:2019/AC:2021 European Committee for Standardization: Sustainability of construction works − Environmental product declarations − Core rules for the product category of construction products.

General Programme Instructions of the International Climate Intelligence System