

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2024-010-0040-01

FLAT GLASS 4mm



Date of Issue:
Jan 10, 2024

Expiration:
Jan 10, 2029

Last updated:
Mar 11, 2024

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General Information

Saint-Gobain Glass

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Product Name:	FLAT GLASS 4mm
Declared Unit:	1 ton
Declaration Number:	SmartEPD-2024-010-0040-01
Date of Issue:	January 10, 2024
Expiration:	January 10, 2029
Last updated:	March 11, 2024
EPD Scope:	Cradle to gate A1 - A3
Market(s) of Applicability:	North America

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017
PCR:	NSF International PCR for Flat Glass: UN CPC 3711 v.2 Date of issue: September 30, 2020 Valid until: September 30, 2025
PCR review panel:	Contact Smart EPD for more information.
General Program Instructions:	Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

LCA Author/Creator:	Sam Schneider Saint-Gobain North American ESG Sustainability Group sustainability@saint-gobain.com
EPD Program Operator:	Smart EPD info@smartepd.com www.smartepd.com 585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA

Verification:

Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071 :

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Independent external verification of EPD, according to ISO 14025 and reference PCR(s) :

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Limitations, Liability, and Ownership

This EPD was not written to support comparative assertions. Even for similar products, differences in declared unit, use and end-of-life stage assumptions, and data quality may produce incomparable results. It is not recommended to compare EPDs with another organization, as there may be differences in methodology, assumptions, allocation methods, data quality such as variability in data sets, and results of variability in assessment software tools used.

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the whole building life cycle. EPD comparability is only possible when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

The EPD owner has sole ownership, liability, and responsibility for the EPD.

Organization Information

Saint-Gobain, the world leader in the habitat and construction markets, designs, manufactures and distributes building and high-performance materials, providing innovative solutions to the challenges of growth, energy efficiency and environmental protection.

Further information can be found at: <https://www.saint-gobain-northamerica.com/>

Product Description

FLAT GLASS is a soda-lime silicate glass produced using the float process to be used in building applications.

The declared unit is 1 metric tonne (1000 kg) of flat glass to be incorporated into a building. One declared unit is required for the 30 year service life. This EPD covers an average of several products from two manufacturing facilities in Cuautla, Mexico. The products include PLANILUX® (clear glass), PARSOL® GREY (colored glass.) and PARSOL® GREEN (colored glass). 55% of the production was clear glass and 45% was colored glass.

The reference flow is 1 kg with the density of the product being 2,500 kg/m³ with different thicknesses available including 3mm, 4mm, 5mm, 6mm, 8 mm, 10 mm, and 12 mm thicknesses. Material composition does not alter based on thickness. This EPD represents the 4mm Flat Glass.

Further information can be found at: <https://mx.saint-gobain-glass.com/es-MX>

Product Information

Declared Unit:	1 ton
Mass:	1000 kg
Reference Service Life:	30 Years

Product Specificity:

✗ Product Average

✓ Product Specific

Averaging:

The data utilized in this study represent a weighted average for two Saint-Gobain facilities producing FLAT GLASS in Cuautla, Morelos, Mexico. FLAT GLASS, Saint-Gobain Glass Mexico manufactures PLANILUX®, a high-quality clear glass, as well as PARSOL®, a colored glass that improves building energy performance and creates new aesthetics due to its colors.

Plants



Saint-Gobain Glass Mexico
Cd Ayala, Morelos, Mexico

Product Specifications

Product Classification Codes:

UNCPC - 37113

EC3 - Openings -> Glazing -> Panes -> Flat Glass

Light transmittance (TL):

90 %

Energy transmission (TE):

85 %

Energy absorption (AE):

8 %

Solar factor (G-value):

0.87

Mass per m2:

10.0 kg

Material Composition

Material/Component Category	Origin	% Mass
Sand	Unknown	55-60
Sodium carbonate	Unknown	15-20
Dolomite	Unknown	10-12
Limestone	Unknown	7-10
Glass cullet	Unknown	10-12
Feldspar	Unknown	0.25-1.0



Packaging Material	Origin	kg Mass
Cardboard	Unknown	6.00E-01
Wood	Unknown	2.50E-01
Plastics	Unknown	2.00E-02

Hazardous Materials
No regulated hazardous or dangerous substances are included in this product.

EPD Data Specificity

- Primary Data Year:2018
- Manufacturing Specificity:

✗

Industry Average

✓

Manufacturer Average

✓

Facility Specific

Software and LCI Data Sources

- LCA Software:

📖

GaBi v. 8.0
- LCI Foreground Database(s):

📖

GaBi Professional Database v. 2018
- LCI Background Database(s):

📖

Ecoinvent v. 3.5

📖

GaBi Professional Database v. 2018

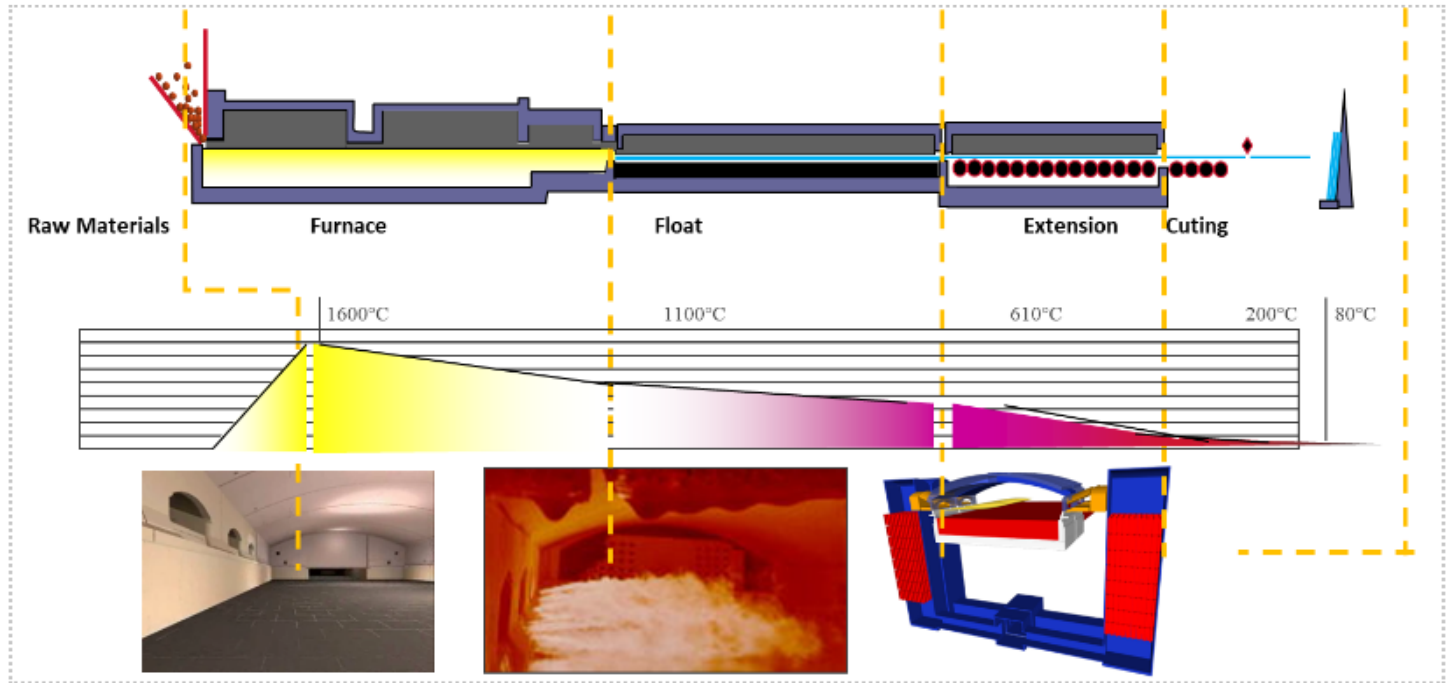
Renewable Electricity

- Renewable electricity is used:No

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	ND
	A5	Assembly / Install	ND
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	ND
	C2	Transport	ND
	C3	Waste Processing	ND
	C4	Disposal	ND
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Product Flow Diagram



Life Cycle Module Descriptions

Product stage, A1-A3

Description of the stage: For flat glass A1 to A3 represents the production of glass in the float from cradle to gate.

The product stage includes the extraction and processing of raw materials and energies, transport to the manufacturer, manufacturing and processing of flat glass.

1. BATCH MIXER: Mix of raw materials (silica, soda ash, lime, feldspar and dolomite) to which recycled glass (cullet) and other compounds are added depending on the desired color and properties.

2. FUSION FURNACE: Raw materials are melted at 1,550°C in a furnace.

3. FLOAT: The molten glass is fed into a bath of molten tin. The glass floats on this flat surface and is drawn off in a ribbon. Serrated wheels, or top rolls, pull and push the glass sideways depending on the desired thickness (from 2 to 19 millimeters).

4. ANNEALING LEHR: The glass is lifted onto conveyor rollers and passes through a controlled cooling tunnel measuring more than 100 meters in length. Approximately 600°C at the start of this step, the glass exits the lehr at room temperature.

5. CUTTING AND STACKING: The glass is automatically cut lengthwise and crosswise. The sheets of glass are raised by vacuum frames that then place them on glass stillage.

6. QUALITY: Automatic inspections and regular samples are taken to check the quality of the glass at each step in the glassmaking process.

7. STORAGE AND TRANSPORTATION: Stillages are placed on storage racks in the warehouse.

8. ENVIRONMENT: Use of recycled cullet, installation of pollution abatement systems and closed-circuit management of water: every measure is taken to limit the consumption of energy, extraction of natural resources, production of waste and emissions into the atmosphere.

LCA Discussion

All inputs and outputs to a process shall be included in the calculation of results. Per PCR requirements, mass and energy flows above 1% are included in the inventory. Any data gaps are filled by conservative assumptions with average, generic, or proxy data. For hazardous substances, as defined by the U.S. Resource Conservation and Recovery Act (RCRA), the following requirements apply:

- The Life Cycle Inventory (LCI) of hazardous substances will be included, if the inventory is available.
- If the LCI for a hazardous substance is not available, the substance will appear as an input in the LCI of the product, if its mass represents more than 0.1% of the product composition.
- If the LCI of a hazardous substance is approximated by modeling another substance, documentation will be provided. This LCA is in compliance with the cut-off criteria since no known processes were neglected or excluded from this analysis. Following the cut-off approach, the recycling at end of life has no environmental burden or credit. For data quality, also suggest you use the full text from the report.

Mass allocation. Attribution of total inputs and outputs are based on kg of production for FLAT GLASS. The declared glass products are available in a range of thicknesses. The reference thickness is declared as the 4 mm flat glass product, this thickness is more common in the commercial and residential markets.

Allocation of background data (energy and materials) taken from the GaBi 2016 databases is documented online at <http://gabi-software.com/support/gabi/gabi-data-base-2014-lci-documentation/>

Data Quality

The data used to create the inventory model shall be as precise, complete, consistent, and representative as possible with regards to the goal and scope of the study under given time and budget constraints. Inventory data quality is judged by its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied) and representativeness (geographical, temporal, and technological).

Results

Environmental Impact Assessment Results

TRACI 2.1, ReCiPe 2016 v1.1

per 1 ton of product.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact Category	Method	Unit	A1	A2	A3	A1A2A3
ODP	TRACI 2.1	kg CFC 11 eq	3.80e-7	3.80e-7	7.52e-5	7.60e-5
AP	TRACI 2.1	kg SO ₂ eq	1.73e+0	1.44e-1	7.70e+0	9.57e+0
EP	TRACI 2.1	kg N eq	4.04e-1	3.96e-2	4.31e+0	4.75e+0
POCP	TRACI 2.1	kg O ₃ eq	1.75e+1	1.31e+0	6.86e+1	8.74e+1
ADP-minerals&metals	ReCiPe 2016 v1.1	kg Fe eq	7.40e-2	5.55e-3	2.90e-1	3.70e-1
GWP-total	TRACI 2.1	kg CO ₂ eq	3.30e+2	1.27e+1	9.27e+2	1.27e+3
ADP-fossil	TRACI 2.1	MJ	5.02e+2	7.17e+1	1.82e+3	2.39e+3

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particulate Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicators

per 1 ton of product.

Indicator	Unit	A1	A2	A3	A1A2A3
RPRT	MJ, net calorific value	2.25e+2	5.42e+0	3.12e+2	5.42e+2
RPRM	MJ, net calorific value	0	0	0	0
RPRT	MJ, net calorific value	2.25e+2	5.42e+0	3.12e+2	5.42e+2
NRPRE	MJ, net calorific value	3.96e+3	1.93e+2	1.52e+4	1.94e+4
NRPRM	MJ, net calorific value	0	0	0	0
NRPRT	MJ, net calorific value	3.96e+3	1.93e+2	1.52e+4	1.94e+4
SM	kg	1.10e+2	0	0	1.10e+2
RSF	MJ, net calorific value	0	0	0	0
NRSF	MJ, net calorific value	0	0	0	0
RE	MJ	0	0	0	0
FW	m3	1.27e+0	2.82e-2	1.52e+0	2.82e+0
SOx	kg	0	0	1.77e-3	1.77e-3
NOx	kg	0	0	6.24e-3	6.24e-3
CO2e	kg	0	0	6.11e-1	6.11e-1
CO	kg	0	0	7.88e-6	7.88e-6
VOCs	kg	0	0	0	0
Fe	kg	0	0	1.29e-7	1.29e-7
PM total	kg	0	0	3.24e-4	3.24e-4
Phosphates	kg	0	0	1.34e-7	1.34e-7
Nitrates	ND	0	0	3.69e-6	3.69e-6
Heavy metals	ND	0	0	1.39e-4	1.39e-4

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

per 1 ton of product.

Indicator	Unit	A1	A2	A3	A1A2A3
HWD	kg	7.07e-5	4.64e-6	1.93e-6	7.73e-5
NHWD	kg	2.78e+1	2.81e-1	0	2.81e+1
MFR	kg	2.86e+1	0	0	2.86e+1
MER	kg	0	0	0	0
MNER	kg	0	0	0	0

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Interpretation

In the production of FLAT GLASS two main sources of impacts can be identified.

One is the energy consumed in the furnace and the other one is the impacts generated in the production of one of the main raw materials, the soda ash.

Soda ash is in the origin of 21% of the GWP, 60% of the abiotic depletion for non-fossil fuels (ADP elements) and more than 20% of the energy consumption.

Planiclear and Parsol glass have the same process and a similar recipe, except for metallic oxides which give the coloration to the glass.

With the very low variations linked to this component, results are seen as representative for both products.

Dioxin results were not completed for this assessment.

Additional Environmental Information

Saint-Gobain's Environmental Policy

Saint-Gobain's environmental vision is to ensure the sustainable development of its activities, while preserving the environment from the impacts of its processes and services throughout their life cycle. The Group thus seeks to ensure the preservation of resources, meet the expectations of its relevant stakeholders, and offer its customers the highest added value with the lowest environmental impact.

The Group has set two long-term objectives: zero environmental accidents and a minimum impact of its activities on the environment. Short and medium-term goals are set to address these two ambitions. They concern five environmental areas identified by the Group: raw materials and waste; energy, atmospheric emissions and climate; water; biodiversity; and environmental accidents and nuisance.

Saint-Gobain's long-term objectives:

Non recovered waste (2010-2025): -50%

Long-term: zero non-recovered waste

Energy consumption: -15% (2010-2025)

CO2 emissions: -20% (2010-2025)

Emissions of NOx, SO2 and dust: -20% for each emissions category (2010-2025)

Water discharge: -80% (2010-2025)

Long-term: zero industrial water discharge in liquid form

2025: promote the preservation of natural areas at Company sites as much as possible

2025: all environmental events are recorded, registered and investigated

More information on our website: www.saint-gobain.com and our Registration Document.

Our products' contribution to Sustainable Buildings

Saint-Gobain encourages sustainable construction and develops innovative solutions for new and renovated buildings that are energy efficient, comfortable, healthy and esthetically superior, while at the same time protecting natural resources.

The following information might be of help for green building certification programs:

RECYCLED CONTENT

(Required for LEED v4 Building product disclosure and optimization - sourcing of raw materials)

Recycled content: proportion (by mass) of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content.

1. Post-consumer material: material generated by households or commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose.

2. In practice, in the case of flat glass, all material coming from glass recycling collection schemes falls under this category, i.e., glass waste from end-of-life vehicles, construction and demolition waste, etc.

3. Pre-consumer material: material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

4. In the case of flat glass, this waste originates from the processing or re-processing of glass that takes place before the final product reaches the consumer market.

Pre-consumer waste flat glass is made of cut-off, losses during laminating, bending and other processing, including the manufacture of insulating glass units or automotive windscreens.

Cullet generated in the furnace plant, and which is reintroduced into the furnace cannot be considered as pre-consumer recycled content, since there was never intent to discard it and therefore it would never have entered the solid waste stream.

Pre-consumer cullet ~11%

Post-consumer cullet < 1%

In the future, Saint-Gobain Glass intends to continue the increase of recycled material in its products, especially when recycling building post-consumer cullet glass dismantling and recycling networks will be available in every country.

Responsible sourcing

(Required for BREEAM International new construction 2013 – MAT 03 Responsible sourcing)

Cuautla (México) Saint-Gobain factories is certified ISO 14001.

All Saint-Gobain Glass Industry sites with a glassmaking furnace are ISO 14001 certified.

All internal Saint-Gobain Glass quarries are certified ISO 14001 like for example SAINT-GOBAIN SAMIN (sand) in France. Many Saint-Gobain Glass raw material suppliers are certified ISO 14001. Our policy consists in encouraging the sourcing of raw materials extracted or made in sites certified ISO 14001 (or the equivalent).

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References

NSF International PCR for Flat Glass: UN CPC 3711 v.2; Date of issue: September 30, 2020; Valid until: September 30, 2025.

EN 15804:2012, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework

ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines

ISO 21930, Sustainability in building construction – Environmental declaration of building products

NFRC 301 - 2017_E0A2 Standard Test Method for Emittance of Glazing Products

CIE (15-2004) – Technical Report: Colorimetry, 3rd Edition.

ASTM E2114-19, Standard Technology for Sustainability Relative to the Performance of Buildings

ASTM E2129-18, Standard Practice for Data Collection for Sustainability Assessment of Building Products

ASTM E2432-19, Standard Guide for General Principles of Sustainability Relative to Buildings EN 15804:2012

Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) FTC Part 260

Green guides (ILCD, 2010) Joint Research Commission, 2010

ILCD Handbook: General Guide for Life Cycle Assessment Intergovernmental Panel on Climate Change (IPCC)

Ecoinvent v3.5 Databases. <http://ecoinvent.org/>

Sphera LCA FE Databases (Formerly GaBi) v8.0. 2018. <https://sphera.com/product-sustainability-software>