Prel-Gard, Prel-Lam, Prel-UniT and Prel-AirSecur Processed Glass

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PRELCO

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006 and ISO 21930:2017

PRELCO is pleased to present this Environmental Product Declaration (EPD) for their Prel-Gard, Prel-Lam, Prel-UniT and Prel-AirSecur Processed Glass. This EPD was developed in compliance with ISO 14025 and ISO 21930 and has been verified by Lindita Bushi, Athena Sustainable Materials Institute.

The LCA and the EPD were prepared by Vertima Inc. The EPD includes cradle-to-gate life cycle assessment (LCA) results.

For more information about PRELCO, visit www.prelco.ca.

For any explanatory material regarding this EPD, please contact the program operator.

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements
For more information visit csaregistries.ca/epd

4761-4853
November 2023-November 2028

1. GENERAL INFORMATION

PCR GENERAL INFORMATION			
Reference PCR	Part B: Processed Glass EPD Requirements UL Environment August 17, 2016 - Validity extended till December 06, 2023		
The PCR review was conducted by:	*Thomas P. Gloria, Ph.D.* *Industrial Ecology Consultants* *35 Bracebridge Rd.* *Newton, MA 02459-1728* *t.gloria@industrial-ecology.*	*Jack Geibig* *Ecoform* *jgeibig@ecoform.com*	*Bill Stough* *Substainable Research Group* *bstough@subtainableresearchgroup.com*

EPD GENERAL INFORMATION		
Program Operator	CSA Group 178 Rexdale Blvd Toronto (Ontario) M9W 1R3 CANADA www.csagroup.org	
Declared Product	**Prel-Gard tempered glass, Prel-Lam laminated glass, Prel-Unit insulating glass units and Prel-AirSecur bird-friendly insulating glass units**	
EPD Registration Number 4761-4853	**EPD Date of Issue** November 27, 2023	**EPD Period of Validity** November 27, 2023 - November 25, 2028
EPD Recipient Organization	Prelco 94 Cartier Boulevard Rivière-du-Loup (Quebec) G5R 2M9 CANADA http://www.prelco.ca	

EPD Type/Scope and Functional Unit Product-specific cradle-to-gate EPD with functional unit of 1 m^2 of processed glass.			**Year of Reported Manufacturer Primary Data** June 1, 2017 to May 31, 2018 and October 1, 2022 September 30, 2023
Geographical Scope North America	**LCA So tware** OpenLCA v.2.0.3	**LCI Databases** Ecoinvent 3.4 and US LCI	**LCIA Methodology** TRACI 2.1 and CML 4.8

This LCA and EPD were prepared by:	Chantal Lavigne, M.A.Sc. Vertima Inc. www.vertima.ca
This EPD and LCA were independently verified in accordance with ISO 14025:2006, ISO 14040:2006, ISO 14044:2006 and ISO 21930:2017, as well as the UL Environment PCR Part B: Processed Glass EPD Requirements ☐ Internal ☒ External	Lindita Bushi Lindita Bushi, Ph.D. Athena Sustainable Materials Institute

LIMITATIONS

Environmental declarations from different programs (ISO 14025) may not be comparable [1].

Comparison of the environmental performance of processed glass 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 building energy use phase as instructed under this PCR [2].

Full conformance with the PCR for North American Processed Glass allows EPD comparability only when all stages of the processed glass life cycle have been considered, which is not permitted under this PCR. However, variations and deviations are possible. Example of variations: Different Life Cycle Assessment (LCA) software and background Life Cycle Inventory (LCI) datasets may lead to differences in results upstream or downstream of the life cycle stages declared [2]. Given this EPD is cradle to gate in scope[1], comparisons of EPD data from one product to another are not allowed.

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[1] Cradle-to-gate EPDs (A1 to A3) are intended for business-to-business (B2B) communications.

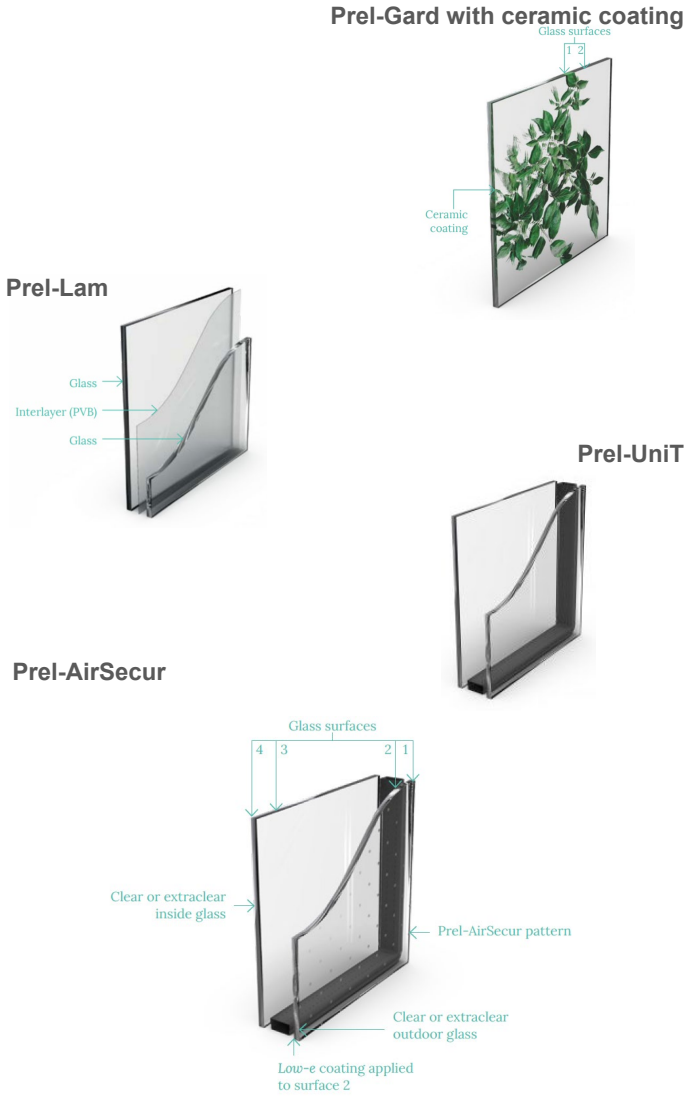
2 PRODUCT SYSTEM DESCRIPTION

Prelco is a Canadian manufacturing company that designs and manufactures glazing products for institutional, commercial and industrial (ICI) buildings. Facilities producing the products under study are located in Montreal (Quebec), Rivière-du-Loup (Quebec) and Edmundston (New Brunswick).

2.1 PRODUCT DESCRIPTION

Prel-Gard[2], Prel-Lam[3] and Insulating Glass, found under the brand names Prel-UniT[4] and Prel-AirSecur[4], are processed glass made of flat glass, tempered or non-tempered, which meet ASTM C1036-21 Standard Specification for Flat Glass [7]. Optionally, the glass can be coated with a Prel-Design coating made of ceramic paint (silkscreened) or ceramic ink (digital printing). Furthermore, Prel-AirSecur Insulating Glass Unit has a bird friendly glass. The bird friendly glass has an etched pattern on its outside to prevent bird collisions.

Prel-Gard is made of monolithic tempered glass, Prel-Lam of two or more pieces of glass permanently bonded together with one or more interlayers of polyvinyl butyral (PVB) resin or ionoplast, and the Insulating Glass Units, Prel-UniT and Prel-AirSecur, consists of assembling two or more individual pieces of glass separated by a dehydrated and hermetically sealed air space. The Prel-UniT Insulating Glass Units are assembled with a spacer bar (three options), a desiccant (one option), a primary sealant (one option), a secondary sealant (one option), and filling gas (two options).



[Photos courtesy of Prelco]

2.2 PRODUCT APPLICATION

Prel-Gard glass, made of tempered glass, provides greater resistance to thermal and mechanical stresses and achieve specific break patterns for safety glazing applications. Prel-Gard is used in interior applications such as railings, glass doors and partitions, shower doors and enclosures, as well as exterior applications in railings, windscreens, glass doors and storefronts.

Prel-Lam protects people and goods in the event of breakage, as the interlayer holds glass fragments together. It is used in interior applications such as railings, glass doors and partitions, museum, or exhibition halls, as well as storefronts. It is also used in exterior applications such as spider systems, skylights, railings, storefronts, and sloped glazing.

Insulating Glass Units, Prel-UniT and Prel-AirSecur, are used in vertical and sloped glazing exterior applications, such as punch windows, curtain walls, spider systems, skylights, canopies, and roof windows. Prel-AirSecur is used specifically to prevent bird collisions.

Prelco's glass has been used in a multitude of projects; please see https://www.prelco.ca/en/architectural/projects/ for examples [8].

2.3 PLACING ON THE MARKET/ APPLICATION RULES

Prelco's products respect the following standards per product type:

a) Prel-Gard Tempered Glass Products
- ASTM C1036-21 - Standard Specification for Flat Glass [7]
- ASTM-C1048-18 - Standard Specification for Heat-Strengthened and Fully Tempered Glass [9]
- ANSI Z97.1-2015 (R2020)- American National Standard for Safety Glazing Materials Used in Buildings [10]
- CAN/CGSB-12.1-2022 - Canadian Standard - Safety Glazing [11]
- CPSC 16 CFR-1201 (2023) – Safety Standard for Architectural Glazing Materials [12]

b) Prel-Lam Laminated Glass Products
- ASTM C1172-19 - Laminated Architectural Flat glass [13]
- CAN/CGSB-12.1-2022 - Canadian Standard - Safety Glazing [11]
- CPSC 16 CFR-1201 (2023) - Safety Standard for Architectural Glazing Materials [12]

c) Prel-UniT and Prel-AirSecur Insulating Glass Units
- ASTM E 2190-19 - Standard Specification for Insulating Glass Unit [14]
- CAN/CGSB 12.8-2017 (R2022) – Insulating Glass Units [15]

[2] Prel-Gard tempered glass is classified under the United Nations Standard Products and Services Code (UNSPSC) 30171706 and the Construction Specification Institute (CSI) MasterFormat code 08 81 00.

[3] Prel-Lam laminated glass is classified under the United Nations Standard Products and Services Code (UNSPSC) 30171705 and the Construction Specification Institute (CSI) MasterFormat code 08 81 00.

[4] Prel-UniT and Prel-AirSecur insulating glass units are classified under the United Nations Standard Products and Services Code (UNSPSC) 30171710 and the Construction Specification Institute (CSI) MasterFormat code 08 81 00.

2.4 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

All products are available with the following different glass types: clear, low-iron, tinted, low-e and reflective, and optional silkscreened or digital printed coatings. Silkscreened coating is available in fourteen standard colours and seven standard patterns as well as custom-made patterns and colours. Digital printed coating is available in a wide range of colour choices and is ideal for projects using different multicolour images or designs on different glass panels.

Prel-Gard thickness ranges from 3 mm to 19 mm; its length can be up to 5182 mm (204 inches) and width up to 2794 mm (110 inches).

Prel-Lam total glass thickness ranges from 6.4 mm to 45 mm with an interlayer of 0.38 mm to 1.52 mm; its length can be up to 5182 mm (204 inches) and width up to 2590 mm (102 inches). Specific properties in terms of safety, energy performance, aesthetics and acoustic, depend on the make-up, i.e., glass thickness. Interlayer types can be PVB or ionoplast.

Insulating Glass Units, Prel-UniT and Prel-AirSecur, total glass thickness ranges from 6 mm to 48 mm, excluding air space; its length can be up to 5182 mm (204 inches) and width up to 2692 mm (106 inches).

Details can be found on Prelco's website https://www.prelco.ca/en/architectural/ [16].

2.5 MATERIAL COMPOSITION

For details on material content for Insulating Glass Units, refer to the health product declaration (HPD) that can be found at http://www.hpd-collaborative.org/hpd-public-repository/ [17].

Materials/Components	Prel-Gard 1 m^2 of Average Product		Prel-Lam 1 m^2 of Average Product		Insulating Glass Units: Prel-UniT and Prel-AirSecur 1 m^2 of Average Product	
	kg	%	kg	%	kg	%
Glass	18.4	99.95%	30.4	95.99%	33.0	97.31%
Silkscreened coating	0.009	0.05%	0.0023	0.01%	0.0011	0.00%
Digital printed coating	0.0003	0.00%	0.00026	0.00%	0.00011	0.00%
PVB or ionoplast	-	-	1.27	4.00%	-	-
Spacer Bar / PP-based	-	-	-	-	0.10	0.29%
Spacer Bar / Steel-based	-	-	-	-	0.014	0.04%
Spacer Bar / Al-based	-	-	-	-	0.019	0.06%
Primary Seal / Silicone	-	-	-	-	0.54	1.60%
Secondary Seal / PIB	-	-	-	-	0.041	0.12%
Dessicant	-	-	-	-	0.177	0.52%
Filling gas / Argon	-	-	-	-	0.018	0.05%
Filling gas / Air	-	-	-	-	0.002	0.00%
TOTAL	18.4	100.00%	31.7	100.00%	33.9	100.00%

2.6 MANUFACTURING

The glass is cut, polished and/or seamed, cleaned and optionally coated with silkscreened or digital printed coating before being tempered. For Prel-Lam Laminated Glass, the laminating process takes place after the tempering process. During the laminating process, the multilayer glass is placed inside a pressurized autoclave, and then subjected to a combination of strong air pressure and high heat. For the Prel-UniT Insulating Glass Unit, the glass is prepared as stated above prior to assembly with sealant, desiccant, spacer, and gas. The sequence of the different process steps carried out at Prelco's facilities are illustrated in section A3 – Manufacturing of Figure 1. The Rivière-du-Loup facility produces all three types of products, while the Edmundston facility only produces Prel-Gard products. The Montreal facility only produces Prel-UniT products from glass cut and polished/seamed on site or from glass cut, polished/seamed coated and tempered at the Riviere-du-Loup or Edmundston facilities. Prel-AirSecur glass is etched at the Edmondston facility and the final assembly into an Insulating Glass Unit is done at the Rivière-du-Loup facility.

2.7 ENVIRONMENT AND HEALTH DURING MANUFACTURING

Health and safety are an integral part of all Prelco's processes and daily routines. Prelco follows provincial and federal rules on Health, Safety and Environment (HSE) policies for a safe workplace that meets OSHAS 18001 [18] or ISO 45001 [19].

2.8 PRODUCT INSTALLATION

Prelco provides installation, storage and handling guidelines in its document entitled "Architectural Glass Care" available online at https://www.prelco.ca/wp-content/uploads/2019/11/20191107-Entretien-Verre-Architectural_EN_web.pdf [20].

2.9 PACKAGING

Prel-Gard Tempered Glass, Prel-Lam Laminated Glass, and Prel-UniT Insulating Glass Units are packaged on reusable steel racks or wood racks. To protect the glass, tentest sheathing, cardboard and cork is used. Packaging items are held together with polyester strapping.

2.10 CONDITION OF USE

No specific information regarding special product features for the period of use to be reported.

2.11 ENVIRONMENT AND HEALTH DURING USE

For this EPD, the system boundaries encompass a cradle-to-gate scope. Environmental impacts of the product-in-use phase are excluded from this declaration, per UL Environment PCR Guidance for Building-Related Products and Services – Part B: Processed Glass EPD Requirements [2].

Prelco provides guidelines for cleaning and maintaining its glass products in its document entitled "Architectural Glass Care," available online at https://www.prelco.ca/wp-content/uploads/2019/11/20191107-Entretien-Verre-Architectural_EN_web.pdf [20].

2.12 EXTRAORDINARY EFFECTS

No extraordinary effects are to be reported.

2.13 RE-USE PHASE

Glass cullet from waste glass can be recycled into new products as often as desired if they are free of contaminants (e.g. non-glass component) [21], [22]. Industries using crushed glass as their raw materials including the fiberglass, glass container, roadways, highway paint, terrazzo flooring, polishing material and landscaping industries.

2.14 DISPOSAL

Waste glass from the demolition of buildings need to contain a low amount of earthenware, stones and porcelain (ESP) to be recycled into flat glass [22]. Worldwide, the recycling rate for flat glass in only 11% [22], while in the United States, in 2018, waste glass found in durable goods was hardly recycled [23].

At their end-of-life, processed glass can be recycled, but is, more often than not, landfilled (86.6% in the US, 2018) or combusted with energy recovery (13.4% in the US, 2018) [23].

2.15 FURTHER INFORMATION

Further information about Prelco's products is available at https://www.prelco.ca/en/architectural/ [16].

3 LCA CALCULATION RULES

This LCA follows the attributional LCA approach.

3.1 DECLARED UNIT

The selected declared unit (DU) for this EPD is **1 m² of processed glass**. All flat glass used in the products has a density of 2500 kg/m³.

Item	Unit	Prel-Gard	Prel-Lam	Insulating Glass Units : Prel-UniT and Prel-AirSecur
Declared unit (DU)	m^2	1	1	1
Mass per piece	kg	18.4	31.7	33.9
Conversion factor to 1 kg		0.054	0.032	0.029
Glass thickness -average (Range of glass thicknesses)	mm	7.4 (3 – 19)	12.7 (6.4 – 45)	13.6 (6 – 48)
Glass % mass	wt. %	99.95%	95.99%	97.31%
Interlayer % mass	wt. %	0.00%	4.00%	0.00%
Rest of materials % mass	wt. %	0.05%	0.01%	2.69%

3.2 PRODUCTION AVERAGE

The average processed glass weight for each product has been calculated using the annual production average values collected from June 1, 2017 to May 31, 2018, i.e., total product mass production divided by total assembled product area production. The additional etching process step for Prel-AirSecur was calculated based on October 1, 2022 to September 30, 2023 production data.

3.3 SYSTEM BOUNDARIES

System boundaries are **cradle-to-gate** [2], i.e., cover the production life cycle stage as illustrated in Table 1. Within this life cycle stage, three (3) modules are considered, namely A-1) Extraction and upstream production, A-2) Transport to factory and A-3) Manufacturing. Construction (A-4; A-5), Use (B-1 to B-7) and End-of-Life (C-1 to C-4) stages are not included in this EPD. Figure 1 presents the process flow diagram for Prel-Gard Tempered Glass, Prel-Lam Laminated Glass, and Prel-UniT and Prel-AirSecur Insulating Glass Units, respectively. It should be noted that no CO_2 certificates are used in this EPD project.

Table 1: Description of the system boundary modules

PRODUCTION STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END-OF-LIFE STAGE			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Assembly/Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction / Demolition	Transport to waste processing or disposal	Waste Processing	Disposal of waste
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Key: X = included; MND = module not declared (excluded)

Extraction and upstream production: This module includes the extraction and transformation of raw materials needed to produce flat glass (soda-lime glass), all the chemicals used for the coatings, the PVB or ionoplast for the laminating interlayer, as well as raw materials to produce the Prel-UniT Insulating Glass Units.

Transport to factory: This module includes the transportation of raw materials from Prelco's suppliers to the Prelco facilities.

Manufacturing: This module includes water and energy (electricity) consumption for manufacturing processes (e.g., seaming, tempering, coating, laminating, and assembling) and excludes heating of the building. Propane used in fork lifts to transport the glass on site is also included, as well as the production of the etching chemicals and the transport to the facility. No air or water emissions from the manufacturing facilities were reported.

There is an average 30% loss of glass during the glass cutting processes steps (e.g., broken, trims) as well as 2% to 7% loss of products (e.g., scrap, defects). These losses have been determined by production weight. Glass waste is sent to a recycling centre while paint and sealant residues are sent to hazardous waste treatment.

Finally, packaging materials to make products ready for shipment, as well as their transport to Prelco's facilities, are covered by this module.

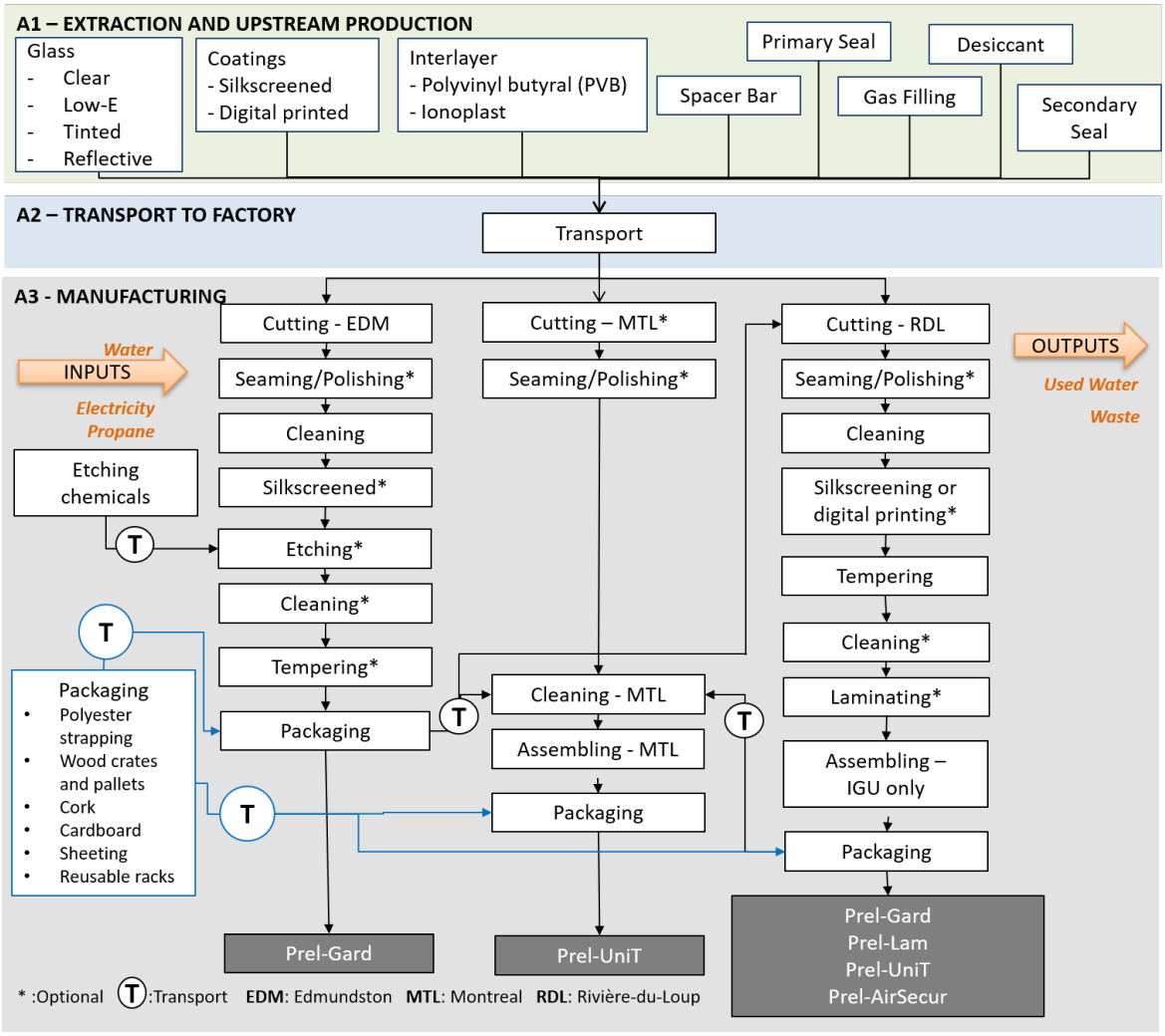


Figure 1: System boundaries of cradle-to-gate LCA of Prelco's Prel-Gard Tempered Glass, Prel-Lam Laminated Glass, as well as Prel-UniT and Prel-AirSecur Insulating Glass Units.

3.4 CUT-OFF CRITERIA

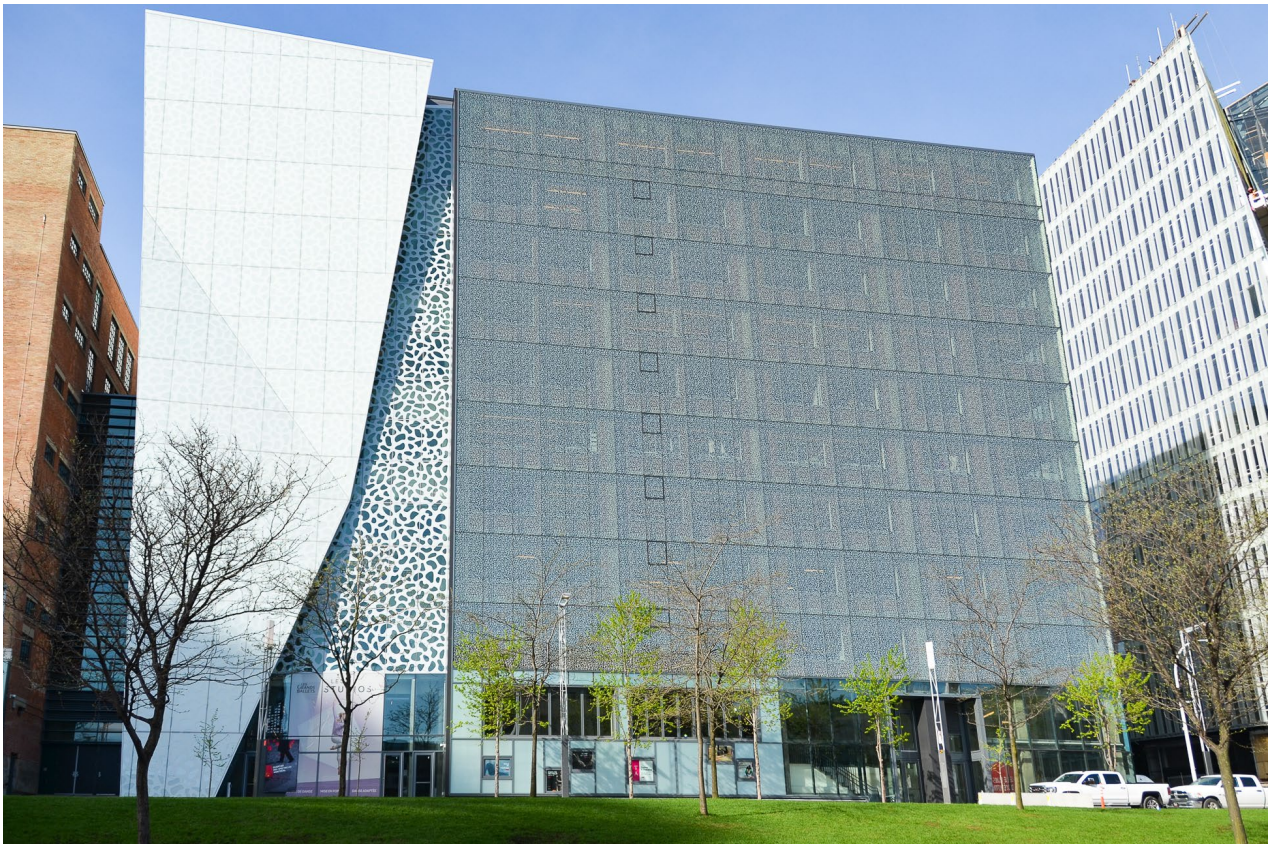
In this EPD, no primary data (input material, energy consumption) was excluded from the system boundaries.

In addition, no data on the construction, maintenance or dismantling of the capital assets, daily employee transport, office work, business trips and other activity by Prelco's employees was included in the model. The model only takes into account the processes associated with infrastructures that are already included in the *ecoinvent* unit processes.

3.5 ALLOCATION

Data relative to process energy consumption (electricity) was provided for each process step and each facility, while energy use in the forklift (propane), water consumption, air emissions, waste and packaging was provided for the whole manufacturing plant. In this EPD, **mass allocation** was used for input energy flows (propane), water flows, waste flows and packaging [2].

Waste processing of the material flows undergoing recycling processes are included up to the system boundary of the end-of-waste state [5]. In other words, a cut-off approach was used as further processing of the recycled material is part of raw material preparation of another product system (open-loop recycling).



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3.6 DATA SOURCES, DATA QUALITY, ESTIMATES, ASSUMPTIONS AND PERIOD UNDER REVIEW

Data Quality Parameter	Data Quality Discussion
Source of manufacturing data: Description sources of data	Manufacturing data was collected from Prelco's manufacturing facilities located in Montreal (Quebec), Rivière-du-Loup (Quebec) and Edmundston (New Brunswick). This data included: total annual mass and area of products under study; raw materials entering the production of the products under study, losses of materials, transport distance of materials, energy consumption per process steps, water consumption, waste treatment, and packaging for each manufacturing facility.
Source of secondary data: Description sources of raw material, energy source, waste and packaging data	Data used to model Flat glass was taken from the National Glass Association's Industry-Wide Flat Glass EPD [24]. Background data were primarily taken from ecoinvent 3.4 "cut-off" datasets representative of Quebec, New Brunswick, Canada, the United-States or North America [25]. When appropriate, the grid mix was changed for the grid mix of the province or country where production takes places. Otherwise, ecoinvent data representative of the global market or "rest-of-the-world" were selected as proxies. Wood data and transport data was taken form the US LCI database [26], which is specific to a North American context.
Geographical representativeness	Manufacturing facilities are based in the province of Quebec or New Brunswick; hence electricity consumption is based on the consumption ratio of the Quebec and New Brunswick grid mix. Geographical correlation of the material supply and the selected datasets are predominantly representative of the same area. When this was not possible, datasets that represent a larger geographical area were taken.
Temporal representativeness	Primary data was collected so as to be representative of one full year starting June 1, 2017 and ending May 31, 2018. Additional data was collected from October 1, 2022 to September 30, 2023 to include the Prel-AirSecur etching process. Life cycle inventory datasets selected from published EPDs were published within the last ten years, while this is not always the case for ecoinvent and US LCI datasets. Nevertheless, ecoinvent and US LCI remain the reference LCI databases.
Technological representativeness	Primary data, obtained from the manufacturer, is representative of the current technologies and materials used by this company.
Completeness	All relevant process steps were considered and modeled to satisfy the goal and scope. No known flows were cut-off.

4 LIFE CYCLE ASSESSMENT RESULTS

Results are presented for **1 m² of processed glass**. It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds safety margins, or risks. Also, the six impact categories, AP, EP, GWP, ODP, SFP and FFD (or ADP-f), are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development.

Environmental Indicator		Unit	Prel-Gard	Prel-Lam	IGU : Prel-UniT and Prel-AirSecur
			(per m^2)	(per m^2)	(per m^2)
TRACI 2.1 (with the exception of ADP elements)					
AP	Acidification potential	kg SO2 eq.	2.73E-01	4.61E-01	4.82E-01
EP	Eutrophication potential	kg N eq.	2.95E-02	5.11E-02	4.98E-02
GWP(1)	Global warming potential	kg CO_2 eq.	4.96E+01	8.51E+01	8.83E+01
ODP	Ozone layer depletion potential	kg CFC-11 eq.	5.29E-07	7.86E-07	7.85E-07
SFP	Smog formation potential	kg O_3 eq.	6.57E+00	1.13E+01	1.13E+01
FFD	Fossil fuel depletion potential	MJ Surplus	5.49E+01	1.02E+02	9.74E+01
ADP-e	Abiotic resource depletion potential - minerals (per ReCiPe)	kg Fe eq.	5.60E-01	1.06E+00	1.11E+00
CML 4.8					
AP Air	Acidification potential for air emissions	kg SO_2 eq.	2.73E-01	4.60E-01	4.81E-01
EP	Eutrophication potential	kg $(PO_4)^{3-}$ eq.	2.30E-02	4.13E-02	4.01E-02
GWP	Global warming potential	kg CO_2 eq.	4.96E+01	8.51E+01	8.83E+01
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 eq.	3.98E-07	6.04E-07	6.27E-07
POCP	Formation potential of tropospheric ozone	kg C_2H_4 kg eq.	5.17E-01	8.70E-01	8.73E-01
ADP-f	Abiotic depletion potential for fossil resources	MJ, LHV	3.83E+02	6.86E+02	7.37E+02
ADP-e	Abiotic depletion potential for non-fossil resources	kg Sb eq.	1.58E-04	2.71E-04	6.17E-04

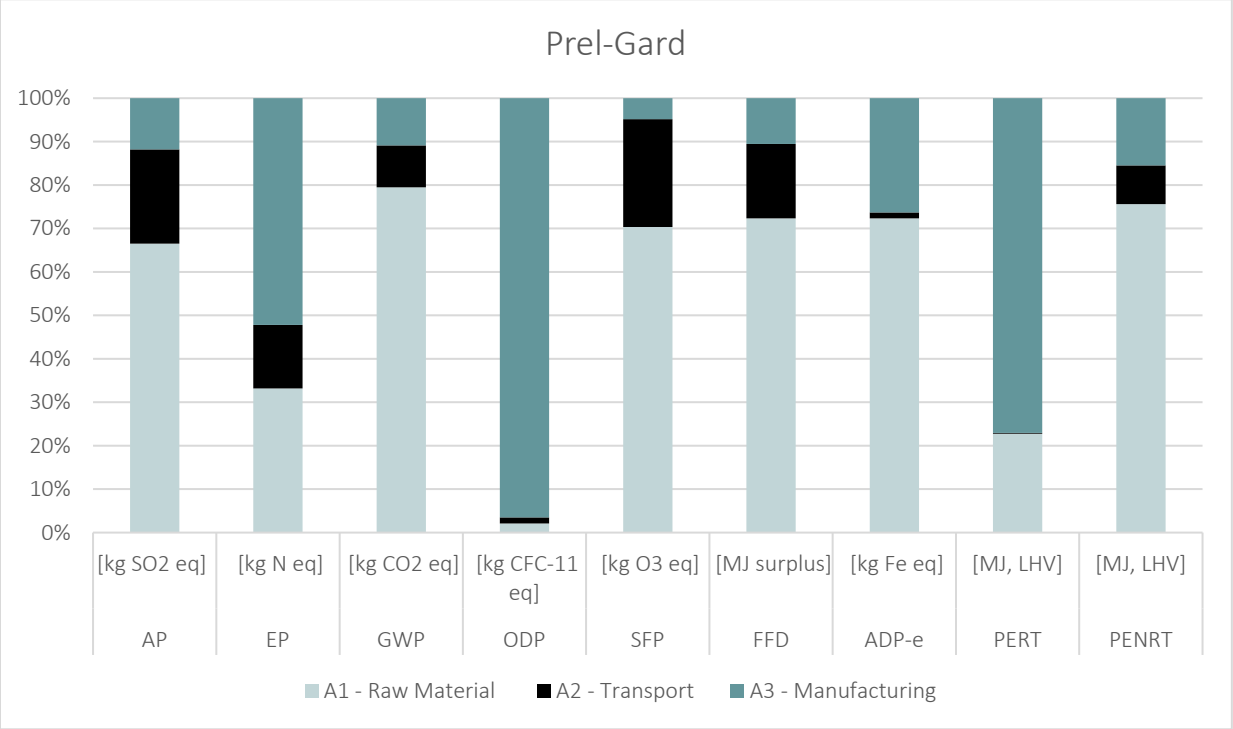
(1): GWP indicator is based on IPCC 2013 (AR5) 100-year GWP.[27]

Environmental Indicator		Unit	Prel-Gard	Prel-Lam	IGU : Prel-UniT and Prel-AirSecur
			(per m^2)	(per m^2)	(per m^2)
Resource use					
PERE[(1)]	Renewable primary energy as energy carrier	MJ, LHV	8.15E+01	2.40E+02	1.64E+02
PERM[(2)]	Renewable primary energy as material utilization	MJ, LHV	0.00E+00	0.00E+00	0.00E+00
PERT	Total use of renewable primary energy resources	MJ, LHV	8.15E+01	2.40E+02	1.64E+02
PENRE[(3)]	Non-renewable primary energy as energy carrier	MJ, LHV	7.58E+02	1.28E+03	1.38E+03
PENRM[(4)]	Non-renewable primary energy as material utilization	MJ, LHV	4.22E-01	2.91E+01	1.22E+01
PENRT	Total use of non-renewable primary energy resources	MJ, LHV	7.59E+02	1.31E+03	1.39E+03
SM[(5)]	Use of secondary material	MJ, LHV	0.00E+00	0.00E+00	8.52E-03
RSF	Use of renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of non-renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00
FW[(6)]	Use of net fresh water	m^3	7.28E+01	1.22E+02	1.25E+02
Output flows and waste categories					
HWD[(7)]	Hazardous waste disposed	kg	1.95E-02	3.82E-02	7.33E-02
NHWD[(8)]	Non-hazardous waste disposed	kg	1.01E+01	1.57E+01	1.61E+01
RWD[(9)]	Radioactive waste disposed	kg	7.60E-05	7.74E-05	4.80E-03
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00
MFR[(10)]	Materials for recycling	kg	9.90E+00	1.72E+01	1.47E+01
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00
EE	Exported energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00

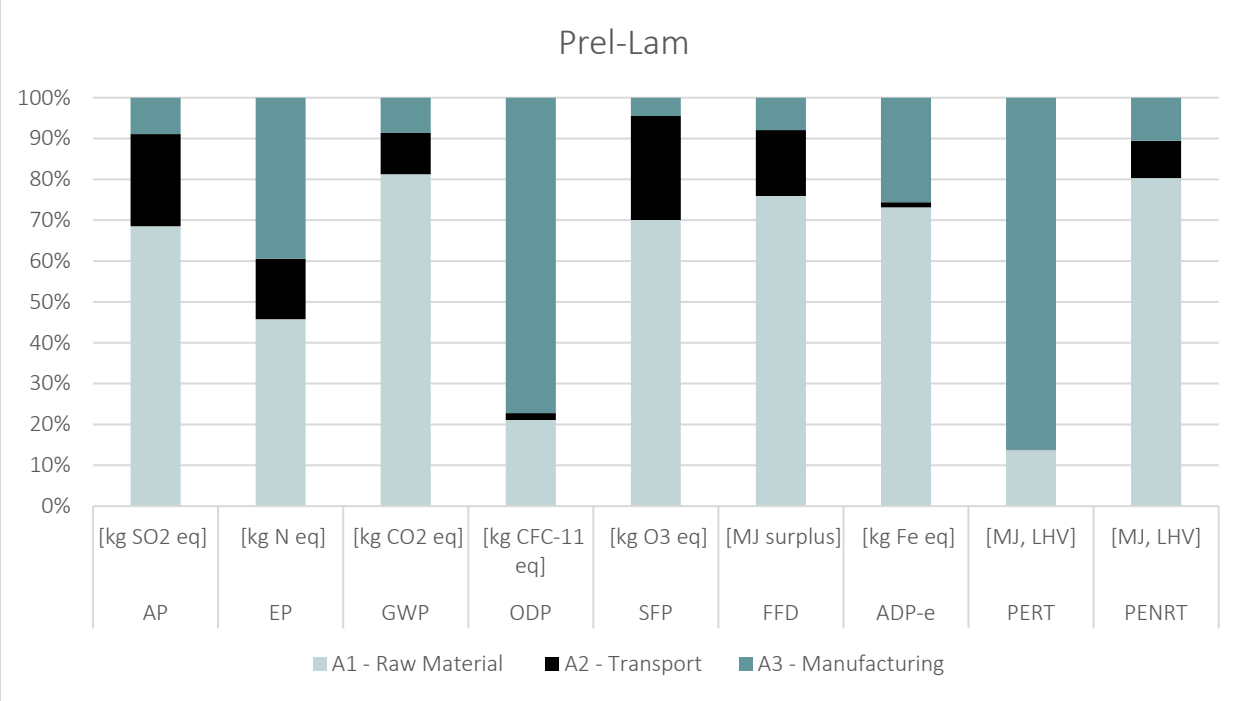
(1): PERE = RERT - RERM, where RERT is equal to the value for renewable energy obtained using the CED LHV methodology.
(2): Calculated as per ACLCA ISO 21930 Guidance [2], 6.2 Renewable primary resources with energy content used as a material, RERM.
(3): PENRE = PENRT - PENRM, where PENRT is equal to the value for non-renewable energy obtained using the CED LHV methodology.
(4): Calculated as per ACLCA ISO 21930 Guidance [2], 6.4 Non-renewable primary resources with energy content used as a material, PENRM.
(5): Calculated as per ACLCA ISO 21930 Guidance [2], 6.5 Secondary materials, SM: includes aluminum spacer materials.
(6): Represents the use of net fresh water, i.e., water consumption.
(7): Calculated from life cycle inventory results, based on datasets marked as "hazardous" and EPD values.
(8): Calculated from life cycle inventory results, based on waste that is neither "hazardous" nor "radioactive" and EPD values.
(9): Calculated from life cycle inventory results, based on flows marked as “spent nuclear fuel.”
(10): Calculated based on the amounts leaving the system boundary when they have reached the end-of-waste state.

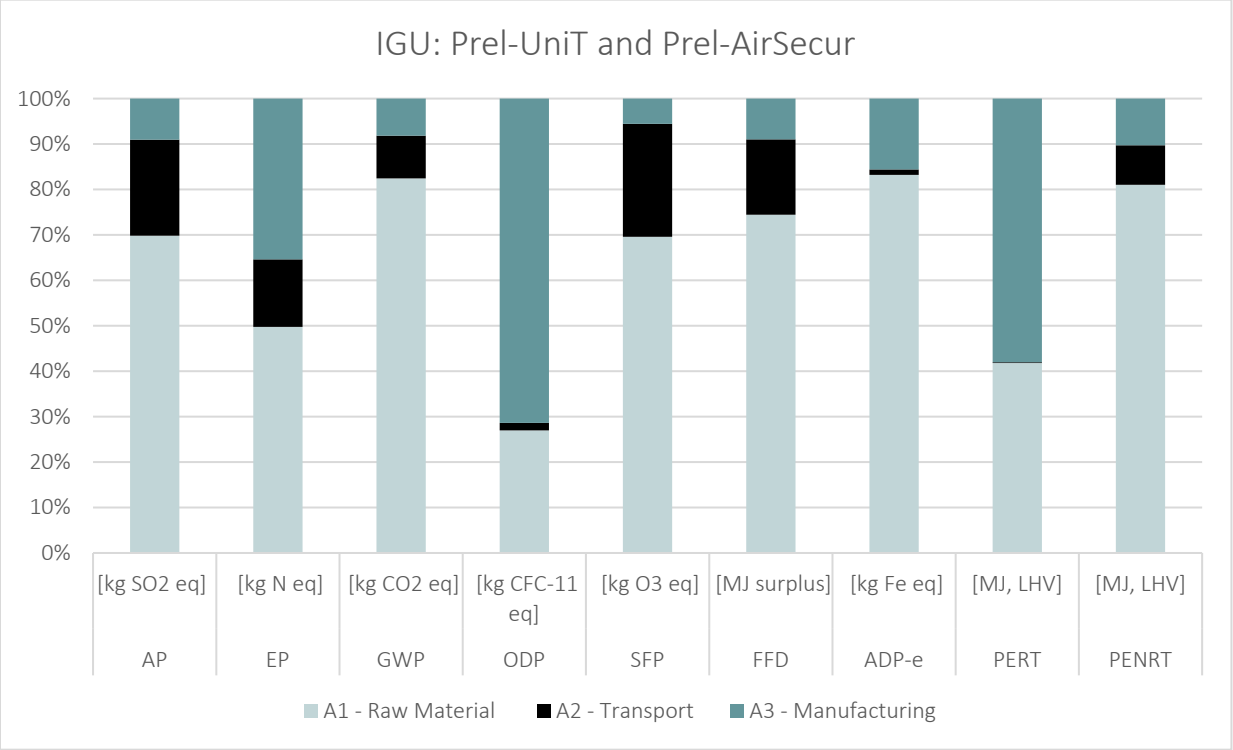
5 INTERPRETATION

For all processed glass, the life cycle module *raw materials* is the largest contributor to 5 environmental impact indicators out of 7, and to total use of non-renewable primary energy resources (PENRT). *Manufacturing* is the main contributor to ozone layer depletion potential (ODP) and total use of renewable primary energy resources (PERT). As for eutrophication potential, *manufacturing* is also the main contributor for the Prel-Gard and IGU products, while it is *raw materials* for Prel-Lam.



AP: Acidification potential; **EP**: Eutrophication potential; **GWP**: 100-year global warming potential; **ODP**: Ozone layer depletion potential; **SFP**: Smog formation potential; **FFD**: Fossil fuel depletion potential; **ADP-e**: Abiotic resource depletion potential – minerals; **PERT**: Total use of renewable primary resources; **PENRT**: Total use of non-renewable primary resources.





AP: Acidification potential; **EP**: Eutrophication potential; **GWP**: 100-year global warming potential; **ODP**: Ozone layer depletion potential; **SFP**: Smog formation potential; **FFD**: Fossil fuel depletion potential; **ADP-e**: Abiotic resource depletion potential – minerals; **PERT**: Total use of renewable primary resources; **PENRT**: Total use of non-renewable primary resources.

6 ADDITIONAL ENVIRONMENTAL INFORMATION

6.1 VALIDATED ECO-DECLARATION® AND HEALTH PRODUCT DECLARATION®

Prelco is part of a third-party verification process with Vertima Inc. where Prelco's products and its entire supply chain are assessed. At the end of the process, they have received a Validated Eco-Declaration® summarizing verified environmental claims, as well as Vertima's Environmental Data Sheet.

Prelco has also published a Health Product Declaration® for Insulating Glass Units. More details are available on the HPDC public repository: https://www.hpd-collaborative.org/hpd-public-repository/.

6.2 REGULATED HAZARDOUS SUBSTANCES

No substances required to be reported as hazardous are associated with the products.

6.3 DANGEROUS SUBSTANCES

No dangerous substances are known to be associated with the production of the products.

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