

Environmental Product Declaration



Inline

Fiberglass Windows



ASTM INTERNATIONAL

According to
EN 15804
ISO 21930
ISO 14025

1. General Information

Manufacturer Name: Inline – 30 Constellation Court,
Toronto, Ontario, Canada.
M9W 1K1

Program Operator: ASTM International
100 Barr Harbor Drive
West Conshohocken, PA
19428-2959, USA

Declaration Number: EPD 266

Reference PCR: Earthsure Cradle to Gate Window Product Category Rule
30171600-2015

Date of Issuance: October 29, 2021

End of Validity: October 29, 2026

Product Name: Fiberglass Windows

EPD Owner: Inline

Declared Unit: 1 kg of Inline Fiberglass Windows

EPD Scope: Cradle-to-gate (A1, A2, and A3)

Verification: ISO 21930 serves as the core PCR. Independent verification of the
declaration according to ISO 14025 and ISO 21930. ☐ internal
☒ external

**LCA Reviewer
and EPD Verifier:** Timothy S. Brooke
ASTM International



2. Product

2.1 Product Description

The declared product is Fiberglass Windows. The EPDs covers the 300 Series Tilt and Turn, 300 Series Fixed, 325 Series Awning/Casement, 325 Series Fixed, and 400 Series.

2.2 Technical Data

Table 1 provides technical data for Fiberglass Windows. The assumed window size is 1.5m x 1.3 m.

Table 1: Technical Data		
Name	Value	Unit
Area	1.95	m ²
Frame Thickness	4.00	cm
Glazing Area	1.42	m ²
Total Weight	60.50	kg

2.3 Base Materials

Table 2 provides base materials data for Fiberglass Windows.

Table 2: Product Composition		
Name	Value	Unit
Glazing Unit	46.47	kg
Framing	13.53	kg
Total Weight	60.50	kg

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is 1 square meter of Fiberglass Windows produced at Inline's production facility.

3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. (see also Table 4):

- **A1 Raw material supply:** Extraction, handling, and processing of input materials.
- **A2 Transportation:** Transportation of all input materials from the suppliers to the gate of the manufacturing facility.
- **A3 Manufacturing:** The preparation processes of Fiberglass Windows at Inline's manufacturing facility. This phase also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values.

3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

3.5 Background Data and 3.6 Data Quality

Data was gathered for the primary material and energy inputs used in production for calendar year 2020. Table 3 describe each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 3 also includes a data quality assessment for on the basis of the technological, temporal, and geographical representativeness.

Table 3: Secondary Data Sources and Data Quality Assessment

A1: Raw Material Inputs

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Fiberglass Roving	ecoinvent 3: Glass fibre {RoW} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: very good Data is representative of global conditions.
Fiberglass Matt	ecoinvent 3: Glass fibre {RoW} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: very good Data is representative of global conditions.
Resin Polyester	ecoinvent 3: Polyester resin, unsaturated, at plant/RER with US electricity U	Global	2018	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: very good Data is representative of global conditions.
Clay (Alumina)	ecoinvent 3: Alumina, at plant NREL /US	Global	2018	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: very good Data is representative of global conditions.
Styrene	ecoinvent 3: Styrene, at plant/RER with US electricity U	Global	2018	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: very good Data is representative of global conditions.
Vinyl Acetate Polymers	ecoinvent 3: Ethylene vinyl acetate copolymer, at plant/RER with US electricity U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.

Calcium Carbonate	IMA-NA Calcium Carbonate Life Cycle Assessment	North America	2016	Technology: very good Process models average global technology Time: very good Data is <5 years old Geography: fair Data is representative of global conditions.
Di-(4-tert-butylcyclohexyl peroxydicarbonate)	ecoinvent 3: Chemical, organic {GLO} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.
Tert-butylperoxy-2-ethylhexanoate	ecoinvent 3: Chemical, organic {GLO} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.
Stoddard Solvent	ecoinvent 3: Chemical, inorganic {GLO} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.
Fatty Acid Esters (Oil)	ecoinvent 3: Chemical, organic {GLO} production Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.

A2: Transportation				
Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Trucking	ecoinvent 3: Transport, freight, lorry 7.5-16 metric ton, EURO3 {GLO} market for Alloc Rec, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.

A3: Manufacturing				
Energy	LCI Data Source	Geography	Year	Data Quality Assessment
Electricity	ecoinvent 3: Electricity, high voltage {CA-ON} market for Cut-off, U	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.
Natural Gas	ecoinvent 3: Natural gas, combusted in industrial boiler NREL /US	Global	2018	Technology: very good Process models average global technology Time: good Data is <5 years old Geography: very good Data is representative of global conditions.

3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2020.

3.8 Allocation

At Inline Fiberglass several different fiberglass products are produced. Since the primary data for manufacturing was only available on a facility level, the environmental load among the products produced is allocated according to its mass. For waste that is recycled, the 'recycled content approach' was chosen. The recycling of waste generated by the product system is cut off.

3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

4. LCA Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics. Table 4 and 5 below summarize the LCA results for the cradle-to-gate (A1-A3) product system.

Table 4: Description of the System Boundary (x: included in LCA; mnd: module not declared; mnr: module not reported)

Product			Construction Installation		Use							End-of-life				Benefits Beyond the System Boundary		
Raw Material supply	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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	x	mnd	mnd	mnd	mnd	mnr	mnr	mnr	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd

Table 5 shows the results for cradle-to-gate (A1-A3) for Fiberglass Windows.

Table 5: Results per 1m ² Declared Unit			Total A1-A3	A1	A2	A3
Category Indicator						
Global warming potential	GWP	kg CO ₂ e	7.57E+01	6.04E+01	3.65E+00	1.17E+01
Acidification potential of soil and water sources	AP	kg SO ₂ e	5.05E-01	4.43E-01	4.81E-02	1.39E-02
Eutrophication potential	EP	kg Ne	1.03E-01	9.76E-02	2.90E-03	2.73E-03
Formation potential of tropospheric ozone	SFP	kg O ₃ eq	6.40E+00	4.93E+00	1.24E+00	2.27E-01
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	7.53E-06	5.63E-06	1.54E-10	1.90E-06
Total primary energy consumption						
Non-renewable fossil	NRF	MJ (HHV)	1.01E+03	7.64E+02	4.86E+01	1.97E+02
Non-renewable nuclear	NRN	MJ (HHV)	2.67E+02	6.01E+01	3.58E-02	2.07E+02
Renewable (solar, wind, hydro, and geothermal)	RSWHG	MJ (HHV)	2.19E+01	2.15E+01	5.03E-02	2.76E-01
Renewable (biomass)	RB	MJ (HHV)	1.27E+01	1.26E+01	6.40E-03	4.89E-02
Material resources consumption						
Non-renewable material resources	NRMR	kg	5.42E+01	5.32E+01	0.00E+00	1.04E+00
Renewable material resources	RMR	kg	1.08E+00	1.03E+00	0.00E+00	4.65E-02
Net fresh water (inputs minus outputs)	NFW	L	2.32E+02	2.31E+02	0.00E+00	1.84E+00
Non-hazardous waste generated	NHW	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Hazardous waste generated	HW	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. The A1 contributions are split into the glazing and frame contributions for more accurate analysis. For Fiberglass Windows, the raw material supply (A1) is the major contributor to the overall impact across all impact categories shown. Total A1 impacts account for between 75% and 95% of each impact category shown. This is since A1 incorporates all the upstream extraction and production of the chemical inputs. Transportation (A2) impacts are small in all declared impact categories (0 – 19%). The manufacturing (A3) is also small for all impact categories selected (3 – 25%).

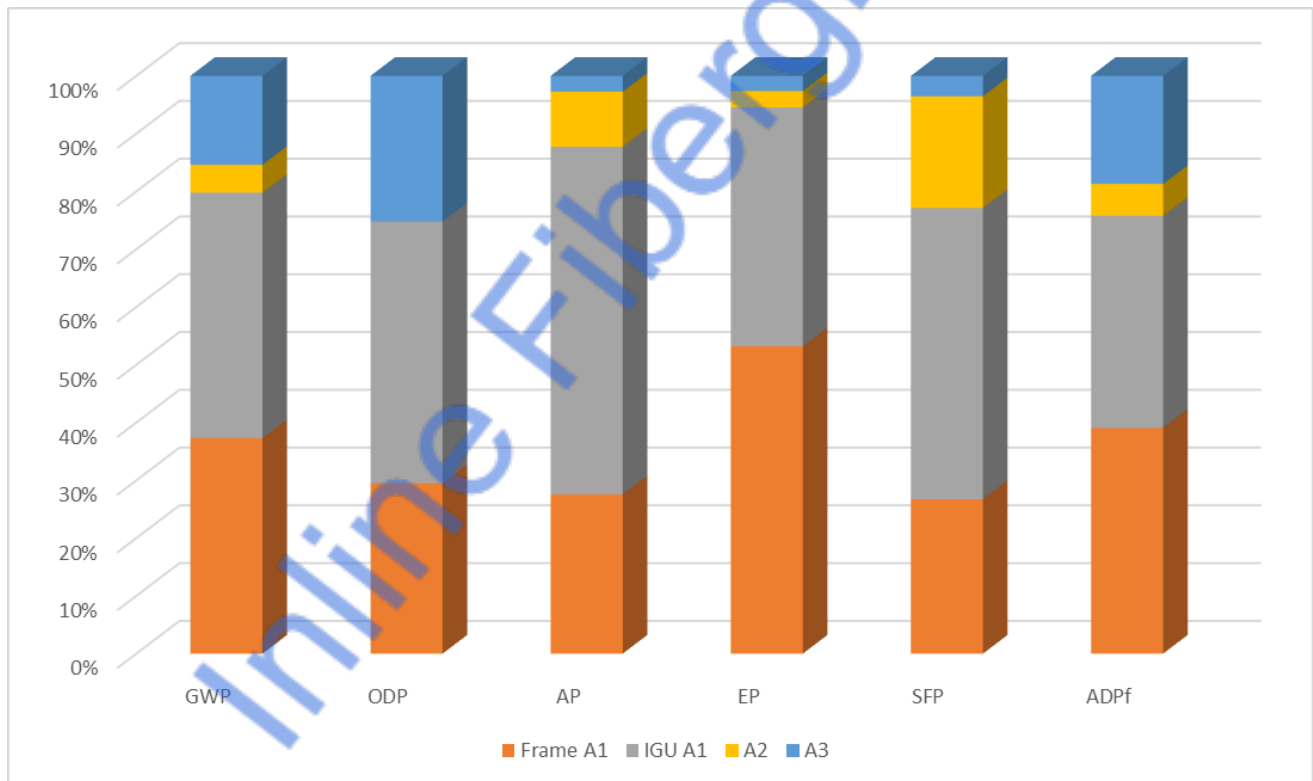


Figure 1. Contribution analysis for Fiberglass Windows

6. References

1. Athena Institute: 2021 - A Cradle-to-Gate Life Cycle Assessment of Fiberglass Window Products Manufactured by Inline Fiberglass
2. Earthsure. "Cradle to Gate Window Product Category Rule." September 2015, v.1.02. Earthsure PCR Cradle-to-Gate 30171600:2015.
3. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.
4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
5. ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.
6. 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.