



Traditional Curtain Walls




Environmental Product Declaration

Conducted in accordance with ISO 14025 and ISO 21930

EPDs are not intended to make comparisons with other products due to varying background data in LCA softwares and/or varying Program Operator rules or Product Category Rules. An EPD is informational and does not warrant performance.



EPD SUMMARY

Product Name	Arcadia Traditional Curtain Walls
EPD Scope	Cradle-to-Gate
Declaration Holder	Arcadia Inc.
Declaration Number	199
Date of Issuance	April 12, 2021
Valid through	April 11, 2026
Program Operator	ASTM International
Reference PCR	Earthsure Cradle to Gate Window Product Category Rule 30171600-2015
PCR Reviewed by	Thomas P. Gloria, LCACP, Industrial Ecology Consultants, Chair; Adolf Merl, ThinkStep GmbH; Philip Moser, Simpson Gumpertz & Heger Inc.
LCA conducted by	Four Elements Consulting, LLC
Third Party Review	Independent verification of the declaration and LCA data, according to ISO 14044:2006/AMD 2:2020, ISO 14025:2006 and ISO 21930:2007 internal X external
Review Conducted by	
Name	Thomas P. Gloria, LCACP
Organization	Industrial Ecology Consultants
Signature	
For more information	Contact Anne Greig, anne@fourelementslc.com

Arcadia Inc.

Since 1930, Arcadia Inc. has helped the architectural community complete successful projects by providing high performance windows and doors that stand the test of time. Arcadia offers custom window and door solutions that successfully tackle the most challenging design concepts. Arcadia's projects help to reduce liabilities, achieve costs savings, and deliver a better end product for clients. Arcadia has enjoyed decades-long relationships with customers and partners who cite high quality and personal service as key reasons why they prefer Arcadia.

Product Description and Declaration Summary

A curtain wall is "an external non-bearing wall, intended to separate the exterior and interior environments." (AAMA/ WDMA / CSA 101/I.S.2/A440-05). The stick-built traditional curtain wall system is assembled at the building site where the frame or mullions and glass are connected piece by piece. Arcadia's curtain wall systems are offered in a variety of depths, profiles, and finishes, with framing thermally- or non-thermally improved.



Cradle-to-Gate Results Summary

Declared unit: 1 m²

Mass per m²: 36 kg

Impact Results

Global Warming Potential	kg CO ₂ -eq	188
Acidification Potential	kg SO ₂ -eq	1.2
Eutrophication Potential	kg N-eq	0.1
Smog Formation Potential	kg O ₃ -eq	12
Ozone Depletion Potential	kg CFC11-eq	4.4 E-6

Primary Energy

Non-renewable Energy	MJ	2,278
Renewable Energy	MJ	549

Resources Consumed

Non-renewable Materials	kg	222
Renewable Materials	kg	0.9
Net Fresh Water	L	2,466
Non-hazardous Waste	kg	0.03
Hazardous Waste	kg	0.01

Other Declarations

Recyclable content: aluminum 39%, glass 52%

Hazardous materials in >0.1% of window: none

The Arcadia curtain wall windows included in this EPD:

- ❖ T500-OPG1500
- ❖ T500-OPG6000
- ❖ T500-OPG1900
- ❖ T500-OPG2900
- ❖ T500-OPG3000
- ❖ T500-TI Beam 3 Series
- ❖ T500-TI Beam 1 Series (5-1/2, 6-1/2, 8-7/16, 9-7/8)

Life Cycle Assessment Overview

A cradle-to-grave Life Cycle Assessment (LCA) was completed on the curtain walls in accordance with ISO 14040 / ISO 14044, and the study was reviewed for conformance with ISO 14044 and the PCR. Arcadia's curtain wall products were assessed on a weighted average basis, based on the total volume produced.

System Boundaries

The LCA evaluated the cradle to gate of the window. This includes: raw material extraction and processing (A1), transportation of the materials to fabrication plants (A2), and manufacturing or fabrication (A3). This is depicted below in the context of the full life cycle as defined in EN 15804, Section 5.2.

Table 1 EPD System Boundary Modules

Product Stage			Construction Process		Use Stage							End-of-Life Stage				Bens/Loads Beyond SB
Raw Material Supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse - Recovery - Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

MND = "module not declared"

Figure 1 presents A1-A3 as they pertain to Arcadia, plus excluded elements.

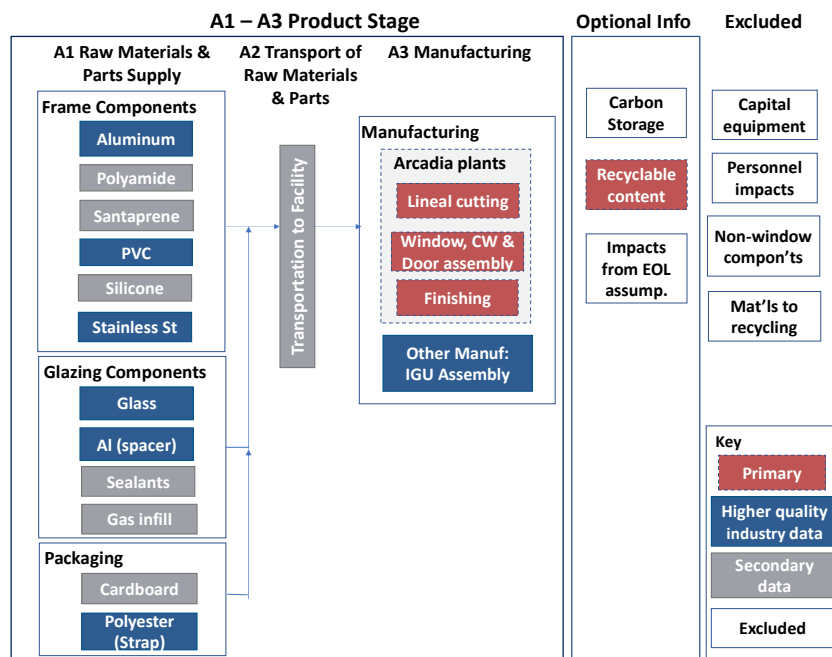


Figure 1 Arcadia Windows System Boundary and Data

Declared Unit

The declared unit is one square meter (1 m²) of a window. A functional unit is not reported since the product system boundaries are cradle-to-gate, and no use phase over a reference service life has been modeled. As a result, this EPD may not be compared with other EPDs.

A1 Raw Material Extraction and Processing

Module A1 accounts for the extraction of materials and production of window parts and components and packaging components.

A2 Transportation to Manufacturing

Module A2 models transportation of raw materials to the Arcadia window manufacturing plants in Vernon, CA, Las Vegas, NV, and Stamford, CT. The distances of each material to the plants by heavy duty diesel truck were weighted on a facility production basis of these windows.

A3 Manufacturing

Module A3 includes fabrication activities at Arcadia's facilities, which include cutting of extruded aluminum lineals, assembly of framing parts, and preparation and assembly of windows up until insertion and sealing of insulated glass units (IGUs). 2019 energy use, emissions, and waste management were included in the model. Regional electricity grids were used to account for different geographical locations; CA and NV facilities were modeled using the Western Electricity Coordinating Council (WECC) grid, and the CT facility uses NE Power Coordinating Council (NPCC).

Cut-off Criteria

The cut-off goal of at least 95% of all mass and energy used in the system was exceeded since all materials and energy involved in the materials systems were included.

Allocation

Arcadia's facilities produce windows, doors, and sunshade products. Data were provided on a total facility basis since there was no clear-cut way to accurately measure process inputs and outputs for one type of product. Thus, an allocation was made on a total mass basis, basing the allocation on the number of units of windows, doors, and sunshades made at each facility.

Software and Data Used

The SimaPro LCA software was used to model the window. Data came from sources appropriate for North America and with the highest data quality in mind. Secondary data came from U.S. LCI database, DATASMART, EcoInvent, and pertinent cradle-to-gate production EPDs whose data on anodized, extruded aluminum were deemed appropriate for use in this EPD. The data sets from EcoInvent were customized to North American conditions.

Data Quality

The data applied to this study represent current Arcadia products and practices. Arcadia's manufacturing facilities supplied 2019 process data, which were aggregated into weighted averages based on facility production output. Energy and transportation data are based on the late 2010's, and production data for materials are based on mid 2010's through 2020. Data for energy and transportation are North American based. Data for materials and processes are based on a combination of North American and European sources which, where possible, were customized to North American conditions. Technological coverage for the upstream materials and processes are generally industry average, and in some instances, it is typical technology.

Results and Contribution Analysis

The Life Cycle Impact Assessment (LCIA) results were calculated using the North American impact assessment methodology, Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) v.2.1. All results are presented for the total of A1 through A3 and the percentage of A1, A2, and A3 to the total.

Table 2 Impact Assessment and Inventory Results – 1 m2 Curtain Wall Window

Impact Category Indicator	Abbrev	Unit	Total	A1 Raw Mat'ls Prod'n	A2 Transp. to Plant	A3 Manuf- acturing
Global warming potential	GWP	kg CO2-eq	187.58	96%	0.8%	2.8%
Acidification potential - soil & water	AP	kg SO2-eq	1.16	97%	1.8%	1.1%
Eutrophication potential	EP	kg N-eq	0.11	59%	1.1%	40%
Smog formation pot'l (tropospheric ozone)	SFP	kg O3-eq	12.02	94%	4.4%	1.4%
Stratospheric ozone layer depletion pot'l	ODP	kg CFC11-eq	4.37E-06	91%	0%	9.5%
Total primary energy consumption						
Total non-renewable primary energy		MJ (HHV)	2277.77	96%	0.9%	3.5%
Nonrenewable fossil	NRF	MJ (HHV)	1825.49	95%	1.1%	3.6%
Nonrenewable nuclear	NRN	MJ (HHV)	452.28	97%	0%	3.1%
Total renewable primary energy		MJ (HHV)	548.94	100%	0%	0.3%
Renewable (solar, wind, hydro, geo.)	RSWHG	MJ (HHV)	490.68	100%	0%	0%
Renewable (biomass)	RB	MJ (HHV)	58.25	97%	0%	3.2%
Material Resources Consumption						
Nonrenewable material resources	NRMR	kg	221.99	100%	0%	0.2%
Renewable material resources	RMR	kg	0.85	91%	0%	9.1%
Net fresh water (inputs minus outputs)	NFW	L	2465.50	99%	0%	1.0%
Non-hazardous waste generated	NHW	kg	0.03	100%	0%	0%
Hazardous waste generated	HW	kg	0.01	100%	0%	0%

Notes: Results may not add to 100% due to rounding. 0% implies less than 0.1%.

Performance Standards & Certifications

Arcadia's products are tested, certified and labeled for the following performance standards: ^{see note}

- ❖ AAMA/WDMA/CSA 101/IS2/A440 (NAFS-North American Fenestration Standard/Specification for windows, doors, and skylights)
- ❖ ASTM E283, AAMA 501 and NFRC 400 Air Leakage
- ❖ ASTM E331 and AAMA 501 Water Penetration
- ❖ ASTM E330 and AAMA 501 Static Structural Performance
- ❖ AAMA 1503, AAMA 507 and NFRC 100 Thermal Transmittance – U-Factors
- ❖ AAMA 1503, CSA A440.2 and NFRC 500 Condensation Resistance (CRF, I, CR)
- ❖ AAMA 507 and NFRC 200 Overall Solar Heat Gain Coefficient and Visible Transmittance (SHGC) & (VT)
- ❖ AAMA 1801, ASTM E90 and ASTM E1425 Sound Transmission (STC, OITC)

Note: testing varies by product type, glazing specified, and specific products tested.

Other Environmental Information

At end of life of the window, the aluminum and glass, which make up 39% and 52% of the total mass, respectively, are recyclable. Arcadia's aluminum extrusions have 40% to 50% recycled content. Through their sustainability and waste reduction initiatives, Arcadia strives to help their environment and enhance the value of their products for architects and building professionals. Arcadia's environmental management activities include:

- ❖ Recycling up to 50% of the water consumed in the aluminum anodizing process
- ❖ Keeping 1,350 tons of solid anodizing waste out of landfills each year
- ❖ Replacing potentially hazardous chemicals with environmentally-friendly products

In the building realm:

- ❖ Arcadia's core products comply with the Leadership in Energy and Environmental Design (LEED) Green Building Rating System.
- ❖ By providing high performance products and applying sustainable design principles to every project, Arcadia is committed to helping the American Institute of Architects (AIA) hit its goal of carbon-neutrality by 2030.
- ❖ Arcadia's products achieve and exceed standards set by the U.S. Green Building Council; the American Society of Heating, Refrigerating and Air-Conditioning Engineers; the International Green Construction Code; CALGreen.



References

Aluminum Extruders Council (AEC), Environmental Product Declaration of Aluminum Extrusions: Mill Finished, Painted, and Anodized. Declaration number 11240237.101.1. Dated 4 Oct 2016 and valid 5 years. (AEC, 2016a)

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