ENVIRONMENTAL PRODUCT DECLARATION

Oldcastle BuildingEnvelope®

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

OBE Window Wall Systems

Oldcastle Building Envelope (OBE)

Oldcastle BuildingEnvelope® is the leading supplier of value-added, glazing-focused interior and exterior products and services in North America. This includes curtain walls, architectural windows, storefronts and entrances, architectural glass, glazing hardware, sun controls, interior partitions and more.

With the industry's largest national footprint, Oldcastle BuildingEnvelope® products have been used to achieve sustainability objectives for decades. From providing ample daylighting to improving the thermal performance of buildings, our integrated solutions artfully balance performance and aesthetics.

This EPD represents OBE's window walls framing systems produced at Terrel, TX and Midway, TN. Glazing has been excluded from this EPD. The declared unit for this LCA is 1 m^2.

Cradle-to-Gate w/ Options Results Summary Declared unit: 1 m^2 Mass per m^2: 7.44 kg		
Potential Environmental Impacts		
Global Climate Change	kg CO2 eq	1.06E+02
Acidification	kg SO2 eq	5.27E-01
Eutrophication	kg N eq	1.68E-02
Ozone Depletion	kg CFC-11 eq	2.99E-09
Photochemical Smog Formation	kg O3 eq	6.82E+00
Resources, Energy, & Waste		
Renewable Energy Resources	MJ	2.31E+02
Non-renewable Energy Resources	MJ	1.22E+03
Renewable Material Resources	kg	-
Non-renewable Material Resources	kg	-
Secondary materials	kg	1.45E+00
Freshwater Consumption	m^3	8.09E-01
Hazardous Waste Production	kg	1.26E-01
Non-Hazardous Waste Production	kg	1.46E+00
Materials for recycling	kg	8.52E+00

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EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Solutions 333 Pfingsten Rd, Northbrook, IL 60062 www.ul.com www.spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	Program Operator Rules v 2.7 2022
MANUFACTURER NAME AND ADDRESS	Oldcastle BuildingEnvelope, 5005 LBJ Freeway, Suite 1050, Dallas, Texas 75244
DECLARATION NUMBER	4789369971.106.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	1 m^2 of window wall framing system
REFERENCE PCR AND VERSION NUMBER	Earthsure Cradle-to-Gate Window PCR 30171600:2015, v 1.02
DESCRIPTION OF PRODUCT APPLICATION/USE	Window/Façade Framing Products
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	September 1, 2023
PERIOD OF VALIDITY	5 years
EPD TYPE	Product Average
DATASET VARIABILITY	2015-2021
EPD SCOPE	Cradle to gate with required options
YEAR(S) OF REPORTED PRIMARY DATA	2019
LCA SOFTWARE & VERSION NUMBER	LCA for Experts (formerly GaBi Professional) v10.7
LCI DATABASE(S) & VERSION NUMBER	Managed LCA Content (formerly GaBi databases) CUP 2022.2
LCIA METHODOLOGY & VERSION NUMBER	IPCC AR5, TRACI 2.1

The PCR review was conducted by:	Earthsure PCR Review Panel earthsure@iere.org
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒EXTERNAL	Cooper McCollum Cooper McCollum, UL Solutions
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only 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.

To better understand the environmental impacts of window wall, Sphera Solutions, Inc. ("Sphera") performed the cradle-to-gate w/ options life cycle assessment (LCA) according to Earthsure's Cradle-to-Gate Window PCR. Other PCRs and standards referred to for this LCA include ISO 14040/44, ISO 14025, and ISO 21930.

The results of this LCA were used to create an EPD for OBE's window wall framing systems. The background LCA report was validated by Tom Gloria. EPD and data were independently, externally, verified according to ISO 14025 and published by UL as the program operator. For more information contact info@obe.com.

OBE Window Walls

Window walls provide nearly infinite design possibilities offered as captured, structurally glazed and unitized fabrications. These solutions can be used as window walls or leveraged in punched openings for a streamlined aesthetic on buildings of all sizes. These products leverage a variety of infill options and come in various standard sizes. OBE window walls meet various levels of thermal performance and offer design flexibility with a full suite of accessories and anchoring options. OBE window walls are tested for numerous market and project-specific needs such as impact resistance, force-entry resistance, blast resistance, and more.

OBE window wall products include the following product lines: BRW 500 BlastMax, ICR 225, PDR 225, Reliance Window Wall, RW 5000 StormMax, RW 5100 StormMax, Signature Series SGHT, TCR 225, TCR 250.

Oldcastle BuildingEnvelope's window wall systems find use in several applications such as multi-family, mixed-use, office, education, and more when high thermal and structural performance is critical. Window wall products offer flexibility with the option for pre-glazed and pre-assembled systems with a high span capability.

System Boundaries and Data

The system boundary for this LCA is "cradle-to-gate w/ options" in accordance with the Earthsure Cradle-to-Gate Window PCR. Primary data represented 2019 calendar year for the two facilities in Midway, TN, and Terrel, TX. Secondary data was used from the Managed LCA Content (formerly GaBi databases) CUP 2022.2 databases. The project specific LCA model was created using the LCA for Experts (formerly GaBi Professional) v10.7 software system for life cycle engineering, developed by Sphera Solutions, Inc.

The MLC database 2022.2 provides the life cycle inventory data for several of the raw and process materials obtained from the background system. All primary and secondary data were modeled to be specific to the technologies or technology mixes under study.

Table 1 shows the different life cycle stages (or modules) that were included or excluded from this EPD.

Table 1: Included and excluded stages and modules

PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	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	X	X	X	X	MND

Table 2 below shows the nomenclature used by Earthsure PCR for different life cycle stages and that used by ISO 21930 for the corresponding modules.

Table 2 – Included life cycle stages and their nomenclature

NSF PCR Nomenclature	ISO Nomenclature
Raw Material Processing	A1
Transport	A2
Manufacturing	A3
End-of-Life	C1, C2, C3, and C4

Figure 1 below shows the system boundary for this EPD, which can be categorized as “cradle-to-gate w/ options”, with “options” being modules C1, C2, C3, and C4.

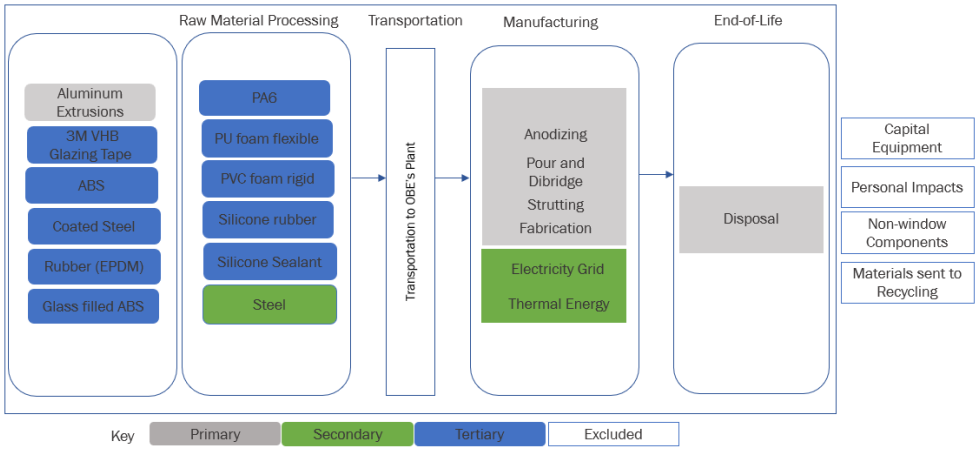

Figure 1: Cradle-to-Gate w/ Options System Boundary

Modules A1, A2, and A3 have been aggregated together and reported as a single module A1-A3, which signifies production of window walls.

Modules C1 and C3, which represent deconstruction and waste processing at end of life, respectively, have been assumed as zero. This is because deconstruction of the product is done manually and waste processing is not required before sending materials for recycling or for disposal at end of life, thus resulting in zero environmental impacts for these two modules.

Module C2 represents waste transport at end of life. In absence of primary transport data, it was assumed that the waste is transported over 20 miles to be recycled or disposed. This assumption is based on U.S. Environmental Protection Agency's Waste Reduction Model (WARM) model.

Module C4 represents disposal at end of life. It is assumed that 95% of the aluminum content within window walls is recycled, and the remaining 5% is disposed in a landfill. Recycling rate of 95% for aluminum was adopted as an assumption from the 2022 report published by The Aluminum Association.

Allocation and Product Average

Mass based physical multi-output allocation of foreground processes and data was performed for the products manufactured at the two facilities and life cycle inventories were developed for each product based on their production in metric tons.

Production data and data on procurement of different materials was utilized to develop product formulations, or bill of materials, for different types of window walls. The collected production data represented around 94% of total window wall production. The remaining 6% represents window wall products that are manufactured in very small quantities and will have an insignificant contribution to the overall impact.

Hence, an average or a hybrid product formulation was determined to represent the overall production of window walls throughout the calendar year 2019. Inputs to this average product were calculated as the weighted averages of inputs to different window wall products and normalized via extrapolation so that the average product represented 100% of window wall production.

End-of-Life allocation generally follows the requirements of ISO 14044, section 4.3.4.3. This study uses the cut-off allocation approach and, therefore, scrap input to the production process is considered free of burdens and no credit is received for recycling of materials at end-of-life.

Contribution Analysis and Additional LCIA Results

Table 2 shows the life cycle environmental impacts, use of resources, and output flows and waste categories associated with 1 m2 of window wall.

GWP impacts represent GWP excl. biogenic carbon and have been calculated using IPCC AR5 methodology. AP, EP, ODP, and SFP have been calculated using TRACI 2.1 methodology. All other life cycle inventory (LCI) impact indicators shown have been calculated as per ISO 21930.

There are no biogenic carbons or removals associated with this product as it does not include any bio-based components.

Table 3 - Life cycle impacts per m^2 of window wall framing systems

Parameter	Unit	A1-A3 (Production)	C2 (EOL Transport)	C4 (Disposal)
Impact Categories				
Global Climate Change (GWP)	kg CO_2 eq.	1.65E+02	4.17E-01	7.25E-02
Acidification (AP)	kg SO_2 eq.	8.28E-01	1.15E-03	3.11E-04
Eutrophication (EP)	kg N eq.	2.67E-02	1.22E-04	1.73E-05
Ozone Depletion (ODP)	kg CFC 11 eq.	1.45E-08	7.79E-16	2.29E-15
Photochemical Smog Formation (SFP)	kg O_3 eq.	1.06E+01	2.62E-02	5.46E-03
Use of Resources				
Renewable Energy Resources (RPRe)	MJ	3.37E+02	2.25E-01	1.02E-01
Non-renewable Energy Resources (NRPRe)	MJ	1.89E+03	5.80E+00	1.09E+00
Renewable Material Resources (RPRm)	kg	N/A	N/A	N/A
Non-renewable Material Resources (NRPRm)	kg	3.09E+01	N/A	N/A
Secondary materials (SM)	kg	1.72E+00	N/A	N/A
Renewable secondary fuels (RSF)	kg	N/A	N/A	N/A
Non-renewable secondary fuels (NRSF)	kg	N/A	N/A	N/A
Recovered energy (RE)	MJ	N/A	N/A	N/A
Freshwater Consumption (FW)	m^3	1.22E+00	8.10E-04	1.56E-04
Output Flows and Waste				
Hazardous Waste Production (HWD)	kg	1.78E-01	N/A	N/A
Non-Hazardous Waste Production (NHWD)	kg	1.84E+00	N/A	1.70E+00
High-level radioactive waste (HLRW)	kg	3.77E-05	1.90E-08	1.09E-08
Intermediate- and low-level radioactive waste (ILLRW)	kg	2.91E-02	1.61E-05	9.53E-06
Components for reuse (CRU)	kg	N/A	N/A	N/A
Materials for recycling (MFR)	kg	3.66E+00	N/A	9.07E+00
Materials for energy recovery (MER)	kg	N/A	N/A	N/A
Exported energy (EE)	MJ	N/A	N/A	N/A

Figure 2, Figure 3, and Figure 4 present the above results as graphs. It should be noted that impact indicators which do not have a value are excluded from the figures.

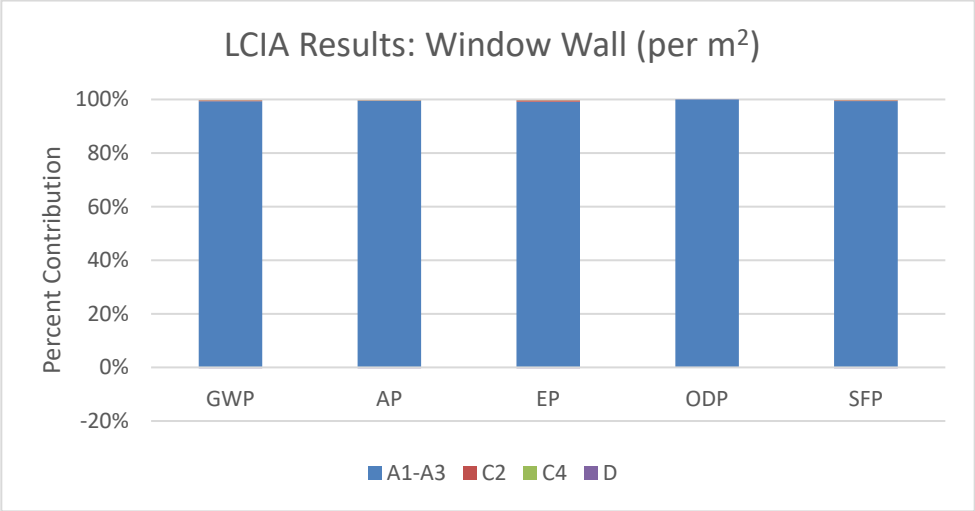

Figure 2: Contribution analysis for impact categories

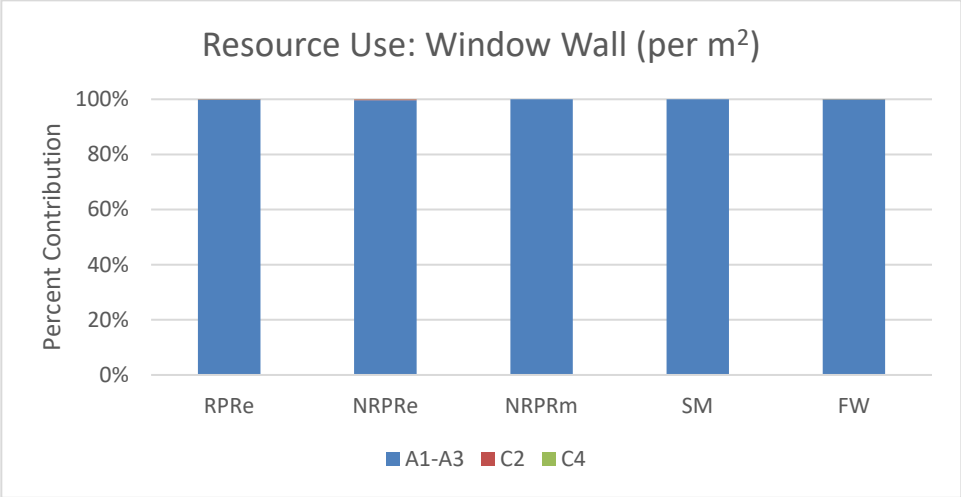

Figure 3: Contribution analysis for resource use

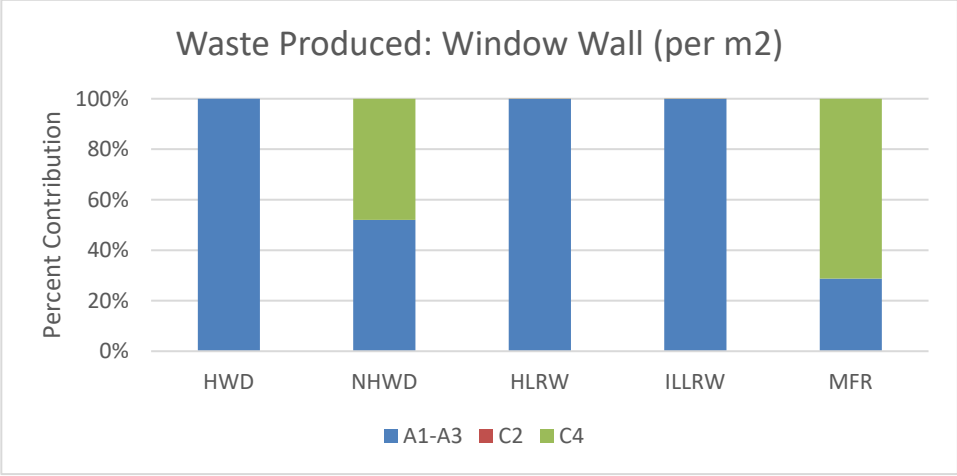

Figure 4: Contribution analysis for output flows and waste

Sensitivity Analysis

As per the NSF PCR and ISO 21930, a sensitivity analysis must be conducted for an EPD representing an average product. Sensitivity analyses were conducted by varying the amount of aluminum content by ±5% in the window wall. The table below show the results of sensitivity analyses. It can be said that the environmental impacts exhibit a nearly proportional relationship to the aluminum content of the products, which makes sense given that A1-A3 stage is the chief contributor to most of the impact categories as it can be seen from the LCIA results in the sections above.

Table 4 – Results from sensitivity analysis

Impact Indicator	Window Wall (-5% Al)	Window Wall	Window Wall (+5% Al)
GWP – excl. bio carbon	-5%	0%	5%
AP	-5%	0%	5%
EP	-5%	0%	5%
ODP	-2%	0%	2%
SFP	-5%	0%	5%

Performance Standards & Certifications

Oldcastle Building Envelope products are tested and certified for the following performance standards:

- ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- ASTM B807/B807M - Standard Practice for Extrusion Press Solution Heat Treatment for Aluminum Alloys – Heat treatment
- AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum – Test procedures for aluminum oxide coating
- AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
- AAMA 2604 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Pigmented Organic Coatings on Aluminum Extrusions and Panels
- AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Pigmented Organic Coatings on Aluminum Extrusions and Panels

References

Earthsure Program. (2015). Cradle to Gate Window Product Category Rule. Vashon WA: Institute for Environmental Research and Education and NSF International. V1.02 Extended per PCRext 2022-112, valid through September 30, 2023.

EPA. (2012). Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) – User's Manual. Washington, D.C.: U.S. EPA.

IPCC. (2013). Climate Change 2013: The Physical Science Basis. Genf, Schweiz: IPCC.

ISO. (2006). ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

ISO. (2006a). ISO 14040: Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO. (2006b). ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

ISO. (2017). ISO 21930: Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services. Geneva: International Organization for Standardization.

Sphera. (2022). GaBi LCA Database Documentation. Retrieved from Sphera Solutions, Inc.: https://sphera.com/product-sustainability-gabi-data-search/

UL Environment. (2022). General Program Instructions v 2.7

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PCR Owner

https://d2evkimvhatqav.cloudfront.net/documents/PCR-Windows-2022-Ext-DRAFT.pdf?v=1667586144