MiTek®

Benson® Curtain Wall

ASTM INTERNATIONAL

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. The EPD and PCR process are informational only and do not warrant performance.

EPD SUMMARY

PROGRAM OPERATOR	ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA, 19428. https://www.astm.org/
DECLARATION NUMBER	437
DATE OF ISSUE	15 March 2023
VALID UNTIL	14 March 2028
EPD HOLDER	MiTek Inc. 16023 Swingley Ridge Road, Chesterfield, MO 63017 Benson Industries 1650 NW Naito Parkway Suite 200, Portland OR 97209 https://www.mii.com/ info.benson@mii.com +1 314.434.1200
DECLARED PRODUCT & UNIT	MiTek® / Benson® Curtain Wall – per 1 m^2
MARKET OF APPLICABILITY	North America, intended for B2B communication
EPD TYPE	Product-specific, cradle-to-gate scope
LCA SOFTWARE	SimaPro 9.4
PCR SUBCATEGORY	Earthsure. "Cradle to Gate Window Product Category Rule." September 10, 2015, v 1.02, Extended per PCR ext 2022-112, valid through September 30, 2023. Reviewed by: Tom Gloria, LCACP, Industrial Ecology Consultants, Chair; Adolf Merl, ThinkStep GmbH; Philip Moser, Simpson Gumpertz & Heger Inc.

The declaration and LCA data were independently verified in accordance with ISO 14044:2006, ISO 14025:2006 and ISO 21930:2017. Verification was performed: ___ Internally _X_ Externally	
Life cycle assessment practitioner:	Anne Landfield Greig, LCA CP, Four Elements Consulting, LLC https://www.fourelementsllc.com anne@fourelementsllc.com
Third-party verifier:	Lindita Bushi, PhD, Athena Sustainable Materials Institute

MiTeK® Inc.

At MiTek, we seek to transform the building industry by championing better building methods through our Design-Make-Build approach. We collaborate across the building industry to empower transformational breakthroughs in design and construction. Our innovative and integrated solutions enable our partners to transform the way the industry designs, makes, and builds.

Our Benson® Curtain Wall product capitalizes on this by incorporating innovative off-site construction methods that minimize waste, reduce risk, improve quality and accelerate the building schedule. Additionally, our focus on off-site manufacturing concentrates on sustainability by eliminating job site waste, reductions in equipment and trades required on a project and minimized transportation impacts.

Product Description

The Benson® Curtain Wall is a unitized curtain wall system that is fabricated, assembled, and glazed off-site in a controlled shop environment. The Benson Curtain Wall uses pressure equalized, dry gasketed joints to ensure excellent performance against both air and water infiltration and to accommodate building movements and tolerances with minimal on-site application of sealants.

The Benson® Curtain Wall is fully customizable, able to accommodate a variety of finishes, features, and loading conditions and optimized for superior thermal performance. This evaluation considered an iteration of the system capable of meeting the demanding needs of high rise, monumental construction. For completeness, all features of a typical Benson® Curtain Wall are included, including insulated back pans and shadowboxes. Benson Curtain Wall CSI code: 08 44 13 (Aluminum Curtain Walls); UNSPSC code: 30151806 (Glass Curtainwalling).

Life Cycle Assessment Overview

A cradle-to-grave Life Cycle Assessment (LCA) was completed on the MiTek / Benson Curtain Wall in accordance with ISO 14040 / ISO 14044, and the study was reviewed for conformance with ISO 14044, ISO 21930:2017, ASTM program operator rules, and the PCR subcategory. The product assessed was based on data from MiTek's largest projects in 2021.

System Boundaries

The LCA evaluated the cradle to gate of the curtain wall system. 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 construction works life cycle (adapted from 21930:2017 Fig 1).

Table 1 EPD System Boundary Modules

A1-A3			A4-A5		B1-B7					C1-C4				D
PRODUCTION Stage			CONSTRUC-TION Stage		USE Stage					END-OF-LIFE Stage				Benefits & Loads
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Product Use	Maintenance	Repair	Full replacement	Refurbishment	Deconstruction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Reuse, recovery, recycling potential
Mandatory			Scenarios		Scenarios B6 Operational energy use scenario B7 Operational water use scenario					Scenarios				Scenario

Figure 1 presents A1-A3 as they pertain to the Benson Curtain Wall and additionally provides aspects of the life cycle that are excluded from the study.

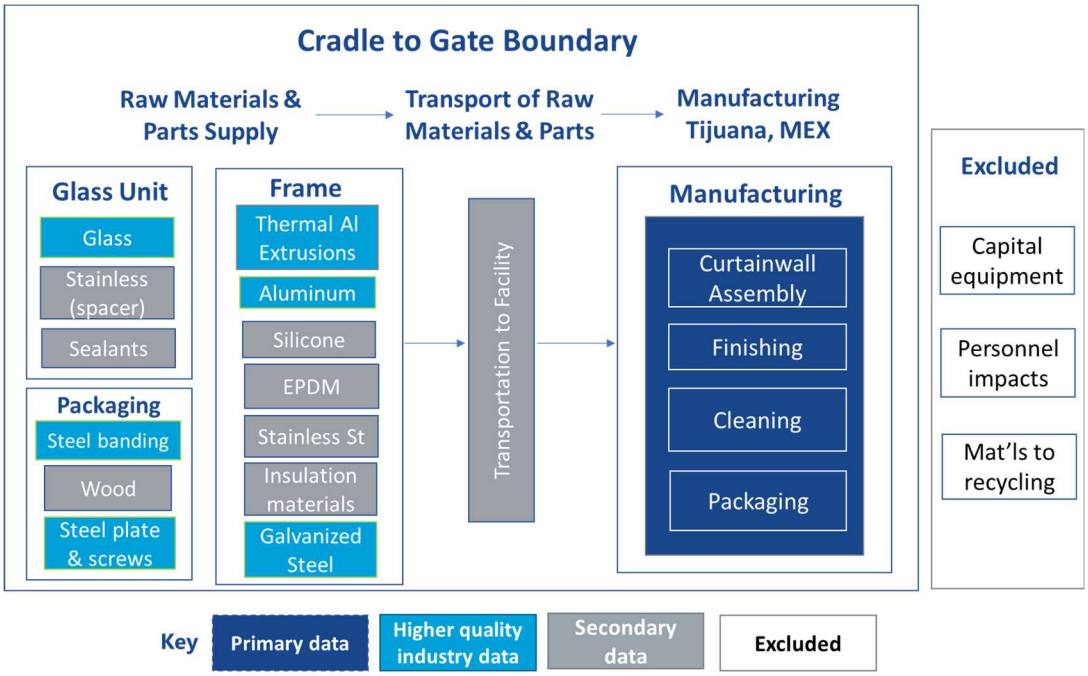

Figure 1 Benson Curtain Wall System Boundary and Data

Declared Unit

The declared unit is one square meter (1 m^2) of the Benson Curtain Wall produced at the MiTek manufacturing plant in Tijuana, Mexico. 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.

A1 Raw Material Extraction and Processing

Main Component	Materials	% of Total
Frame	Aluminum & polyamide	19.90%
	Silicone parts	4.10%
	Steel parts	1.70%
	Aluminum parts	6.40%
	Insulation	5.90%
Glass Unit	Glass	61.40%
	Stainless steel	0.50%
	Sealants	0.10%

Module A1 accounts for the extraction of materials and production of framing, insulated glass units (IGUs), and packaging parts and components. Additional curtain wall features specified for some projects were evaluated and included for the sake of completeness of the product and the LCA, such as insulated back pans and shadowboxes. Table 2 presents the bill of materials as a percent of the total product.

Table 2 Bill of Materials

A2 Transportation to Manufacturing

Module A2 accounts for transportation of raw materials to Tijuana, Mexico. The distances of the parts and materials to Tijuana by heavy duty diesel truck and ocean freighter were based on supplier data provided by MiTek.

A3 Manufacturing

Module A3 includes assembly of unitized curtain wall sections at the Tijuana facility. 2021 energy use, emissions, and waste management were included in the model. The Mexico electricity grid mix was used for the Tijuana production plant.

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

Data was provided on a total facility basis. No allocations needed to be made since the product output included all unitized curtain walls.

Software and Data Used

The SimaPro LCA software was used to model the unitized curtain wall system. Data came from sources appropriate for the Benson Curtain Wall model, with intentional choices for the highest data quality. Secondary data came from several databases, including Industry 2.0 for industry-average high quality LCA data, DATASMART for North American energy, transportation, parts and materials, and ecoinvent for energy, parts and materials outside North America.

Data Quality

The data applied to this study represent the current Benson Curtain Wall system. MiTek's Tijuana, Mexico, facility supplied 2021 process data, which was based solely on unitized curtain walls assembled and packaged in preparation for project sites. Energy and transportation data are based on the high 2010's, and production data for materials are based on mid 2010's through 2022. Data for energy, transportation, materials and processes are North American-, European-, and Asian-based, and were specific to MiTek supplier locations. Technological coverage for the upstream materials and processes is 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 Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) v.2.1, a North American impact assessment methodology. Global Warming Potential is based on IPCC 6th Assessment. Abiotic Depletion Potential for fossil fuels is based on CML's baseline methodology. LCIA results in

Table *3* and Table 4 are presented for the cradle to gate totals, showing A1, A2, and A3 as absolute values and as percentages, respectively. The Life Cycle Inventory (LCI) results follow.

Table 3 Impact Assessment Results – absolute values

Per 1 m^2 Declared Unit			Materials production	Transport to facility	Manuf-acturing
Impact Categories - LCIA	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Global warming potential	kg CO2-e	216.65	193.83	16.01	6.81
Acidification potential	kg SO2-e	1.12	0.94	0.15	0.03
Eutrophication potential	kg N-e	0.32	0.29	0.01	0.02
Smog creation potential	kg O3-e	16.17	11.39	4.45	0.33
Ozone depletion potential	kg CFC11-e	2.16 E-05	2.09 E-05	2.80 E-08	5.92 E-07
ADP fossil	MJ, LHV	2732.17	2433.37	199.11	99.68
Total energy (used as fuel)	MJ	3044.61	2726.29	202.48	115.84

Table 4 Impact Assessment Results – percentages

Per 1 m^2 Declared Unit			Materials production	Transport to facility	Manuf-acturing
Impact Categories – LCIA	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Global warming potential	kg CO2-e	216.65	89.47%	7.39%	3.14%
Acidification potential	kg SO2-e	1.12	84.07%	13.51%	2.42%
Eutrophication potential	kg N-e	0.32	90.91%	3.65%	5.44%
Smog creation potential	kg O3-e	16.17	70.46%	27.50%	2.04%
Ozone depletion potential	kg CFC11-e	2.16 E-05	97.12%	0.13%	2.75%
ADP fossil	MJ, LHV	2732.17	89.06%	7.29%	3.65%
Total energy (used as fuel)	MJ	3044.61	89.54%	6.65%	3.80%

Note: numbers may not add to 100% due to rounding. 0% implies less than 0.1%.

Table 5 Inventory Results

Per 1 m^2 Declared Unit			Materials production	Transport to facility	Manuf-acturing
Additional Categories – LCI	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Resource Use: Energy					
Non-renewable primary energy – fuel	MJ (LHV)	2830.85	2520.58	202.02	108.25
Non-renewable primary engy. res. - raw materials	MJ (LHV)	69.41	69.41	N/A	0.00
Renewable primary energy – fuel	MJ (LHV)	213.76	205.72	0.46	7.59
Renewable primary engy. res. - raw materials	MJ (LHV)	3.82 E-07	3.82 E-07	N/A	0.00
Resource use: Materials					
Use of secondary materials	Kg	12.42	12.42	N/A	0.00
Use of renewable secondary fuels	MJ (LHV)	0.00	N/A	N/A	0.00
Use of non-renewable secondary fuels	MJ (LHV)	0.00	N/A	N/A	0.00
Use of recovered energy	MJ (LHV)	0.00	N/A	N/A	0.00
Use of net fresh water (inputs minus outputs)	m^3	1.10	1.08	1.77 E-03	2.41 E-02
Waste categories					
Non-hazardous waste disposed	kg	2.57	N/A	N/A	2.57
Hazardous waste disposed	kg	0.00	N/A	N/A	0.00
High-level radioactive waste	kg	4.19 E-04	3.87 E-04	8.51 E-06	2.38 E-05
Intermediate- & low-level radioactive waste	kg	3.31 E-03	3.06 E-03	1.90 E-05	2.32 E-04
Other output flows					
Components for reuse	kg	0.00	0.00	0.00	0.00
Materials for recycling	kg	4.44	4.44	0.00	0.00
Materials for energy recovery	kg	0.00	0.00	0.00	0.00
Exported energy	MJ (LHV)	0.00	0.00	0.00	0.00

Additional Environmental Information

At end of life, approximately 90% of the total mass of the product may be recycled. This includes the aluminum framing and glass plus the additional aluminum and steel components in the curtain wall.

There are no substances in the Benson Curtain Wall that are on the Candidate List of Substances of Very High Concern. The are no materials present in over 0.1% by mass of the product that are hazardous to human health and the environment.

Performance Standards & Certifications

The Benson Curtain Wall is tested, certified & labeled for the following performance standards:

- AAMA TIR A-11 Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads
- AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
- ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen
- ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- AAMA 1503, NFRC 100 Thermal Transmittance, U-Factors
- AAMA 1503, NFRC 500 Condensation Rating (CRF,CI)
- NFRC 200 Overall Solar Heat Gain Coefficient and Visible Transmittance (SHGC & VT)

Limitations & Comparability

EPDs are not intended for making comparisons with other products due to varying background data in LCA softwares and/or varying Program Operator or Product Category Rules. For example, Product Category Rules may cause differences in modeling decisions or impact category requirements. Different LCA software and background LCI datasets may lead to different results in the life cycle stages declared.

Full conformance with the PCR for products allows EPD comparability only when all stages of a life cycle have been considered, including the product's Use phase in a building. Variations and deviations, as noted above, are likely. If comparisons to other EPDs are done, these variations and deviations must be acknowledged. Furthermore, EPDs are comparable only if they comply with ISO 21930: 2017, use the same sub-category PCR, include all relevant information modules, and are based on equivalent scenarios with respect to the context of construction works.

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