ENVIRONMENTAL PRODUCT DECLARATION

Industrial Louvers, Inc. (ILI) is a customer-focused, woman owned and operated manufacturer of custom architectural metal products including architectural louvers, equipment screens, decorative grilles, sunshades, and column covers.

Industrial Louvers, Inc.

https://www.industriallouvers.com

Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org
General Program Instructions	NSF Program Operator Rules, February 2015
Manufacturer Name and Address	Industrial Louvers, Inc. 511 S. 7th Street Delano, MN 55328
Declaration Number	EPD10628
Declared Product and Functional Unit	Painted Aluminum Louvers Functional Unit: 100 m^2 of painted louver maintained for 75 years
Reference PCR and Version Number	UL PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL PCR Part B: Insulated Metal Panels Metal Composite Panels and Metal Cladding - Roof and Wall Panels
Product's intended Application and Use	Louvers
Product RSL	30 years
Markets of Applicability	North America
Date of Issue	October 21, 2021
Period of Validity	5 years from date of issue
EPD Type	Product Specific
Intended Audience	Business-to-Business, Business-to-Consumer
Range of Dataset Variability	N/A
EPD Scope	Cradle to Grave
Year of reported manufacturer primary data	2020
LCA Software and Version Number	GaBi 9.5.0.43
LCI Database and Version Number	GaBi Database, Service Pack 40
LCIA Methodology and Version Number	TRACI 2.1 CML 2001-Oct 2012
The PCR review was conducted by:	Thomas Gloria, PhD (chair) Jack Geibig, P.E. Michael Overcash, PhD
This declaration was independently verified in accordance with ISO 14025:2006. ISO 21930:2017 serves as the core PCR along with EN 15804 (2012) and UL PCR Part A, v3.1 (2018), with additional considerations from the UL PCR Part B: Insulated Metal Panels Metal Composite Panels and Metal Cladding - Roof and Wall Panels. ☐ Internal ☒ External	Tony Favilla afavilla@nsf.org
This reference life cycle assessment was conducted in accordance with ISO 14044 and the reference PCRs by:	WAP Sustainability Consulting
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Jack Geibig jgeibig@ecoform.com

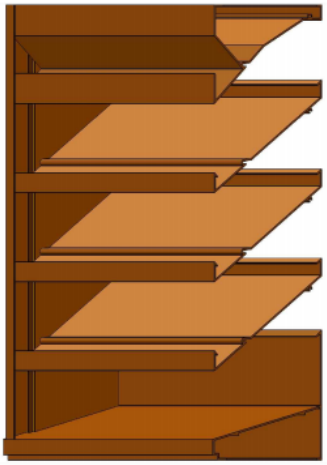
Limitations:
Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for Products 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.

1. PRODUCT DEFINITION AND INFORMATION

1.1 Description of Company

Industrial Louvers, Inc. (ILI) is a customer-focused, woman-owned, and operated manufacturer of custom architectural metal products including architectural louvers, equipment screens, decorative grilles, sunshades, and column covers. ILI products are all made in the United States, manufactured, and finished in their Delano, MN location. ILI's products are designed to integrate seamlessly with a wide range of substrates, including other manufacturers' curtain wall. For more information, please visit https://www.industriallouvers.com

1.2 Product Description



Louvers serve a critical need to allow air flow through openings in buildings while rejecting unwanted elements such as water and airborne debris. Non-drainable louvers provide maximum free air flow and a basic level of resistance to water penetration. Drainable louvers also provide maximum free air flow with increased protection against heavy rain. Specialized stormproof and storm-resistant louvers, including hurricane-approved and Florida-approved louvers, provide protection from wind-driven rain and extreme storm events.
ILI's aluminum louvers are assemblies of aluminum extrusions, fastened with stainless steel fasteners and finished with a factory applied PVDF finish. This study is based on a typical painted aluminum louver manufactured by ILI that is representative of all the aluminum louvers manufactured by ILI. The representative product was chosen that incorporated factors which would lead to higher impacts and sales figures. Therefore, the chosen product can be considered a conservative estimate with high sales quantities and is therefore representative of the full product category, the results of which are not expected to deviate by more than 10%. Schematics of a representative type of aluminum louver (653XP) is shown here. For a full-list of available options of painted aluminum louvers manufactured by ILI please refer to: https://www.industriallouvers.com/product/?filter=fixed-extruded-drainable

1.3 Application

Louvers serve a critical need to allow air flow through openings in buildings while rejecting unwanted elements such as water and airborne debris. Non-drainable louvers provide maximum free air flow and a basic level of resistance to water penetration. Drainable louvers also provide maximum free air flow with increased protection against heavy rain. Specialized stormproof and storm-resistant louvers, including hurricane- and Florida-approved louvers, provide protection from wind-driven rain and extreme storm events.

1.4 Technical Data

The products considered in this EPD meet or exceed the following Technical Specifications:

- AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.
- AAMA 2605 – High Performance Organic Coatings on Architectural Extrusions and Panels.
- ASCE 7 – Minimum Design Loads for Buildings and Other Structures
- ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- ASTM B221 – Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods,

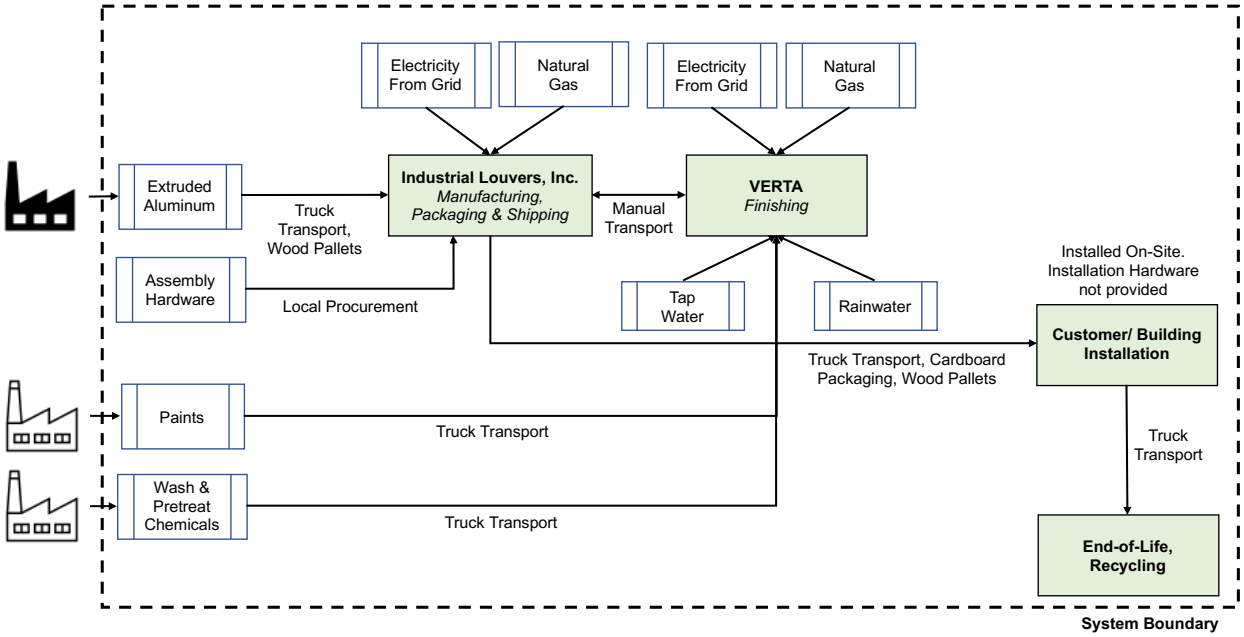
Wire, Profiles, and Tubes.

- ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposure of Paint and Related Coatings.
- ASTM D4214 – Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films.
- ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.
- Living Building Challenge – Red List Free.

1.5 Declaration of Methodological Framework

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle stages included in this EPD is presented in 2.2. The reference service life is outlined in Table 5 and is only applicable if all manufacturing guidelines are followed regarding site-selection and installation, found online. No known flows are deliberately excluded from this EPD. Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impacts in all impact categories required by the PCR.

1.6 Process Flow Diagram



1.7 Manufacturing

Aluminum billets are sourced from suppliers and transported to extruders by trucks. Extruded aluminum is shipped to the plant via trucks over wood pallets. At the Industrial Louvers Inc. manufacturing facility, the extruded aluminum is assembled to form the louvers. Once assembled, the aluminum louvers are painted with a PVDF coating in house at Verta, the finishing facility. The products are transported between the two facilities via manually pushed carts. Once painted they are dried in ovens powered by natural gas. The finished products are then shipped to jobsites for installation from the Industrial Louvers facility.

1.8 Material Composition

Table 1: Material Composition per functional unit of 100 m^2 of painted aluminum louvers

	Painted AL Louvers (kg/100 m^2)	Painted AL Louvers (kg/m^2)	Painted AL Louvers (% mass)
Extruded Aluminum	1913.85	19.14	72.28
Paint and Sealants	733.81	7.34	27.72

This product contains no regulated substances.

1.9 Packaging

Input (m^2)	Disposal Mechanism	Value	Unit
Cardboard	Recycled (75%) Landfilled (20%) Incinerated (5%)	0.241	kg/m^2
Plastics (1/16")	Recycled (15%) Landfilled (68%) Incinerated (17%)	1.78	kg/m^2

Packaging waste disposal has been modeled as per guidelines in section 2.8.5 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements.

1.10 Product Installation

Product installation instructions and guidelines are outlined on the Industrial Louvers website for all available painted aluminum louvers (https://www.industriallouvers.com/product/?filter=fixed-extruded-drainable). Since these products are shipped custom-cut according to the customer's specification no installation scraps are generated as part of the installation process.

1.11 Use Conditions

Once installed, the louvers require little to no maintenance and hence no required maintenance is needed. Hence B1-B3 and B5-B7 are not included

1.12 Product Reference Service Life and Building Estimated Service Life

According to Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment, V3.2, 2018, the Estimated Service Life (ESL) of the building is assumed to be 75 years. The Reference Service Life (RSL) of the aluminum louvers is taken to be 30 years, thereby requiring 2.5 installations of the product over the ESL.

1.13 Disposal

All waste has been classified according to regional-specific legislation as laid out in Section 2.8.6 in Part A: Life Cycle Assessment Calculation Rules and Report Requirements from UL Environment. Since the louvers are almost entirely made of aluminum, 85% of it is recycled and 15% is landfilled at the end-of-life as per the PCR.

2. LIFE CYCLE ASSESSMENT BACKGROUND INFORMATION

2.1 Functional Unit

The functional unit according to the PCR is 100 m^2 of installed painted aluminum louver.

Table 2: Functional Unit

	Painted Aluminum Louver
Functional Unit	100m^2
Weight	1913.85 kg

2.2 System Boundary

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle modules included in this EPD is presented in Table 3. Infrastructure flows have been excluded.

Table 3:Summary of Included Life-Cycle Modules

Module	Description	Module	Description	Module	Description
A1	Product Stage: Raw Material Supply	**B1**	Use Stage: Use	**C1**	EOL: Deconstruction
A2	Product Stage: Transport	**B2**	Use Stage: Maintenance	**C2**	EOL: Transport
A3	Product Stage: Manufacturing	**B3**	Use Stage: Repair	**C3**	EOL: Waste Processing
A4	Construction Process Stage: Transport	**B4**	Use Stage: Replacement	**C4**	EOL: Disposal
A5	Construction Process Stage: Installation	**B5**	Use Stage: Refurbishment	**D**	Benefits beyond system
		B6	Operational Energy Use		
		B7	Operational Water Use		

2.3 Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. Most of the estimations are within the primary data. The primary data was collected as annual totals including all material inputs, utility usage and production information. For the LCA, the total utility usage information was divided by the annual input of all materials and then allocated to the product based on its material composition. Another assumption is that the manufacturing tools and equipment are used enough times that the impacts are negligible per functional unit of the product.

2.4 Cutoff Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. No known flows are deliberately excluded from this EPD.

2.5 Data Sources

Primary data was collected by Industrial Louvers, Inc. associates for onsite energy, water and waste during manufacturing. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was used from GaBi Database Version 9.5.0.43, Service Pack 40. All calculation procedures adhere to ISO14044.

2.6 Data Quality

The geographical scope of the manufacturing portion of the life cycle is Delano, MN. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2020. Primary data provided by the manufacturer is specific to the technology that the company uses in manufacturing their product. It is site-specific and considered of good quality. Data used to allocate energy and water on a per unit of product produced includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality.

2.7 Period under Review

The period under review is calendar year 2020.

2.8 Allocation

General principles of allocation were based on ISO 14040/44. The manufacturing processes at Industrial Louvers, Inc. and their finishing facility, Verta, studied in this LCA, produces different types of louvers and sunshades that are similar in product specifications. A mass-based allocation method was adopted for this study. All manufacturing inputs such as electricity, natural gas and water and wastes generated from the manufacturing process were divided by the total mass input to the manufacturing process. The manufacturing inputs and wastes were allocated on a mass basis to the product. As a default, secondary GaBi datasets use a physical mass basis for allocation. Throughout the study recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at end of life are also excluded (i.e., production into a third life or energy generation from the incineration plant). The study does include the impacts associated with reprocessing and preparation of recycled materials that are part of the bill of materials of the products under study.

3. LIFE CYCLE ASSESSMENT SCENARIOS

The product is delivered to the customer via truck. The frame depth is 6 inches, and the length is customized for the project. Transportation averages are calculated based on sales records and are shown in Table 4.

Table 4: Transport to building site (A4)

	Painted Aluminum Louvers
Vehicle Type	U.S. Flatbed truck
Fuel Type	Diesel
Fuel Consumption	2.29-04 kg
Distance [km]	1500 (estimated value)
Capacity Utilization [%]	61

The products under study have a reference service life (RSL) of 30 years and the estimated service life (ESL) of the building is 75 years per the PCR.

Table 5: Reference Service Life

Name	Value	Unit
Reference Service Life	30	years
Number of Installations required for the estimated service life (ESL) of the building	2.5	
Declared product properties (at the gate) and finishes, etc.	See Table 1	-

Since no maintenance is required for this product, B1-B3 and B5-B7 are not relevant

Note: The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the variability of the results and make comparisons misleading. Without understanding the specific variability, the user is therefore not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results. Full conformance with the PCR for Insulated Metal Panels Metal Composite Panels and Metal Cladding - Roof and Wall Panels 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.

4. LIFE CYCLE ASSESSMENT RESULTS

All results are given per functional unit, which is 100 m^2 of installed painted aluminum louvers over a reference service life of 30 years thereby requiring 2.5 installations of the product over an estimated building life of 75 years. Environmental impacts were calculated using the GaBi software platform. Impact results have been calculated using both TRACI 2.1 and CML 2001-Jan 2016 characterization factors. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories 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, however the EPD users shall not use additional measures for comparative purposes. Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories

Table 6: Description of the System Boundary Modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	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
Cradle to Grave	X			X	X	X	X	X	X	X	X	X	X	X	X	X	MND

Table 7:Acronym Key

Acronym	Text	Acronym	Text
Impact Categories			
ADP-elements	Abiotic depletion potential for non-fossil resources	**GWP**	Global warming potential
ADP-fossil	Abiotic depletion potential for fossil resources	**ODP**	Depletion of stratospheric ozone layer
AP	Acidification potential of soil and water	**POCP**	Photochemical ozone creation potential
EP	Eutrophication potential	**Resources**	Depletion of non-renewable fossil fuels
LCI Indicators			
RPR_E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	**SM**	Use of secondary materials
RPR_M	Use of renewable primary energy resources used as raw materials	**RSF**	Use of renewable secondary fuels
$NRPR_E$	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	**NRSF**	Use of non-renewable secondary fuels
$NRPR_M$	Use of non-renewable primary energy resources used as raw materials	**FW**	Net use of fresh water
HWD	Disposed-of-hazardous waste	**MR**	Materials for recycling
NHWD	Disposed-of non-hazardous waste	**MER**	Materials for energy recovery
HLRW	High-level radioactive waste, conditioned, to final repository	**EE**	Exported energy
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	**CRU**	Components for reuse
RE	Recovered energy		

4.1 CML Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP [kg CO2 eq]	2.35E+04	4.67E+01	4.62E+02	0.00E+00	0.00E+00	0.00E+00	3.61E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E+01	0.00E+00	1.22E+01
ODP [kg CFC 11 eq]	1.30E-06	9.33E-15	3.56E-13	0.00E+00	0.00E+00	0.00E+00	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.94E-15	0.00E+00	4.24E-14
AP [kg SO2 eq]	9.93E+01	9.78E-02	5.28E-01	0.00E+00	0.00E+00	0.00E+00	1.50E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.18E-02	0.00E+00	4.94E-02
EP [kg Phosphate eq]	5.77E+00	2.67E-02	2.35E-01	0.00E+00	0.00E+00	0.00E+00	9.08E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-02	0.00E+00	6.18E-03
POCP [kg Ethene eq]	5.84E+00	-3.31E-02	1.57E-01	0.00E+00	0.00E+00	0.00E+00	8.92E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.75E-02	0.00E+00	4.74E-04
ADP-elements [kg Sb eq]	7.64E-03	1.43E-05	2.03E-03	0.00E+00	0.00E+00	0.00E+00	1.45E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.58E-06	0.00E+00	3.32E-06
ADP-fossil fuel [MJ]	2.11E+05	5.52E+02	8.19E+02	0.00E+00	0.00E+00	0.00E+00	3.19E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E+02	0.00E+00	1.47E+02

4.2 TRACI Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
AP [kg SO2 eq]	9.63E+01	1.33E-01	1.01E+00	0.00E+00	0.00E+00	0.00E+00	1.46E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E-02	0.00E+00	5.41E-02
EP [kg N eq]	3.17E+00	1.53E-02	1.71E-01	0.00E+00	0.00E+00	0.00E+00	5.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.12E-03	0.00E+00	3.01E-03
GWP [kg CO2 eq]	2.35E+04	4.67E+01	4.62E+02	0.00E+00	0.00E+00	0.00E+00	3.61E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E+01	0.00E+00	1.22E+01
ODP [kg CFC 11 eq]	1.30E-06	9.33E-15	3.56E-13	0.00E+00	0.00E+00	0.00E+00	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.94E-15	0.00E+00	4.24E-14
Resources [MJ]	2.92E+04	8.76E+01	9.45E+01	0.00E+00	0.00E+00	0.00E+00	4.42E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E+01	0.00E+00	2.47E+01
POCP [kg O3 eq]	9.46E+02	3.03E+00	6.82E+00	0.00E+00	0.00E+00	0.00E+00	1.44E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E+00	0.00E+00	9.61E-01

4.3 Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
RPRE [MJ]	1.42E+05	2.73E+01	1.00E+02	0.00E+00	0.00E+00	0.00E+00	2.13E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E+01	0.00E+00	1.61E+01
RPRM [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RPRT [MJ]	1.42E+05	2.73E+01	1.00E+02	0.00E+00	0.00E+00	0.00E+00	2.13E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E+01	0.00E+00	1.61E+01
NRPRE [MJ]	3.10E+05	6.61E+02	9.94E+02	0.00E+00	0.00E+00	0.00E+00	4.68E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+02	0.00E+00	1.94E+02
NRPRM [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRT [MJ]	3.10E+05	6.61E+02	9.94E+02	0.00E+00	0.00E+00	0.00E+00	4.68E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+02	0.00E+00	1.94E+02
SM [kg]	1.32E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	1.32E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	4.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.68E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m3]	4.40E+02	1.16E-01	4.82E-01	0.00E+00	0.00E+00	0.00E+00	6.61E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.16E-02	0.00E+00	2.67E-02

4.3 Output Flows and Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD [kg]	3.18E+01	5.53E-08	9.60E-08	0.00E+00	0.00E+00	0.00E+00	4.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-08	0.00E+00	1.84E-08
NHWD [kg]	6.72E+03	6.08E-02	3.17E+02	0.00E+00	0.00E+00	0.00E+00	1.10E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-02	0.00E+00	2.89E+02
HLRW [kg]	5.80E-03	2.23E-06	1.56E-05	0.00E+00	0.00E+00	0.00E+00	8.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-06	0.00E+00	1.87E-06
ILLRW [kg]	5.02E+00	1.88E-03	1.37E-02	0.00E+00	0.00E+00	0.00E+00	7.56E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.93E-04	0.00E+00	1.62E-03
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	5.17E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.24E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+03	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE [MJ]	9.20E+00	0.00E+00	3.19E+02	0.00E+00	0.00E+00	0.00E+00	4.92E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET [MJ]	4.33E+00	0.00E+00	1.06E+02	0.00E+00	0.00E+00	0.00E+00	1.65E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. LIFE CYCLE ASSESSMENT INTERPRETATION

For the painted aluminum louver, aluminum utilized in the manufacturing process is the largest contributor in terms of GWP, contributing approximately 78% of the total GWP impact over the entire life cycle for the products under consideration. Within the manufacturing stage (A3), electricity sourced from the grid contributes to approximately 7.8% and natural gas contributes to approximately 15% of the total GWP impacts over the entire life cycle. Overall, the sourcing and manufacturing phases (A1-A3) account for almost all the GWP impacts at 97.73%. Installation phase (A5), which includes the packaging materials needed to ship the products to the customers contribute to 2% of the total GWP impacts. In addition to the total GWP impacts, aluminum is also the largest contributor to the following impact categories: acidification potential, eutrophication potential, and photochemical ozone creation potential at approximately 87% over the entire reference service life for the products under consideration.

6. REFERENCES

1. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
2. ISO 14044: 2006/ Amd 1:2017 Environmental Management – Life cycle assessment – Requirements and Guidelines – Amendment 1.
3. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
4. ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
5. European Standard DIN EN 15804: 2012.04+A1 2013. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products (includes Amendment A1:2013)
6. CML-IA Characterization Factors. 5 September 2016. https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
7. TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 – User Guide - https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf.
8. UL PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements
9. UL PCR Part B: Insulated Metal Panels Metal Composite Panels and Metal Cladding - Roof and Wall Panels