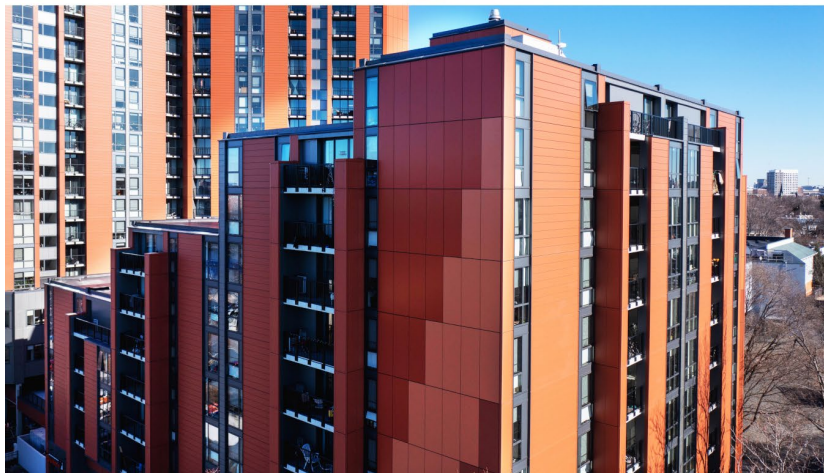


ENVIRONMENTAL PRODUCT DECLARATION

INSULATED METAL PANELS

WALL AND ROOF PANEL SYSTEMS



The Metal Construction Association (MCA) is a non-profit organization formed in 1983 with the primary purpose of expanding the use of metal in construction. MCA unites diverse industry segments for the purpose of informing decision makers about the benefits of metal through awareness and education programs. MCA also supports third-party metal product research and testing. MCA and its members are committed to creating a cleaner, safer environment evidenced by the association's LCA program and support of similar initiatives.

Insulated Metal Panels are a major product category developed by MCA members. These factory fabricated metal panels have a continuous insulating core that together with the metal skins act as an air, water vapor, and thermal barrier.

This Environmental Product Declaration for Insulated Metal Panels is one of several different product EPDs offered by MCA.

For more information visit
<https://metalconstruction.org>



ENVIRONMENTAL PRODUCT DECLARATION



Insulated Metal Panels
Industry-Wide EPD



According to ISO 14025,
EN 15804, and ISO21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Solutions 333 Pfgingsten Rd, Northbrook IL, 60062 www.ul.com www.spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	UL Solutions Program Operator Rules v.2.7 2022
MANUFACTURER NAME AND ADDRESS	Metal Construction Association 1061 American Lane, Suite 310 Schaumburg, IL 60173
DECLARATION NUMBER	4792126919.101.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Insulated Metal Panels; 100 m ² coverage
REFERENCE PCR AND VERSION NUMBER	PCR Part A "Life Cycle Assessment Calculation Rules and Report Requirements" (UL Environment, 2022) and PCR Part B: "Insulated Metal Panels, Metal Composite Panels, and Metal Cladding: Roof and Wall Panels" (UL Environment, 2018) (extended to Oct 31, 2026)
DESCRIPTION OF PRODUCT APPLICATION/USE	Comprised of polyurethane core sandwiched between two pre-finished steel sheets which form a single, all-in-one insulated metal panel used as exterior wall and roof cladding systems, interior ceiling, and partition walls.
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	August 11 th , 2026
PERIOD OF VALIDITY	5 Years
EPD TYPE	Industry-average
RANGE OF DATASET VARIABILITY	Industry-average only
EPD SCOPE	Cradle to gate
YEAR(S) OF REPORTED PRIMARY DATA	2023
LCA SOFTWARE & VERSION NUMBER	Sphera LCA FE v10.9
LCI DATABASE(S) & VERSION NUMBER	Sphera Managed LCA Content (MLC) 2025.2
LCIA METHODOLOGY & VERSION NUMBER	IPCC AR6 + CML 2001 Aug 2016 + TRACI 2.2

The PCR review was conducted by:

UL Solutions
PCR Review Panel
pcr@ul.com

This declaration was independently verified in accordance with ISO 14025: 2006.

☐ INTERNAL ☒ EXTERNAL

Cooper McCollum, UL Solutions

This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:

Sphera Solutions, Inc.

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: Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of metal panel and cladding 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 use phase as instructed under this PCR. Full conformance with the PCR for metal panels and cladding allows EPD comparability only when all stages of a life cycle have been considered when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. 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.



Insulated Metal Panels
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According to ISO 14025,
EN 15804, and ISO 21930:2017

1. Product Definition and Information

1.1. Description of Company/Organization

The Metal Construction Association (MCA) is recognized as the leading advocate for the architectural metal products industry. Since it was formed in 1983, MCA has focused on promoting the use of metal in the building envelope through marketing, education, and action on public policies that affect the use of metal. MCA is a volunteer-led organization that works to eliminate barriers to using metal in construction by supporting product performance testing, initiating research, and monitoring and responding to codes and regulations that affect metal. Visit <https://metalconstruction.org> for more information.

Information in this document has been prepared by MCA technical staff and members of MCA’s Insulated Metal Panels Council who are volunteers representing the leading manufacturers of IMPs. The product configurations offered herein use ranges representative of all types of IMPs based on specific products from the following MCA member companies:

	All Weather Insulated Panels (AWIP) specializes in the design and manufacture of foam composite insulated metal wall and roof systems, operating facilities across North America. The company produces high-performance building envelopes engineered for superior interior climate control and energy efficiency. AWIP is committed to long-term sustainability through its Planet Passionate program, focusing on reducing carbon emissions throughout its operations. www.awip.com
	Kingspan North America is a global leader in high-performance building envelope solutions, specializing in insulated metal panels for a wide variety of wall and roof applications. Their systems feature proprietary QuadCore® technology, a next-generation hybrid insulation core that delivers best-in-class thermal performance and industry-leading R-values. These panels provide a complete, airtight barrier against air, water, and vapor in a single component, significantly accelerating construction speed while reducing embodied carbon compared to traditional wall systems. www.kingspan.com/us/en/business-groups/kingspan-insulated-panels
	Metl-Span, a Nucor company, has been a pioneering North American manufacturer of insulated metal panels for commercial, institutional, and industrial applications since 1968. The company specializes in energy-efficient, all-in-one panel solutions that combine air, thermal, vapor, and water barriers into a single, durable product for walls and roofs. With seven manufacturing facilities across the United States and Canada, they offer diverse, aesthetically versatile options designed to accelerate construction schedules. www.metlspan.com



1.2. Product Description

Product Identification

Insulated metal panels (IMPs) in their simplest form are rigid foam sandwiched between two sheets of coated metals as shown in Figure 1. The panels are molded in a variety of styles and sizes depending on application.



Figure 1: Section of a 4-inch Insulated Metal Panel

Image Courtesy of AWIP

Steel panel facings and joinery combined with sealants work together to create vapor, air, and moisture barriers and provide long-term thermal stability as shown in Figure 2.

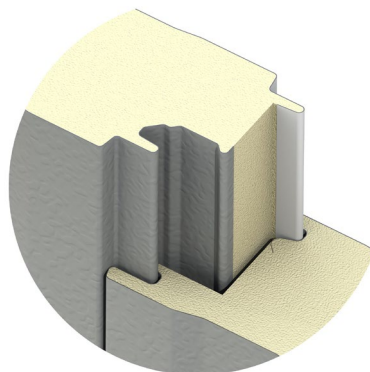


Figure 2: Typical IMP Joinery

Image Courtesy of Metl-Span

MCA IMP products are used in a multitude of building coverage applications and offer a wide range of benefits, including aesthetics, durability, rain screening, fireproofing, and reduced energy costs, with each product offering its

own unique properties. Three common construction assemblies are shown in Figure 3 – horizontal panel wall, vertical panel wall, and roof.

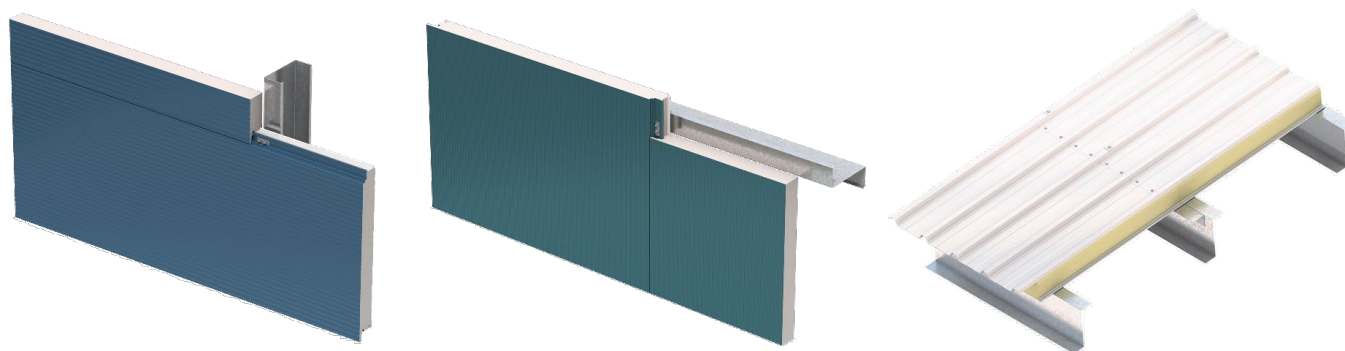


Figure 3: Common IMP Constructions

Image courtesy of Kingspan

This EPD focuses on panel products that are considered representative of common products manufactured by member companies, as seen in Table 1. Over all participants, 4-inch nominal thickness panels accounted for over 50% of all production, so a primary product core thickness of 4 inches was used.

Product Specification

Table 1. Insulated metal panel specification

PRODUCT	DESCRIPTION	PRIMARY PROCESSES
Insulated Metal Panel (IMP)	Coil gauge: 22 – 26 Foam core thickness: 2 – 6 inches Primary product: 4" IMP with polyurethane/polyisocyanurate foam core and 24 gauge steel coil	IMP continuous foaming

Flow Diagram

Figure 4 displays the cradle-to-gate manufacturing process of IMPs.

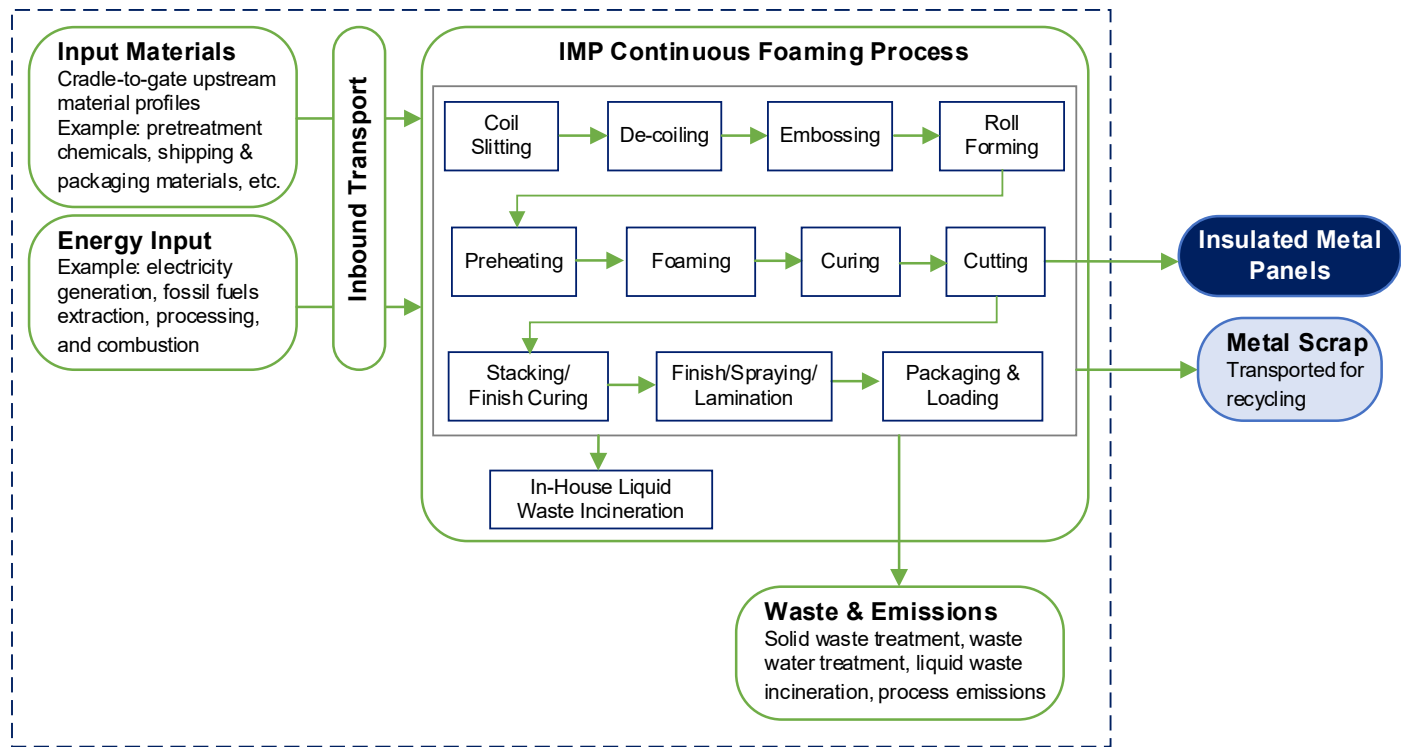


Figure 4. Cradle-to-Gate system boundary for insulated metal panel manufacturing

1.3. Application

IMPs are factory-manufactured composite building components consisting of an insulating foam core bonded between two metal facings. IMPs are used as exterior wall and roof systems in commercial, industrial, institutional, and refrigerated buildings.

These systems provide thermal insulation, air and moisture control, and structural performance within a single panel assembly. Typical applications include manufacturing facilities, cold storage and food processing plants, healthcare facilities, educational buildings, warehouses, aircraft hangars, sports complexes, and similar structures.

1.4. Declaration of Methodological Framework

This EPD is “cradle-to-gate” covering the modules A1 to A3. This includes raw material extraction and upstream processing, secondary material production, inbound transportation, panel manufacturing, and subsequent fabrication into finished panel products. This study excludes installation, use, and end-of-life stages as they are not required as per PCR. Module D has also been excluded as it is optional as per the PCR. Further details are described in MCA’s background report (Sphera, 2026).

Capital goods and infrastructure flows are excluded from this analysis due to the minimal extent to which they affect the LCIA results. For the manufacturing of IMPs, capital goods and infrastructure last for decades with periodic replacement of key components as needed. All other impacts associated with the use stage of the building while the product is being produced, and all human labor and commute have also been excluded.



No other known flows are deliberately excluded from this EPD.

1.5. Technical Requirements

Not all standards are applicable to all products. Consult specific manufacturer's information for standards compliance.

Material Standards

ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755	Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A792	Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

Performance Standards – General

ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C1363	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
ASTM D2126	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D6226	Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ANSI/CRRS S100	Standard Test Methods for Determining Radiative Properties of Materials
FM 4471	Approval Standard for Class 1 Panel Roofs
FM 4481	Approval Standard for Class 1 Exterior Wall Systems

Performance Standards – Air/Water

AAMA 501.1	Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
ASTM E1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
ASTM E1680	Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems





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ASTM E283	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E96	Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

Performance Standards – Paint/Finish

ASTM C1371	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
ASTM C1549	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM E903	Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
ASTM D523	Standard Test Method for Specular Gloss
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1308	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D4214	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

Performance Standards – Acoustical

ASTM E413	Classification for Rating Sound Insulation
ASTM E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

Performance Standards – Fire

ASTM D1929	Standard Test Method for Determining Ignition Temperature of Plastics
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ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E108	Standard Test Methods for Fire Tests of Roof Coverings
CAN/ULC S101	Standard Method of Fire Endurance Tests of Building Construction and Materials
CAN/ULC S102	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
CAN/ULC S107	Standard Methods of Fire Tests of Roof Coverings
CAN/ULC S126	Standard Method of Test for Fire Spread Under Roof-Deck Assemblies
CAN/ULC S127	Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials
CAN/ULC S134	Standard Method of Fire Test of Exterior Wall Assemblies
CAN/ULC S138	Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration
FM 4880	Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems
NFPA 259	Standard Test Method for Potential Heat of Building Materials
NFPA 268	Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
NFPA 285	Standard Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components
NFPA 286	Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
UL 723	Standard for Test for Surface Burning Characteristics of Building Materials
UL 790	Standard Test Method for Fire Tests of Roof Coverings

Performance Standards – Structural

ASTM C273	Standard Test Method for Shear Properties of Sandwich Core Materials
ASTM D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D1623	Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM D3359	Standard Test Methods for Rating Adhesion by Tape Test
ASTM E72	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
ASTM E330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1592	Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by



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According to ISO 14025,
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	Uniform Static Air Pressure Difference
UL 580	Tests for Uplift Resistance of Roof Assemblies
UL 1897	Uplift Tests for Roof Covering Systems

1.6. Properties of Declared Product as Delivered

Manufacturers supply IMPs in a variety of sizes and configurations customized to each project's requirements. The data for this EPD is representative of panels offered by the participating manufacturers. Technical properties of panel products under study can be seen in Table 2.

Table 2. Product properties.

Name	Value	Unit
Length	1 – 15	m
Width	0.6 – 1	m
Thickness	40 – 150	mm (nominal)
Mass per Unit Area	9.5 – 20	kg/m ²
Skin Tensile Strength	350 – 550	MPa
Skin Modulus of Elasticity	200,000	MPa
Core Density	33-45	kg/m ³
Core Compressive Strength	100 - 200	kPa
Core Shear Strength	140 - 240	kPa
U-factor	0.014 – 0.72	W/m ² ·K
R-value (Clear-Field)	1.6 – 8.5	m ² ·K/W
Airborne Sound Reduction	15 – 25	dB
Noise Reduction Coefficient	10 – 25	%

1.7. Material Composition

Steel coil represents steel that has been rolled out into 22, 24, or 26 gauge sheet and hot-dipped galvanized.

Polyester polyol is one the primary components of polyurethane and is typically produced by polymerizing propylene oxide and ethylene oxide.

Methylene diphenyl diisocyanate (MDI) is another primary component of polyurethane.

Blowing agent is an inert gas to facilitate the formation of foam. Hydrofluorocarbons (HFCs), hydrofluoroolefins (HFOs) and hydrocarbons are utilized by MCA member companies.

Catalysts are used to balance the reaction between polyester polyol and MDI that produces polyurethane. They also



contain surfactants to aid in adhesion to the metal skins.

Table 3. Base material mass by percentage, MCA industry average

Material	Mass (%)
Steel	72%
Polyurethane Foam	28%

1.8. Manufacturing

The process of manufacturing IMPs requires a marriage of customized mechanical equipment and foam chemistry. IMPs are manufactured on a continuous production line, as depicted in Figure 5.

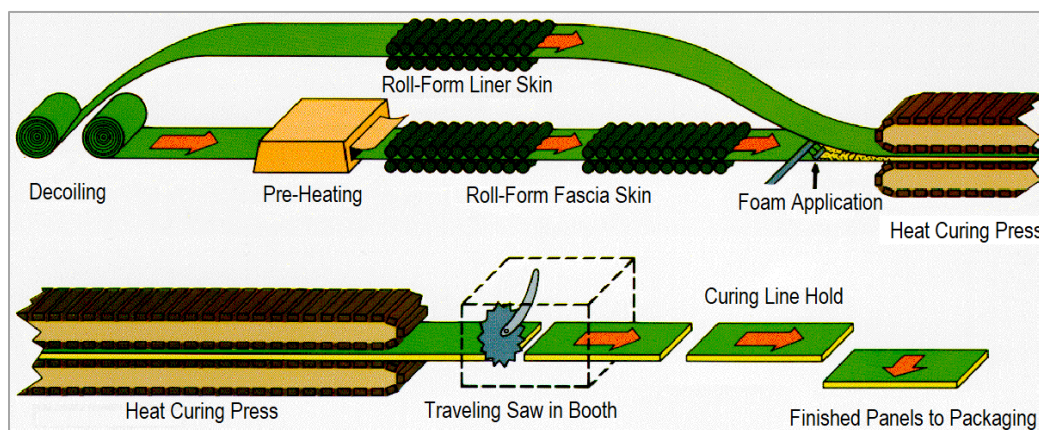


Figure 5. Schematic of continuous manufacturing process for insulated metal panels.

In IMP production, foam chemicals are mixed and injected in-line between the two steel sheets. This process entails forming the continuous metal facers just prior to injecting the foam mixture into the panel assembly. The foam then expands and fills the cavity between the metal skins as they enter a platen conveyor. The conveyor maintains proper temperature and pressure until the foam reaches a gel stage and becomes dimensionally stable. The panels then enter a time-controlled rack conveyor to allow the curing process to complete.

MCA member companies use a variety of blowing agents, including HFCs, HFOs, and hydrocarbons. Emissions mainly occur during foam injection between metal sheets. Once the foam has cured, panels are cut to length with an in-line cross cut saw. Post-fabrication work, available through some manufacturers, can be performed on the product to treat the cut ends of the panels. IMPs are subsequently packaged and distributed to construction sites.

1.9. Packaging

The insulated metal panels are separated and protected during transport using foam sheets layered between panels, and stacked on oriented strand board (OSB) and expanded polystyrene (EPS) underlayment. The stack is wrapped in polyethylene (PE) film for protection. Additional packaging materials include cardboard, plastic end caps, foam feet, and tissue paper to protect against damage in transit.



1.10. Transportation

Average weighted distances and modes of transportation are included for the inbound transportation of raw materials, operating materials, and auxiliary materials to each manufacturing facility. Outbound transportation for external waste treatment has also been included.

1.11. Industry Average

This declaration represents a production-weighted industry average for IMP products manufactured by 3 different participating MCA member organizations at 3 manufacturing facilities in North America, as identified in Table 4. The declaration is intended to represent IMP products within the scope defined in this EPD and should not be used to represent products with substantially different material compositions, manufacturing technologies, or geographic production locations. The MCA has independently confirmed that the participating manufacturers represent more than 50% of the annual production volume for the IMP industry in North America. The median reference flow corresponds to 100 m² of IMP panel. Variability between manufacturers is primarily driven by steel source, insulation core type and thickness, coating specifications, product configuration, facility scale, and regional electricity grid mixes.

Table 4. Manufacturers, manufacturing location and areal mass.

COMPANY	MANUFACTURING LOCATION	IMP
AWIP	Little Rock, AR	13.4 kg/100 m ²
Kingspan	Deland, FL	11.5 kg/100 m ²
Nucor	Lewisville, TX	15.1 kg/100 m ²

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

The declared unit is 100 square meters (1,076 square feet) of coverage area with panel product. The coverage area refers to the flat, projected surface area of the product as measured after the final manufacturing step and does not include material losses from side joinery and scrap during installation.

Table 5. Reference flow of insulated metal panels, weighted average basis

Name	IMP
Declared Unit [m ²]	100
Product mass [kg / 100 m ²]	1,354





2.2. System Boundary

This EPD is “cradle-to-gate” covering the production stage (modules A1 to A3). This includes raw material extraction and upstream processing, secondary material processing, inbound transportation, manufacturing and fabrication. The construction stage (modules A4 to A5), use stage (modules B1 to B7), and end-of-life stage (modules C1 to C4) are not included in this study.

The manufacturing of IMPs, capital goods, and infrastructure last for 20 to 35 years with periodic replacement of key components identified during routine maintenance and predictive failure modeling. All other impacts are associated with the use stage of the building while the product is being produced. All human labor and commute have also been excluded.

2.3. Estimates and Assumptions

This study is based on primary data collected from MCA member manufacturing facilities. Background datasets that are based on regional averages are used to represent the production of raw and auxiliary materials by upstream suppliers. When multiple datasets were available, a conservative approach was adopted where a dataset with the higher environmental impact was used.

2.4. Cut-off Criteria

The cut-off approach was adopted in the case of any post-consumer and post-industrial recycled content, which was assumed to enter the system burden-free. Only environmental impacts from the point of recovery and forward (e.g., inbound transport, remelting, subsequent processing, etc.) are considered. Additionally, the cut-off approach was applied to manufacturing (pre-consumer) scrap sent to external recycling. Transport of manufacturing scrap to the point of recovery is included, but no impacts are assigned to the recycling processes or future use of the material.

The specific criteria for including or excluding materials, energy, and emissions data of the study are as follows:

1. **Mass** – According to ISO guidelines, if a flow is less than 1% of the cumulative mass of the model it may be excluded, providing its environmental relevance is not a concern. For the purpose of this LCA, all known mass flows are reported, and no known flows were deliberately excluded.
2. **Energy** – According to ISO guidelines, if a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern. For the purpose of this LCA, all known energy flows are reported, and no known flows were deliberately excluded.
3. **Environmental relevance** – If a flow meets the above criteria for exclusion yet is thought to potentially have a significant environmental impact, it was included. Material flows which leave the system (emissions) and whose environmental impact is greater than 1% of the whole impact of an impact category that has been considered in the assessment must be covered. This judgment was made based on experience and documented as necessary.

Packaging of incoming raw materials (e.g. pallets, totes, super-sacks) is excluded as they represent less than 1% of the product mass and are not environmentally relevant.

Capital goods and infrastructure to produce IMPs have also been excluded as they produce millions of units over the course of their life, so the impact on a single declared unit is minimal.

2.5. Data Sources

The LCA model was created using the LCA for Experts (LCA FE) software v10.9 system for life cycle engineering,





developed by Sphera (Sphera, 2025). Background life cycle inventory data for raw materials and processes were obtained from the Sphera MLC 2025.2 database (CUP 2025.2). Primary manufacturing data was provided by manufacturers who are MCA members.

2.6. Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive internal review of the project-specific LCA models developed as well as the background data used. A full data quality assessment is documented in the background report.

Temporal coverage

Primary data is taken from the 2023 calendar year of continuous operation. These data were then used to calculate the weighted average production of MCA members. All secondary data were from Sphera's MLC 2025.2 databases and are representative of the years 2011 – 2025. For MDF, OSB, and PU flexible foam, the most recent LCI datasets are CORRIM 2011 and Europur 2013, specific to packaging applications. Alternative non-industry datasets were not used as proxies, as the environmental profiles of these materials are not expected to differ significantly in ways that would materially affect the study results.

Geographical coverage

Primary data for this study is based on site-specific data collected from MCA members' manufacturing facilities. Regionally specific datasets were used to represent energy consumption. Proxy datasets were used as needed for raw material inputs to address the lack of data for a specific material or a specific geographical region. These proxy datasets were chosen for their technological representativeness of the actual materials.

Technological coverage

Manufacturing data were collected directly from MCA members. To that end, data on material composition, manufacturing, and transport were provided as primary data by the MCA members. The raw material inputs were based on total production output, bill of materials, and recycled content composition. Waste, emissions, and energy use were based on measured and calculated data during the reference year.

2.7. Period under Review

This EPD intends to represent production in 2023.

2.8. Allocation

Multi-output allocation follows the requirements of ISO 14044, section 4.3.4.2 (ISO, 2006a; ISO, 2006b). When allocation becomes necessary during the data collection phase, the allocation rule most suitable for the respective processing step was applied. Energy output was allocated based on production mass.

3. Life Cycle Assessment Results

The included and excluded life cycle stages are summarized in Table 6.



Table 6. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCTION 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
EPD Type	x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

MND = Module not declared | x = Declared

3.1 Life Cycle Impact Assessment Results

Table 7 presents the cradle-to-gate LCIA results (modules A1-A3) for insulated metal panels, respectively, normalized to 100 m² of installed product. The reported GWP excludes contributions from land use change and biogenic CO₂. Contributions from upstream processes, including land use and land use change embedded in the LCA datasets are included in the reported total. Separate reporting of GWP-LULUC is not required by the governing PCR. Biogenic carbon flows, such as carbon stored in packaging materials, are reported separately under BCRK in module A3.

Abiotic depletion potential (fossil fuels) is calculated using the CML 2001 method. GWP 100 is calculated using IPCC AR6 factors, and all other LCIA categories are calculated using TRACI 2.2. The impact categories included in this EPD are considered sufficiently mature for inclusion in Type III environmental product declarations, while additional indicators continue to be developed. LCIA results are relative expressions of potential environmental impacts and do not predict actual impacts on category endpoints, exceedance of thresholds, or safety margins. Results presented in this EPD shall not be used as the sole basis for comparative assertions.

Table 7. North American Impact Assessment Results, Resource Use, Waste and Output Flows, and Carbon Emissions and Removals per 100 m² of insulated metal panels.

INDICATORS	UNITS	A1	A2	A3	TOTAL
Impact Categories					
Global Warming Potential (GWP 100), IPCC 2021	kg CO ₂ eq	3.74E+03	4.21E+02	2.25E+02	4.39E+03
Ozone Depletion Potential (ODP)	kg CFC 11 eq	1.65E-06	1.18E-10	6.65E-08	1.72E-06
Eutrophication Potential, Freshwater (EP _{freshwater})	kg P eq	2.78E-03	3.39E-04	5.86E-04	3.71E-03
Eutrophication Potential, Marine (EP _{marine})	kg N eq	3.58E+00	1.42E+00	2.38E-01	5.24E+00
Acidification Potential (AP)	kg SO ₂ eq	7.66E+00	1.57E+00	5.42E-01	9.77E+00

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Smog Formation Potential (SFP)	kg O ₃ eq	1.32E+02	3.61E+01	8.92E+00	1.77E+02
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP _{fossil})	MJ, LHV	5.38E+04	5.34E+03	4.27E+03	6.34E+04
Resource Use					
RPR _e : Renewable primary resources used as energy carrier	MJ	6.06E+03	2.22E+02	7.97E+01	6.37E+03
RPR _m : Renewable primary resources with energy content used as material	MJ	0.00E+00	0.00E+00	1.12E+03	1.12E+03
NRPR _e : Non-renewable primary resources used as energy carrier	MJ	4.56E+04	5.39E+03	3.58E+03	5.45E+04
NRPR _m : Non-renewable primary resources with energy content used as material	MJ	1.09E+04	0.00E+00	9.51E+02	1.18E+04
SM: Secondary materials	kg	3.90E+02	0.00E+00	2.58E+00	3.93E+02
RSF: Renewable secondary fuels	MJ	-	-	-	0.00E+00
NRSF: Non-renewable secondary fuels	MJ	-	-	-	0.00E+00
RE: Recovered energy	MJ	-	-	-	0.00E+00
FW: Use of net freshwater resources	m ³	1.48E+01	2.40E-01	8.42E-01	1.59E+01
Waste Categories and Output Flows					
HWD: Hazardous waste disposed (HWD)	kg	-	-	-	0.00E+00
NHWD: Non-hazardous waste disposed	kg	0.00E+00	0.00E+00	4.02E+01	4.02E+01
HLRW: High-level radioactive waste, conditioned, to final repository	kg	9.24E-04	2.19E-05	9.38E-05	1.04E-03
ILLRW: Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	9.54E-01	1.84E-02	8.03E-02	1.05E+00
CRU: Components for re-use	kg	-	-	-	0.00E+00
MFR: Materials for recycling	kg	0.00E+00	0.00E+00	8.65E+01	8.65E+01
MER: Materials for energy recovery	kg	0.00E+00	0.00E+00	1.94E+00	1.94E+00
EEE: Recovered electrical energy exported from the product system	MJ	0.00E+00	0.00E+00	2.07E+01	2.07E+01
EET: Recovered thermal energy exported from the product system	MJ	0.00E+00	0.00E+00	9.15E+00	9.15E+00
Carbon Emissions and Removals					
BCRP: Biogenic carbon removal from product	kg	-	-	-	0.00E+00
BCEP: Biogenic carbon emission from product	kg	-	-	-	0.00E+00
BCRK: Biogenic carbon removal from packaging	kg	0.00E+00	0.00E+00	1.31E+02	1.31E+02
BCEK: Biogenic carbon emission from packaging	kg	-	-	-	0.00E+00
BCEW: Biogenic carbon emission from combustion of renewable waste used in production	kg	-	-	-	0.00E+00
CCE: Calcination carbon emissions	kg	-	-	-	0.00E+00
CCR: Carbonation carbon removal	kg	-	-	-	0.00E+00



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According to ISO 14025,
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CWNR: Carbon emission from combustion of non-renewable waste used in production	kg	-	-	-	0.00E+00
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4. LCA Interpretation

Module contributions, as seen in Figure 4, show that A1 dominates all the impact categories, accounting for 85% of total GWP results, followed by A2 at 10% and A3 at 5%. This pattern is consistent across most impact categories, indicating that embodied carbon is primarily driven by material production rather than plant-level energy use or inbound logistics. For GWP, impacts are concentrated in key material inputs including steel-based inputs followed by polyurethane chemistry.

Similar contribution trends are observed across most other impact categories, where coated steel and foam precursor materials remain the dominant contributors. ODP is an exception, where the primary contributing inventory flow is driven by butyl sealant input, contributing 95%, rather than the dominant steel and foam inputs influencing other categories.

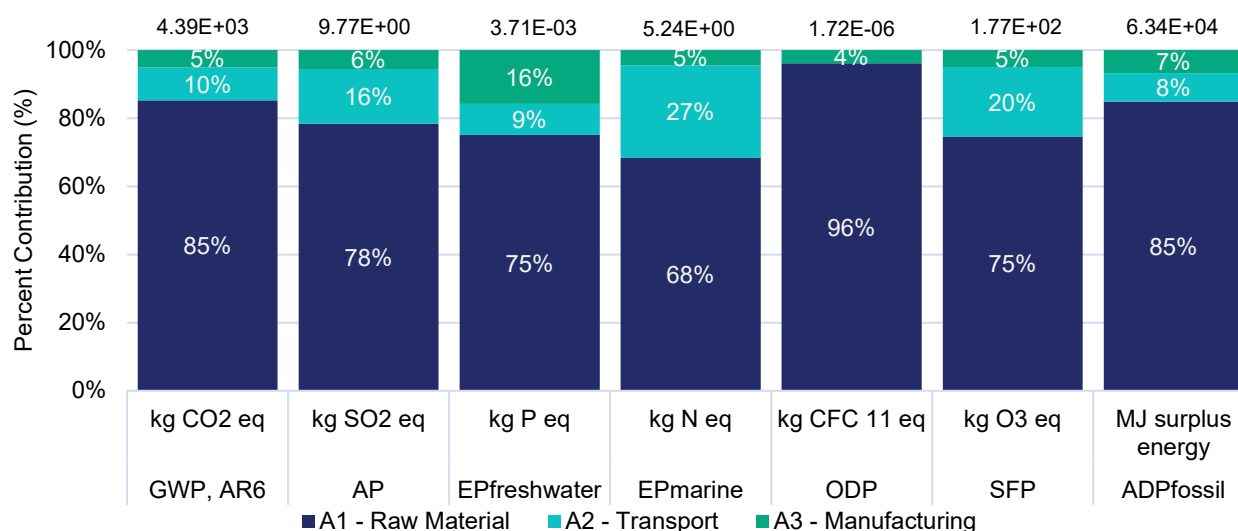


Figure 2. Contribution Analysis by module of insulated metal panels per 100 m² coverage (GWP100 results exclude biogenic CO₂).

5. Additional Environmental Information

5.1 Environment and Health During Manufacturing

The manufacturing process follows standard industry practices for worker health and environmental protection. Emissions and occupational exposures are managed in compliance with applicable health, safety, and environmental regulations. No substances required to be reported as hazardous are associated with the production of this product.





5.2 Extraordinary Effects

Fire

Steel claddings are non-combustible, and while extreme heat may damage coatings or finishes, the base materials remain largely intact and recyclable. Environmental impacts from fire are not included in the LCA.

Water

Claddings are corrosion-resistant and designed for exposure to weather. Extraordinary flooding or prolonged submersion is not included in the study, though temporary wetting during normal service life is assumed.

Mechanical Destruction

Claddings may be dented or deformed by accidental impacts or extreme loads. Such events are considered extraordinary and are excluded from the LCA, as the materials remain recoverable and recyclable.

5.3 Delayed Emissions

No delayed emissions are expected during the use phase of the product. The materials used are stable under normal service conditions and do not release VOCs or other substances over time.

5.4 Environmental Activities and Certifications

This EPD represents an industry average product manufactured by multiple companies. Environmental and health-related certifications may vary by manufacturer and fabricator.

The following certifications may apply to some of the IMPs covered by this EPD:

- ISO 14001 – Environmental Management Systems
- UL GREENGUARD / GREENGUARD Gold – Low-emitting materials for indoor use
- LEED v4.1 Material Ingredient or EPD Credits
- LEED v5 MRp2 (Quantify and Assess Embodied Carbon), MRc2 (Reduce Embodied Carbon), and MRc4 (Building Product Selection and Procurement)

Details about these certification programs are available on the certifying bodies' websites. To verify which certifications apply to a specific product or supplier, please contact the manufacturer or visit their website.

5.5 Further Information

More information can be found at www.metalconstruction.org





6. References

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According to ISO 14025,
EN 15804, and ISO 21930:2017

7. Contact Information

7.1 Study Commission



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7.2 LCA Practitioner



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