Declaration Owner
Kingspan Group
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https://www.kingspan.com/us/en-us/about-kingspan/kingspan-insulated-panels/quadcore.

Product
QuadCore - Insulated Metal Panels (2.5", 3", 4")
Manufactured in Langley, British Columbia, Canada

Functional Unit
The functional unit is 100 m^2 of building coverage area over a 75-year period

EPD Number and Period of Validity
SCS-EPD-08096
Date of Issue: July 22, 2022
EPD Valid: July 22, 2022 through July 21, 2027

Product Category Rule
PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018

PCR Guidance for Building-Related Products and Services Part B: Insulated Metal Panels, Metal Composite Panels, and Metal Cladding: Roof and Wall Panels, UL 10010–5. October 23, 2018.

Program Operator
SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
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Declaration Owner:	Kingspan Group
Address:	5202 272nd Street, Langley TWP, BC V4W 1S3, Canada
Declaration Number:	SCS-EPD-08096
Date of Issue:	July 22, 2022
Declaration Validity Period:	EPD Valid: July 22, 2022 through July 21, 2027
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Maggie Wildnauer, WAP Sustainability Consulting
LCA Software and LCI database:	GaBi - Version 10.6.0.110, CUP 2021.2
Product RSL:	30 years
Markets of Applicability:	North America
EPD Type:	Product Specific
EPD Scope:	Cradle-to-Grave
LCIA Method and Version:	IPCC AR5, TRACI 2.1, CML 2001-Jan 2016
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☐ external
LCA Reviewer:	Beth Cassese, SCS Global Services
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. December. 2018
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Insulated Metal Panels, Metal Composite Panels, and Metal Cladding: Roof and Wall Panels, UL 10010–5. October 23, 2018
Part B PCR Review conducted by:	Thomas Gloria (Chair), Industrial Ecology Consultants; Lindita Bushi, PhD; Bob Zebcik, PE
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☐ external
EPD Verifier:	Beth Cassese, SCS Global Services
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *Comparison of the environmental performance of insulated metal panels using EPD information shall be based on the product's use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under the referenced PCR.*

Full conformance with the PCR for insulated metal panels 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 Part B PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible.

Environmental declarations from different programs may not be comparable.

1. About Kingspan Group

Kingspan offers aesthetic flexibility with a vast range of insulated panel profiles supported by state-of-the-art specialty fabrications. Their commercial insulated metal roof and wall panel systems combine design flexibility, efficiency, and performance to create the ultimate building envelope solution. Their wide range of insulated metal wall panel systems meets the needs of a variety of market sectors. Their wall systems offer superior quality and high R-values, while providing a modern look.

2. Product

2.1 Product Description

The products covered in this report are the QuadCore 2.5", 3", and 4" panels within the KS Series manufactured at Kingspan's Langley, British Columbia, Canada facility. Insulated Metal Panels (IMPs) in their simplest form are rigid foam sandwiched between two sheets of coated metal. The panels are molded in a variety of styles and sizes depending on application. Steel panel facings create a vapor, air and moisture barrier and provide long-term thermal stability. The metal skins offer long-term durability and come in a multitude of colors and finishes. Kingspan's QuadCore IMPs utilize a hybrid insulation core with a closed microcell structure. The UNSPSC code for this product is 301415 and the CSI/CSC code is 07 42 13.19.

2.2 Application

Kingspan QuadCore IMPs are used in a variety of applications including commercial, industrial, institutional, and refrigerated buildings owing to the excellent thermal efficiency, ease of installation and overall structural integrity for exterior wall applications.

2.3 Technical Data

Property	Test Results (2.5",3",4")	Units	Test Method
Length	0.61-16.2 (2-53)	m (ft)	-
Width	0.61-1.07 (24-42)	m (in)	-
Thickness	63.5, 76.2, 101.6 (2.5, 3, 4)	mm (in)	-
Density	113 - 157 (7.1-9.8)	kg/m^3 (lbs/ft^3)	-
Tensile Strength	Panels tested for tensile bond strength of metal to foam	-	ASTM D1623
	Sample placed in an autoclave device and pressurized to 0.013 MPa at 100 °C for 2.5 hours	MPa	
U-value of assembly including interruptions to insulation	0.18-0.28	$W/(m^2K)$	ASTM C518 @ 75 F
R value of typical materials where continuous	3.52, 4.23, 5.64 20, 24, 32	m^2K/W (ft^2Fh/Btu)	ASTM C518 @ 75 F
Water Vapor Permeance	No uncontrolled water penetration at 97.65 kg/m^2 differential pressure	kg/m^2	ASTM E331
	Dynamic water pressure testing – no sign of water leakage at 73.24 kg/m^2	kg/m^2	AAMA 501.1

Products contained in this EPD meet the performance requirements listed below:

Structural - ASTM E-72 for walls. The maximum deflection criteria for the insulated panels are typically, L/180 for walls.

Thermal Transmittance - ASTM C-1363 at 75 degrees F mean test temperature per ASHRAE 90.1 requirements. A 40-degree F mean test temperature is commonly used for refrigerated buildings or to simulate heating of a commercial building in cold climate zones. Insulated metal panels are available with thermal resistance values generally ranging from R8 to R48.

Core Physical Properties – The hybrid polyisocyanurate core tests include:

- Density per ASTM D1622
- Shear strength per ASTM C273
- Tensile strength per ASTM D1623
- Compressive strength per ASTM D1621

The core is also tested for:
- Humidity aging per ASTM D 2126
- Heat aging per ASTM D 2126
- Cold aging per ASTM D 2126

The core properties of insulated metal panels vary slightly with the type of foam that each manufacturer uses. The most critical factor in panel production is formulating a foam system with the right balance of these properties that will ensure structural integrity and adhesion of the foam to the metal faces.

2.4 Delivery Status

Kingspan supplies IMPs in a variety of sizes and configurations customized to each project's requirements.

Wall panel configurations have a range as follows:
– Thickness: from 2.5 inches to 4 inches, depending on product.
– Width: from 24 inches to 42 inches, depending on product.
– Length: from 8 feet to 53 feet, depending on product.

Joint configurations: Double tongue and groove interlocking rainscreen joint; offset double tongue and groove with extended metal shelf for positive face fastening; mechanically closed single lock standing seam at the exterior side joint with interior side joint being a single tongue-and-groove interlock.

Facings: Material:
Galvalume/ Zincalume®
Gauge ranges:
22, 24- and 26-gauge coated steel

2.5 Material Composition

No substances required to be reported as hazardous are associated with the production of this product.

Material	Amount (kg/100 m²)	Percentage of Total Mass	Amount (kg/100 m²)	Percentage of Total Mass	Amount (kg/100 m²)	Percentage of Total Mass
Insulated Metal Panel – QuadCore	**2.5" IMP**	**2.5" IMP**	**3" IMP**	**3" IMP**	**4" IMP**	**4" IMP**
Steel	745.3	74.6 %	745.3	71.1 %	745.3	64.8 %
Hybrid Polyisocyanurate	154.4	15.5 %	185.3	17.7 %	246.0	21.4 %
Pentane or proprietary chemical	11.1	1.1 %	11.9	1.1%	15.0	1.3 %
Additives - proprietary chemicals	87.6	8.8 %	106.5	10.2 %	144.0	12.5 %
Total	**998.4**	**100%**	**1049.0**	**100%**	**1150.3**	**100%**

2.6 Manufacturing

The manufacturing process begins with the mining/processing of raw materials, which is a mixture composed mostly of steel, polyisocyanurate and some additives. The continuous process (see Figure 1) method is where metal facers (here referred to as external and internal steel sheets) are continuously formed while at the same time at another point on the continuous line, 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 panels are then trimmed and embossed following which the top and bottom edge details are profiled. The panels then go through a curing process and are then cut to standard or customized lengths. The panels are then cooled, stacked, and packaged for shipping.

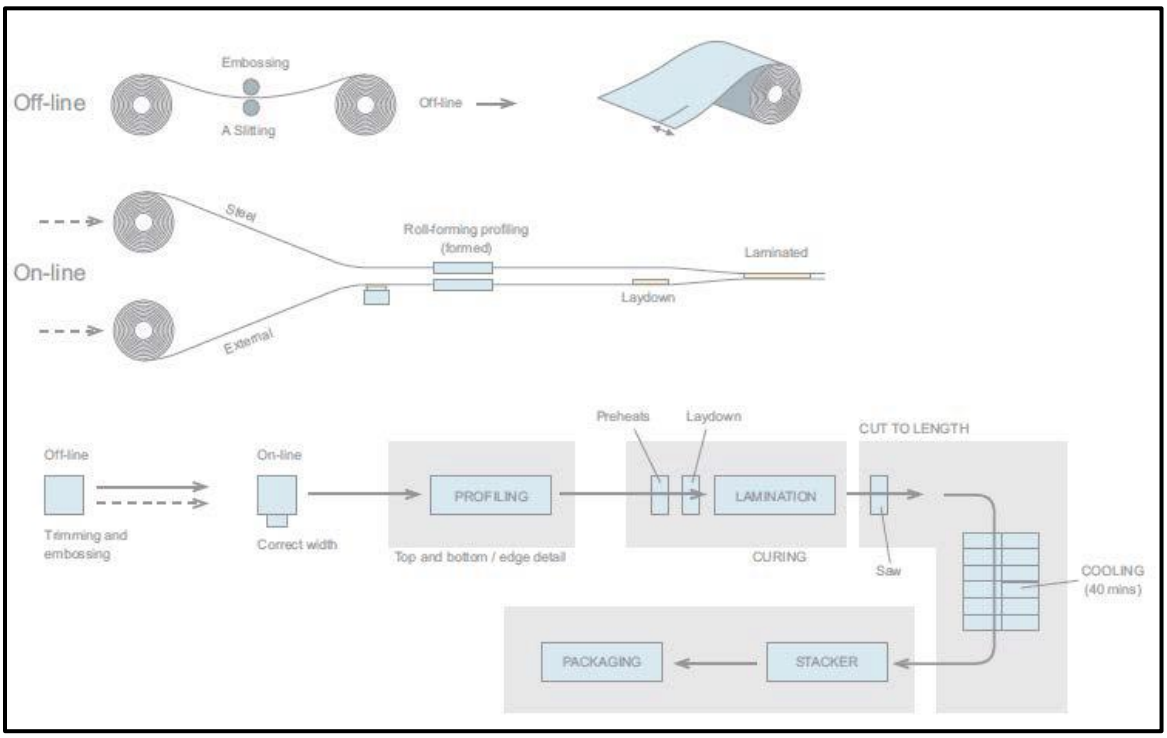

Figure 1: Schematic of continuous manufacturing process for insulated metal panels

2.7 Transportation

The product is delivered to the customer via truck depending on the location of the end-user. Transport to the installation site is assumed to be 554 km as per recommendation by the PCR (Part B) for all insulated metal panels applications.

2.8 Product Installation

The installation instructions require the use of white butyl caulk and some steel trim, clips, and fasteners for recommended installation. From the installation instructions, we understand that there is a forklift and panel cutting equipment that is used during installation as well. However, due to limited data availability on the amount of resources (here, electricity and diesel) used for these operations, quantities recommended by the PCR (Part B) have been used. Product waste rate is assumed to be 5% and all packaging is disposed of at the rates specified in UL Part A.

2.9 Packaging

Once the panels are manufactured, foam sheets are layered between insulated metal panels before the panels are stacked on oriented strand board (OSB) and expanded polystyrene underlayment and wrapped in polyethylene film.

Material	Amount (kg/100 m^2)	Percentage of Total Mass	Amount (kg/100 m^2)	Percentage of Total Mass	Amount (kg/100 m^2)	Percentage of Total Mass
Packaging	**2.5" IMP**	**2.5" IMP**	**3" IMP**	**3" IMP**	**4" IMP**	**4" IMP**
Oriented strand board	40.7	33.2 %	48.9	36.9 %	66.9	35.2 %
Polystyrene	80.2	65.5 %	82.2	61.9 %	121.0	63.6 %
Polyethylene film	1.48	1.21 %	1.48	1.12 %	2.20	1.16 %
Linear low-density polyethylene	0.04	0.03 %	0.05	0.04 %	0.06	0.03 %
Total Packaging	**122.4**	**100%**	**132.6**	**100%**	**190.2**	**100%**

2.10 Use Conditions

The panels are cleaned twice a year, manually, with a 1% sodium lauryl sulfate solution for wall applications. Cleaning frequency and material amount recommendations are taken from Part B of the PCR.

2.11 Reference Service Life

As no additional information on life expectancy was available, the default value of 30 years provided in the PCR was used for the RSL. To meet the ESL of 75 years, 1.5 replacements are required.

2.12 Re-Use Phase

No re-use of the panels is accounted for in the life cycle assessment. However, as part of Kingspan's strategic LIFECycle framework, we commit to keeping our insulated panels at the highest possible value through reuse, cycling, and incineration as the last option. We have proven through several successful projects around the globe that our panels can be disassembled and reinstalled in another location of the build or on a new project altogether. Kingspan is actively working with design professionals and contractors to incorporate this LIFECycle framework into future projects.

2.13 Disposal

All waste has been classified and modeled according to regional-specific legislation as required in Section 2.8.6 in Part A: Life Cycle Assessment Calculation rules and Report Requirements from UL Environment. It was conservatively assumed that the entire panel is sent to landfill.

However, as part of Kingspan's strategic LIFECycle framework to address waste to landfill we are piloting several circular take back schemes & re-use programs at the construction site level along with building end of life. Kingspan is seeking to support you in the transition toward the circular economy by disposing of waste streams from the construction site in the best practicable way. This is part of our Continuous improvement in finding the Best Practicable Environmental Option (BPEO) for all waste streams.

3. LCA: Calculation Rules

3.1 Functional Unit

The functional unit used in the study, as specified in the PCR, is coverage of 100 m^2 of panel surface over 75 years.

	Unit	2.5"	3"	4"
Functional Unit	m^2	100	100	100
Weight per Installation	kg / 100 m^2	998	1,049	1,150
Replacements Required	(RSL/ESL)-1	1.5	1.5	1.5
Weight per Functional Unit	kg / 100 m^2	2,496	2,623	2,876
Mass conversion factor to 1 kg, one installation	-	1.00E-03	9.53E-04	8.69E-04
Mass conversion factor to 1 kg, functional unit	-	4.01E-04	3.81E-04	3.48E-04

3.2 System Boundary

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The diagram below is a representation of the most significant contributions to the life cycle of the insulated metal panel products.

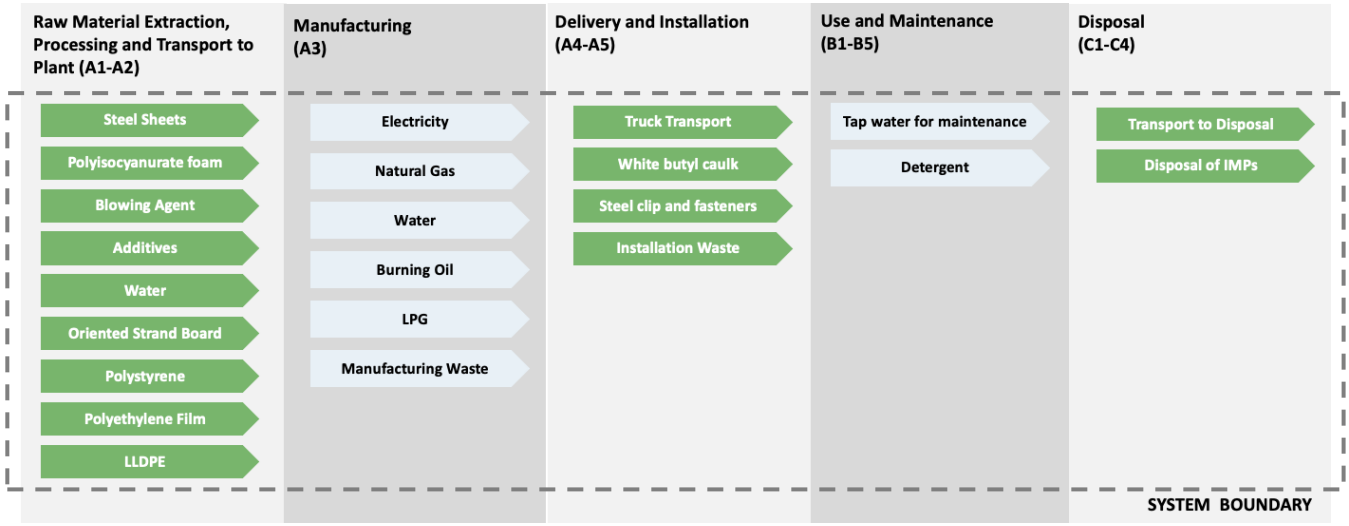

Figure 2: System Boundary

3.3 Units

All results are presented using SI units using three significant figures, as per PCR guidance.

3.4 Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. The primary data was collected as annual totals including all utility usage and production information. For the study, the usage information was divided by the production to create an energy and water use per square meter, then extrapolated to 100 square meters. Another assumption is that the installation tools are used enough times that the per square meter impacts are negligible.

It should also be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The PCR allows for the results for several inventory flows related to construction products to be reported as "other parameters". These are aggregated inventory flows and do not characterize any potential impact; results should be interpreted taking into account this limitation.

3.5 Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. 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 LCA.

3.6 Background Data

Primary data were provided by Kingspan Group for the Langley, British Columbia, Canada facility and from their steel sheet supplier. The sources of secondary LCI data are GaBi - Version 10.6.0.110, CUP 2021.2

Component	Material Description	Material Dataset	Data Source	Publication Date
Product				
Primary Components				
Internal and External Sheet	Steel Sheets	Cold rolled metallic coated, painted steel coil	SDI	2019
Foam	Isocyanate (MDI)	MDI	Sphera	2018
Auxiliary Components				
Foam	Blowing agent	Pentane	PlasticsEurope	2005
Foam	Chemical intermediate	Aromatic Polyester Polyol (APP) production mix	PU Europe	2014
Foam	Chemical intermediate	Diethylene glycol by product ethylene glycol from ethene and oxygen via EO	Sphera	2020
Packaging				
Spacer	Oriented Strand Board	Oriented strandboard (OSB)	Corrim	2011
Underlayment	Polystyrene	Expanded polystyrene foam (PS 25) (A1-A3)	Sphera	2020
Logo Endcap	Polyethylene Film	Polyethylene film (LDPE/PE-LD)	Sphera	2020
Stretch wrap	Linear low-density polyethylene	Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD)	Sphera	2020
Electricity/Heat				
Thermal Energy	Thermal energy from natural gas	Thermal energy from natural gas	Sphera	2017
Electricity	Grid electricity	Electricity grid mix (adapted for Ontario)	Sphera	2017
LPG	Liquefied Petroleum Gas	Liquefied Petroleum Gas (LPG) (70% propane; 30% butane)	Sphera	2017
Water	Process water	Process water from ground water	Sphera	2020
Transportation				
Transport of Raw Materials	Truck	Truck-trailer, Euro 0 - 6 mix, 34 - 40t gross weight / 27t payload capacity	Sphera	2020
Transport of Raw Materials	Train	Rail transport cargo - Diesel, average train, gross tonne weight 1,000t / 726t payload capacity	Sphera	2020
Transport of Raw Materials	Ship	Container ship, 5,000 to 200,000 dwt payload capacity, ocean going	Sphera	2020

3.7 Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	Primary data were provided by Kingspan associates and represent calendar year 2020. Using 2020 data meets the PCR requirement that manufacturer specific data be within the last 5 years. Time coverage of this data is considered good. Data necessary to model cradle-to-gate unit processes were sourced from GaBi LCI datasets. Time coverage of the GaBi datasets varies from approximately 2010 to present. All datasets rely on at least one 1-year average data. Overall time coverage of the datasets is considered good and meets the requirement of the PCR that all data be updated within a 10-year period, with a few exceptions which have minimal contribution to overall results. The specific time coverage of secondary datasets can be referenced in the dataset references table in the LCA report.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The geographical scope of the manufacturing portion of the life cycle is Langley, British Columbia, Canada. This LCA uses country specific energy datasets that take into account country specific energy and transportation mixes, and the province-specific electricity grid mix. Overall, the geographic coverage of primary data is considered good.
Technology Coverage: Specific technology or technology mix	Primary data provided by Kingspan are specific to the technology that the company uses in manufacturing their product. It is site specific and considered of good quality. It is worth noting that the energy and water used in manufacturing the product 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. Data necessary to model cradle-to-gate unit processes were sourced from GaBi LCI datasets or, in the case of steel sheets, from the supplier which utilized GaBi LCI data to generate their inventory. Technological coverage of the datasets is considered good relative to the actual supply chain. While further life cycle data from suppliers would improve technological coverage, the use of lower quality generic datasets does meet the goal of this EPD.
Precision: Measure of the variability of the data values for each data expressed	Process-specific data and secondary data for all upstream processes have been averaged over a year, thus reducing the variability in terms of the precision of the data.
Completeness: Percentage of flow that is measured or estimated	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 were 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.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data collected for the process are considered typical or representative for the specific site and temporal scope. Improvements can be made through the modification of raw material datasets to incorporate more regional specificity, both in terms of energy and technology. However, the data was considered appropriate in relation to the goal, scope and budget of the project.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data of similar quality and age are taken from GaBi LCI database. All life cycle stages were evaluated with equal importance.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	This LCA is reproducible by other LCA practitioners. All the data, assumption, estimates and value choices have been clearly stated in the EPD and background LCA report.
Sources of the Data: Description of all primary and secondary data sources	Primary data was used for all manufacturing processes. 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 the GaBi database.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to the product raw materials and packaging is low. Since actual primary data for each of the manufacturing steps were not available, representative datasets were used. The datasets chosen have been verified by the provider (Sphera – provider of GaBi software and database) and are as close as possible to the regional and temporal scope of this project.

3.7 Period under review

This EPD is based on data from 2020.

3.9 Allocation

General principles of allocation were based on ISO 14040/44. There are no products other than insulated metal panels that are produced as part of the manufacturing processes studied in the LCA. Since there are no co-products, no allocation based on co-products is required. To derive a per unit value for manufacturing inputs such as electricity, natural gas and water, allocation based on total production in square meters was adopted. Discussions with Kingspan staff divulged this was a more representative way than via mass to allocate the manufacturing inputs based on the manufacturing processes used and the types of products created. 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.

3.10 Comparability

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: Scenarios and Additional Technical Information

Delivery and Installation stage (A4 - A5)

Table 1: *Transport to building site (A4) – per 100 m^2*

Name	Value	Unit
Fuel type	Diesel	-
Liters of fuel	39.1	l/100km
Vehicle type	Heavy duty diesel truck/ 45,000 lb payload	-
Transport distance	554	km
Capacity utilization, mass	64-84	%
Weight of products transported	998 – 1,150	kg/100 m^2
Gross density of products	113 – 157	kg/m^3
Capacity utilization, volume	100	%

Table 2: *Installation into the building (A5) – per 100 m^2*

Name	2.5" IMP	3" IMP	4" IMP	Unit
White butyl caulk	15.3	15.3	15.3	kg/100 m^2
Steel trims and fasteners	3.57	3.57	3.57	kg/100 m^2
Electricity	2	2	2	kWh/100 m^2
Diesel	3.15	3.15	3.15	kg/100 m^2
Product Wastage	5 49.9	5 52.5	5 57.5	% kg
Waste materials at the construction site before waste processing, generated by product installation	172.3	185.1	246.7	kg/100 m^2
Packaging waste, OSB	40.7	48.9	66.9	kg/100 m^2
Packaging waste, plastic film, polystyrene, stretch wrap	81.7	83.7	123.2	kg/100 m^2
Output materials resulting from on-site waste processing	172.3	185.1	246.7	kg
Landfill	146.2	158.4	208.2	kg
Incineration	13.9	14.2	21.0	kg
Recycling	12.3	12.6	18.5	kg
Biogenic carbon contained in packaging	70.8	85.2	117	kg CO_2-eq
Direct emissions to ambient air, soil, and water	0	0	0	kg
VOC emissions	N/A	N/A	N/A	µg/m^3

Use stage (B1)

The RSL only applies to the in-use conditions specified in the below table. As the default RSL provided by the PCR was used, it is understood that the in-use conditions align with accepted industry standard.

Table 3: *Reference Service Life*

Name	Value	Unit
RSL	30	years
Declared product properties and finishes, etc.	See Technical Data	-
Design application parameters	Installation per recommendation by manufacturer	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Accepted industry standard	-
Outdoor environment	Accepted industry standard	-
Use conditions	Normal building operating conditions	-

Maintenance stage (B2)

Table 4: *Maintenance per 100 m^2 (B2)*

Name	Valiue	Unit
Maintenance process information	Use phase parameters as recommended by the UL PCR Part B	
Cleaning	150	Cycles/ RSL and Cycles/ ESL
Detergent	0.00505	kg/ 100 m^2/ cleaning cycle
Net freshwater consumption specified by water source and fate	0.495 tap water, evaporated	kg/ 100 m^2/ cleaning cycle
Further assumptions for scenario development	500 ml of 1% (v/v) sodium lauryl sulfate solution, twice per year	

Repair (B3)

Insulated Metal Panels typically do not typically require repair during the service life of the building.

Replacement (B4)

Table 5: *Replacement (B4)*

Name	Value	Unit
Cleaning	150	Cycles/ RSL and Cycles/ ESL
Reference Service Life	30	Years
Replacement cycle	1.5	(ESL/RSL) – 1
Energy input – Electricity	2	kWh / replacement
Energy input – Diesel	3.15	kg / replacement
Ancillary materials - White butyl caulk	15.3	kg / replacement
Ancillary materials - Steel trims and fasteners	3.57	kg / replacement

Refurbishment stage (B5)

Insulated Metal Panels typically do not typically require refurbishment during the service life of the building.

Building operation stage (B6 – B7)

No energy or water are required during the building operation stage.

Disposal stage (C1 - C4)

Name		2.5" IMP	3" IMP	4" IMP	Unit
Assumptions for scenario development		Product is manually removed			
Collection process	Collected separately	0	0	0	kg
	Collected with mixed construction waste	998	1,049	1,150	kg
Recovery	Reuse	0	0	0	kg
	Recycling	0	0	0	kg
	Landfill	998	1,049	1,150	kg
	Incineration	0	0	0	kg
	Incineration with energy recovery	0	0	0	kg
	Energy conversion efficiency rate	0	0	0	%
Disposal	Product or material for final deposition	998	1,049	1,150	kg
Removals of biogenic carbon (excluding packaging)		0	0	0	kg CO2

Module D

As the cut-off approach was used for the recovery of materials and energy, no environmental credits or burdens fall into this module and therefore there is no relevant scenario information to report.

5. LCA: Results

Product			Construction Process		Use							End-of-life				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 extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks

The six impact categories under IPCC AR5 and TRACI 2.1 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

2.5" Quadcore Insulated Metal Panel

CML Life Cycle Impact Assessment (LCIA) results for the 2.5" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Global Warming Potential	kg CO_2 eq.	3.59E+03	4.26E+01	3.07E+02	-	2.76E+01	-	5.98E+03	-	-	3.14E+00	-	4.31E+01	-
Depletion Potential of the Stratospheric Ozone Layer	kg CFC-11 eq.	4.73E-07	8.48E-15	2.40E-08	-	3.64E-14	-	7.45E-07	-	-	6.28E-16	-	1.49E-13	-
Acidification Potential of Land and Water	kg SO_2 eq.	8.12E+00	1.49E-01	6.38E-01	-	3.35E-02	-	1.36E+01	-	-	1.14E-02	-	1.74E-01	-
Eutrophication Potential	kg PO_4^{3-} eq.	9.52E-01	4.01E-02	1.81E-01	-	5.39E-03	-	1.80E+00	-	-	3.07E-03	-	2.18E-02	-
Formation Potential of Tropospheric Ozone	kg C_2H_4 eq.	2.14E+00	-5.77E-02	1.50E-01	-	1.29E-02	-	3.35E+00	-	-	-4.93E-03	-	1.67E-03	-
Abiotic Depletion Potential for Non-Fossil Resources (Elements)	kg Sb eq.	1.69E-02	1.30E-05	8.54E-04	-	1.55E-05	-	2.67E-02	-	-	9.63E-07	-	1.17E-05	-
Abiotic Depletion Potential for Fossil Resources (Fossil Fuels)	MJ eq.	4.60E+04	5.02E+02	3.09E+03	-	3.21E+02	-	7.52E+04	-	-	3.72E+01	-	5.18E+02	-

IPCC AR5 + TRACI Life Cycle Impact Assessment (LCIA) results for the 2.5" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Acidification Potential	kg SO_2 eq.	8.92E+00	2.06E-01	9.33E-01	-	3.91E-02	-	1.54E+01	-	-	1.58E-02	-	1.91E-01	-
Eutrophication Potential	kg N eq.	6.36E-01	1.94E-02	1.34E-01	-	3.24E-03	-	1.20E+00	-	-	1.47E-03	-	1.06E-02	-
Global Warming Potential (IPCC, 100 year)	kg CO_2 eq.	3.69E+03	4.32E+01	3.27E+02	-	2.89E+01	-	6.16E+03	-	-	3.19E+00	-	4.43E+01	-
Global Warming Potential (TRACI 2.1, 100 year)	kg CO_2 eq.	3.65E+03	4.27E+01	2.93E+02	-	2.76E+01	-	6.04E+03	-	-	3.12E+00	-	4.37E+01	-
Ozone Depletion Potential	kg CFC-11 eq.	2.78E-07	8.48E-15	1.43E-08	-	3.64E-14	-	4.38E-07	-	-	6.28E-16	-	1.49E-13	-
Depletion of Fossil Fuel Resources	MJ eq.	5.91E+03	7.96E+01	4.05E+02	-	9.64E+01	-	9.73E+03	-	-	5.90E+00	-	8.71E+01	-
Smog Formation Potential	kg O_3 eq.	1.53E+02	4.75E+00	1.41E+01	-	9.29E-01	-	2.64E+02	-	-	3.63E-01	-	3.39E+00	-

Carbon uptake and emission results for the 2.5" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Biogenic Carbon Removal from Product	kg CO_2	7.33E-01	-	3.67E-02	-	-	-	1.16E+00	-	-	-	-	-	-
Biogenic Carbon Emission from Product	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogenic Carbon Removal from Packaging	kg CO_2	7.08E+01	-	3.54E+00	-	-	-	1.12E+02	-	-	-	-	-	-
Biogenic Carbon Emission from Packaging	kg CO_2	-	-	1.36E+01	-	-	-	2.03E+01	-	-	-	-	-	-
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcination Carbon Emissions	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonation Carbon Removals	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-

Resource use and waste flows for the 2.5" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ eq.	4.53E+03	2.48E+01	2.58E+02	-	1.62E+01	-	7.30E+03	-	-	1.83E+00	-	5.69E+01	-
Use of renewable primary energy resources used as raw materials	MJ eq.	5.80E+02	-	2.90E+01	-	-	-	9.13E+02	-	-	-	-	-	-
Total use of renewable primary energy resources	MJ eq.	5.11E+03	2.48E+01	2.87E+02	-	1.62E+01	-	8.22E+03	-	-	1.83E+00	-	5.69E+01	-
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ eq.	4.99E+04	6.01E+02	3.37E+03	-	7.14E+02	-	8.18E+04	-	-	4.45E+01	-	6.85E+02	-
Use of non-renewable primary energy resources used as raw materials	MJ eq.	1.07E+04	-	5.36E+02	-	0.00E+00	-	1.69E+04	-	-	-	-	-	-
Total use of non-renewable primary energy resources	MJ eq.	6.06E+04	6.01E+02	3.90E+03	-	7.14E+02	-	9.87E+04	-	-	4.45E+01	-	6.85E+02	-
Use of secondary materials	kg	7.29E+01	-	3.64E+00	-	-	-	1.15E+02	-	-	-	-	-	-
Use of renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Recovered Energy	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Fresh Water Use	m^3	1.68E+02	1.06E-01	8.58E+00	-	9.01E-01	-	2.65E+02	-	-	7.84E-03	-	9.40E-02	-
Hazardous waste	kg	3.78E-03	5.02E-08	1.79E-03	-	5.62E-08	-	8.36E-03	-	-	3.72E-09	-	6.47E-08	-
Non-hazardous waste	kg	4.13E+02	5.53E-02	1.57E+02	-	4.58E-01	-	2.38E+03	-	-	4.09E-03	-	1.02E+03	-
High-level Radioactive waste	kg	6.95E-04	2.03E-06	4.11E-05	-	9.11E-06	-	1.12E-03	-	-	1.50E-07	-	6.60E-06	-
Intermediate and low-level Radioactive waste	kg	5.85E-01	1.71E-03	3.44E-02	-	7.62E-03	-	9.40E-01	-	-	1.26E-04	-	5.70E-03	-
Components for re-use	kg	-	-	-	-	-	-	0.00E+00	-	-	-	-	-	-
Materials for recycling	kg	1.93E+02	-	2.19E+01	-	-	-	3.23E+02	-	-	-	-	-	-
Materials for energy recovery	kg	-	-	1.39E+01	-	-	-	2.08E+01	-	-	-	-	-	-
Exported electrical energy	MJ eq.	-	-	8.74E+01	-	-	-	1.31E+02	-	-	-	-	-	-
Exported thermal energy	MJ eq.	-	-	3.60E+01	-	-	-	5.40E+01	-	-	-	-	-	-

3" Quadcore Insulated Metal Panel

CML Life Cycle Impact Assessment (LCIA) results for the 3" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Global Warming Potential	kg CO_2 eq.	3.80E+03	4.93E+01	3.28E+02	-	2.90E+01	-	6.33E+03	-	-	3.30E+00	-	4.53E+01	-
Depletion Potential of the Stratospheric Ozone Layer	kg CFC-11 eq.	5.81E-07	9.82E-15	2.94E-08	-	3.82E-14	-	9.16E-07	-	-	6.59E-16	-	1.57E-13	-
Acidification Potential of Land and Water	kg SO_2 eq.	8.48E+00	1.79E-01	6.71E-01	-	3.52E-02	-	1.43E+01	-	-	1.20E-02	-	1.83E-01	-
Eutrophication Potential	kg PO_4^{3-} eq.	1.02E+00	4.80E-02	2.02E-01	-	5.65E-03	-	1.94E+00	-	-	3.22E-03	-	2.29E-02	-
Formation Potential of Tropospheric Ozone	kg C_2H_4 eq.	2.22E+00	-6.96E-02	1.59E-01	-	1.36E-02	-	3.46E+00	-	-	-5.18E-03	-	1.75E-03	-
Abiotic Depletion Potential for Non-Fossil Resources (Elements)	kg Sb eq.	1.70E-02	1.51E-05	8.58E-04	-	1.63E-05	-	2.68E-02	-	-	1.01E-06	-	1.23E-05	-
Abiotic Depletion Potential for Fossil Resources (Fossil Fuels)	MJ eq.	4.91E+04	5.81E+02	3.25E+03	-	3.37E+02	-	8.02E+04	-	-	3.90E+01	-	5.44E+02	-

TRACI Life Cycle Impact Assessment (LCIA) results for the 3" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Acidification Potential	kg SO_2 eq.	9.35E+00	2.47E-01	1.01E+00	-	4.11E-02	-	1.62E+01	-	-	1.65E-02	-	2.00E-01	-
Eutrophication Potential	kg N eq.	6.88E-01	2.30E-02	1.52E-01	-	3.41E-03	-	1.31E+00	-	-	1.54E-03	-	1.11E-02	-
Global Warming Potential (IPCC, 100 year)	kg CO_2 eq.	3.90E+03	5.01E+01	3.52E+02	-	3.03E+01	-	6.53E+03	-	-	3.35E+00	-	4.65E+01	-
Global Warming Potential (TRACI 2.1, 100 year)	kg CO_2 eq.	3.86E+03	4.94E+01	3.11E+02	-	2.90E+01	-	6.41E+03	-	-	3.28E+00	-	4.58E+01	-
Ozone Depletion Potential	kg CFC-11 eq.	3.42E-07	9.82E-15	1.75E-08	-	3.82E-14	-	5.40E-07	-	-	6.59E-16	-	1.57E-13	-
Depletion of Fossil Fuel Resources	MJ eq.	6.55E+03	9.22E+01	4.39E+02	-	1.01E+02	-	1.08E+04	-	-	6.19E+00	-	9.14E+01	-
Smog Formation Potential	kg O_3 eq.	1.62E+02	5.70E+00	1.47E+01	-	9.75E-01	-	2.79E+02	-	-	3.81E-01	-	3.56E+00	-

Carbon uptake and emission results for the 3" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Biogenic Carbon Removal from Product	kg CO_2	8.80E-01	-	4.40E-02	-	-	-	1.39E+00	-	-	-	-	-	-
Biogenic Carbon Emission from Product	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogenic Carbon Removal from Packaging	kg CO_2	8.52E+01	-	4.26E+00	-	-	-	1.34E+02	-	-	-	-	-	-
Biogenic Carbon Emission from Packaging	kg CO_2	-	-	1.63E+01	-	-	-	2.45E+01	-	-	-	-	-	-
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcination Carbon Emissions	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonation Carbon Removals	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-

Resource use and waste flows for the 3" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ eq.	4.69E+03	2.87E+01	2.67E+02	-	1.70E+01	-	7.58E+03	-	-	1.93E+00	-	5.97E+01	-
Use of renewable primary energy resources used as raw materials	MJ eq.	6.97E+02	-	3.49E+01	-	-	-	1.10E+03	-	-	-	-	-	-
Total use of renewable primary energy resources	MJ eq.	5.39E+03	2.87E+01	3.02E+02	-	1.70E+01	-	8.68E+03	-	-	1.93E+00	-	5.97E+01	-
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ eq.	5.33E+04	6.96E+02	3.55E+03	-	7.49E+02	-	8.75E+04	-	-	4.67E+01	-	7.19E+02	-
Use of non-renewable primary energy resources used as raw materials	MJ eq.	1.23E+04	-	6.13E+02	-	-	-	1.93E+04	-	-	-	-	-	-
Total use of non-renewable primary energy resources	MJ eq.	6.55E+04	6.96E+02	4.17E+03	-	7.49E+02	-	1.07E+05	-	-	4.67E+01	-	7.19E+02	-
Use of secondary materials	kg	7.29E+01	-	3.64E+00	-	-	-	1.15E+02	-	-	-	-	-	-
Use of renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Recovered Energy	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Fresh Water Use	m^3	1.69E+02	1.23E-01	8.66E+00	-	9.46E-01	-	2.67E+02	-	-	8.22E-03	-	9.87E-02	-
Hazardous waste	kg	4.60E-03	5.82E-08	1.84E-03	-	5.90E-08	-	9.66E-03	-	-	3.90E-09	-	6.79E-08	-
Non-hazardous waste	kg	4.17E+02	6.40E-02	1.66E+02	-	4.81E-01	-	2.48E+03	-	-	4.29E-03	-	1.07E+03	-
High-level Radioactive waste	kg	7.78E-04	2.34E-06	4.53E-05	-	9.56E-06	-	1.25E-03	-	-	1.57E-07	-	6.93E-06	-
Intermediate and low-level Radioactive waste	kg	6.53E-01	1.97E-03	3.79E-02	-	8.00E-03	-	1.05E+00	-	-	1.33E-04	-	5.98E-03	-
Components for re-use	kg	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	1.93E+02	-	2.22E+01	-	-	-	3.23E+02	-	-	-	-	-	-
Materials for energy recovery	kg	-	-	1.42E+01	-	-	-	2.13E+01	-	-	-	-	-	-
Exported electrical energy	MJ eq.	-	-	9.19E+01	-	-	-	1.38E+02	-	-	-	-	-	-
Exported thermal energy	MJ eq.	-	-	3.80E+01	-	-	-	5.70E+01	-	-	-	-	-	-

4" Quadcore Insulated Metal Panel

CML Life Cycle Impact Assessment (LCIA) results for the 4" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Global Warming Potential	kg CO_2 eq.	4.30E+03	6.50E+01	3.93E+02	-	3.18E+01	-	7.22E+03	-	-	3.61E+00	-	4.96E+01	-
Depletion Potential of the Stratospheric Ozone Layer	kg CFC-11 eq.	8.20E-07	1.29E-14	4.13E-08	-	4.18E-14	-	1.29E-06	-	-	7.22E-16	-	1.72E-13	-
Acidification Potential of Land and Water	kg SO_2 eq.	9.34E+00	2.46E-01	7.53E-01	-	3.85E-02	-	1.58E+01	-	-	1.31E-02	-	2.00E-01	-
Eutrophication Potential	kg PO_4^{3-} eq.	1.16E+00	6.61E-02	2.56E-01	-	6.19E-03	-	2.27E+00	-	-	3.52E-03	-	2.50E-02	-
Formation Potential of Tropospheric Ozone	kg C_2H_4 eq.	2.93E+00	-9.66E-02	2.05E-01	-	1.49E-02	-	4.56E+00	-	-	-5.67E-03	-	1.92E-03	-
Abiotic Depletion Potential for Non-Fossil Resources (Elements)	kg Sb eq.	1.71E-02	1.99E-05	8.68E-04	-	1.78E-05	-	2.71E-02	-	-	1.11E-06	-	1.34E-05	-
Abiotic Depletion Potential for Fossil Resources (Fossil Fuels)	MJ eq.	5.83E+04	7.67E+02	3.75E+03	-	3.69E+02	-	9.52E+04	-	-	4.27E+01	-	5.95E+02	-

TRACI Life Cycle Impact Assessment (LCIA) results for the 4" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Acidification Potential	kg SO_2 eq.	1.04E+01	3.40E-01	1.20E+00	-	4.50E-02	-	1.82E+01	-	-	1.81E-02	-	2.19E-01	-
Eutrophication Potential	kg N eq.	7.97E-01	3.12E-02	1.98E-01	-	3.73E-03	-	1.56E+00	-	-	1.69E-03	-	1.22E-02	-
Global Warming Potential (GWP, 100 year)	kg CO_2 eq.	4.42E+03	6.60E+01	4.25E+02	-	3.32E+01	-	7.46E+03	-	-	3.66E+00	-	5.09E+01	-
Global Warming Potential (TRACI 2.1, 100 year)	kg CO_2 eq.	4.39E+03	6.52E+01	3.71E+02	-	3.17E+01	-	7.32E+03	-	-	3.59E+00	-	5.02E+01	-
Ozone Depletion Potential	kg CFC-11 eq.	4.50E-07	1.29E-14	2.29E-08	-	4.18E-14	-	7.10E-07	-	-	7.22E-16	-	1.72E-13	-
Depletion of Fossil Fuel Resources	MJ eq.	8.27E+03	1.22E+02	5.32E+02	-	1.11E+02	-	1.36E+04	-	-	6.78E+00	-	1.00E+02	-
Smog Formation Potential	kg O_3 eq.	1.84E+02	7.86E+00	1.63E+01	-	1.07E+00	-	3.19E+02	-	-	4.17E-01	-	3.89E+00	-

Carbon uptake and emission results for the 4" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Impact Category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Biogenic Carbon Removal from Product	kg CO_2	1.17E+00	-	5.87E-02	-	-	-	1.85E+00	-	-	-	-	-	-
Biogenic Carbon Emission from Product	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogenic Carbon Removal from Packaging	kg CO_2	1.17E+02	-	5.83E+00	-	-	-	1.84E+02	-	-	-	-	-	-
Biogenic Carbon Emission from Packaging	kg CO_2	-	-	2.23E+01	-	-	-	3.34E+01	-	-	-	-	-	-
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcination Carbon Emissions	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonation Carbon Removals	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO_2	-	-	-	-	-	-	-	-	-	-	-	-	-

Resource use and waste flows for the 4" QuadCore insulated metal panel product over 75 years. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating value.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ eq.	5.07E+03	3.78E+01	2.90E+02	-	1.86E+01	-	8.20E+03	-	-	2.11E+00	-	6.54E+01	-
Use of renewable primary energy resources used as raw materials	MJ eq.	9.53E+02	0.00E+00	4.77E+01	-	0.00E+00	-	1.50E+03	-	-	-	-	-	-
Total use of renewable primary energy resources	MJ eq.	6.03E+03	3.78E+01	3.38E+02	-	1.86E+01	-	9.70E+03	-	-	2.11E+00	-	6.54E+01	-
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ eq.	6.18E+04	9.18E+02	4.03E+03	-	8.20E+02	-	1.01E+05	-	-	5.11E+01	-	7.87E+02	-
Use of non-renewable primary energy resources used as raw materials	MJ eq.	1.68E+04	-	8.39E+02	-	-	-	2.64E+04	-	-	-	-	-	-
Total use of non-renewable primary energy resources	MJ eq.	7.86E+04	9.18E+02	4.87E+03	-	8.20E+02	-	1.28E+05	-	-	5.11E+01	-	7.87E+02	-
Use of secondary materials	kg	7.29E+01	-	3.64E+00	-	-	-	1.15E+02	-	-	-	-	-	-
Use of renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Recovered Energy	MJ eq.	-	-	-	-	-	-	-	-	-	-	-	-	-
Fresh Water Use	m^3	1.73E+02	1.62E-01	8.87E+00	-	1.04E+00	-	2.73E+02	-	-	9.01E-03	-	1.08E-01	-
Hazardous waste	kg	5.95E-03	7.67E-08	1.90E-03	-	6.46E-08	-	1.18E-02	-	-	4.27E-09	-	7.44E-08	-
Non-hazardous waste	kg	4.26E+02	8.44E-02	2.12E+02	-	5.26E-01	-	2.71E+03	-	-	4.70E-03	-	1.17E+03	-
High-level Radioactive waste	kg	9.56E-04	3.09E-06	5.48E-05	-	1.05E-05	-	1.53E-03	-	-	1.72E-07	-	7.59E-06	-
Intermediate and low-level Radioactive waste	kg	8.05E-01	2.60E-03	4.60E-02	-	8.76E-03	-	1.29E+00	-	-	1.45E-04	-	6.55E-03	-
Components for re-use	kg	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	1.93E+02	-	2.82E+01	-	-	-	3.32E+02	-	-	-	-	-	-
Materials for energy recovery	kg	-	-	2.10E+01	-	-	-	3.14E+01	-	-	-	-	-	-
Exported electrical energy	MJ eq.	-	-	1.34E+02	-	-	-	2.00E+02	-	-	-	-	-	-
Exported thermal energy	MJ eq.	-	-	5.52E+01	-	-	-	8.28E+01	-	-	-	-	-	-

6. LCA: Interpretation

Overall, for Kingspan's QuadCore insulated metal panel products, the majority of impacts are aggregated in the A1-A3 phase of the life cycle of the product. A1-A3 includes raw material sourcing, transportation, and manufacturing. The largest contributors within raw material sourcing (A1) are steel and isocyanate. Various additives make up the rest of A1 impacts. Within manufacturing (A3), the largest contributor to impact is electricity while the second largest contributor is thermal energy from natural gas and LPG.

Kingspan should focus on sourcing steel with higher recycled contents, as well as from suppliers who utilize renewable energy sources. Within isocyanate, Kingspan should explore use of recycled materials where possible, or alternative materials, as well as upstream sourcing of renewable energy.

7. Additional Environmental Information

7.1 Environment and Health during Manufacture

Kingspan has established Environmental, Health and Safety programs to ensure all federal, state, and local regulations are met or exceeded.

7.2 Environment and Health during Installation

Personnel working with panel cutting equipment should always wear respiratory and eye protection as per standard safety measure. All Kingspan Quadcore panels are certified by UL Greenguard for low VOC[1] and Cradle to Cradle Material Health Silver[2].

7.3 Environmental Activities and Certifications

At Kingspan, we are committed to operating a sustainable business that delivers sustainable products and solutions. With this in mind, we have pledged to continually advance and hone sustainable business practice across seven key areas:

- Energy and Carbon
- Waste and Water
- Supply Chain
- Product Innovation
- Product Lifecycle
- Employees
- Stakeholders and Community

Through Planet Passionate, we're playing our part by driving energy and carbon out of our business operations and supply chain, as well as increasing our recycling of rainwater and waste, while also accelerating our participation in the circular economy. To learn more please visit: https://www.kingspan.com/group/commitments/planet-passionate.

7.4 Further Information

For further information on the product, please visit: https://www.kingspan.com/us/en-us/about-kingspan/kingspan-insulated-panels/quadcore.

1 https://ks-kentico-prod-cdn-endpoint.azureedge.net/netxstoreviews/assetOriginal/87903_Greenguard_Gold_Certificate_NA.pdf
2 https://www.kingspan.com/us/en-us/product-groups/insulated-metal-panels/downloads/certifications/cradle-to-cradle-silver-certificate

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