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Products
Kooltherm® K15 Rainscreen Board

Functional Unit
1 m² of insulation with a thickness required for an average thermal resistance RSI = 1 m²K/W

EPD Number and Period of Validity
SCS-EPD-09785
EPD Valid January 24, 2024 through January 23, 2029

Product Category Rule

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

PCR Guidance for Building-Related Products and Services Part B: Building Envelope Thermal Insulation EPD Requirements. Version 3.0. April 2023.

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Declaration Owner:	Kingspan Insulation LLC
Address:	2100 Riveredge Parkway, Suite 175 Atlanta, Georgia, USA 30328
Declaration Number:	SCS-EPD-09785
Declaration Validity Period:	EPD Valid January 24, 2024 through January 23, 2029
Product:	Kooltherm® K15 Rainscreen Board
Product Application:	Thermal Insulation
Market of Applicability:	North America
Program Operator:	SCS Global Services
General Program Instructions:	SCS Program Operator Manual. V11.0 November 2021
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Beth Cassese, LCACP, SCS Global Services
LCA Software:	OpenLCA 2.0.3, ecoinvent v3.9
EPD Type:	Manufacturer Specific
EPD Scope:	Cradle-to-Gate w/Options
Year of Manufacturer Primary Data:	2021
LCIA Methodology & Version:	TRACI 2.1, CML 4.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
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. Sept. 2018
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: Building Envelope Thermal Insulation EPD Requirements. Version 3.0. April 2023
Part B PCR Review conducted by:	Thomas Gloria (chair), Industrial Ecology Consultants; Christoph Koffler, thinkstep; Andre Desjarlais,Oak Ridge National Laboratory
Independent verification of the declaration and data, according to ISO 14025, ISO 21930, and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
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Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and 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.*

Limitations: *Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Building Envelope Thermal Insulation 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 Building Envelope Thermal Insulation 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.

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

About Kingspan

Kingspan Insulation LLC, headquartered in Atlanta, GA, is a leading manufacturer in energy efficiency and moisture management products, offering high-performance insulation, building wraps, and pre-insulated HVAC ductwork.

Kingspan Insulation LLC has a vast product range that includes optimum, premium, and high-performance rigid insulation products and moisture management products.

Kingspan Insulation LLC products are suitable for both new build and renovation in a variety of applications within both residential and non-residential buildings.

1. Product

2.1 Product Description

The Kooltherm® K15 Rainscreen Boards are premium performance insulation products manufactured at the company's production facilities in Pembridge, UK and Castleblaney, Ireland. The products are made with a fiber-free rigid thermoset phenolic core, and a low emissivity composite foil facer on both sides. Kooltherm® K15 Rainscreen Boards are available in several R-Values.

Kingspan Kooltherm® K15 Rainscreen Board products belong to the Thermal Protection specification code, CSI code 07 21 13.13 (Foam Board Insulation) and the UNSPSC code 30141503 (Foam Insulation).



2.2 Application

The Kingspan Kooltherm® K15 Rainscreen Board products provide the primary function of thermal insulation is for use in rainscreen cladding systems for various commercial and residential building applications.

2.3 Methodological Framework

This EPD is a cradle-to-gate with options EPD, including the life cycle stages for raw material extraction and processing, raw material transport, manufacture including packaging, final product distribution, product installation, and end-of-life product disposal. The use phase is excluded.

Resource use at the production facility is allocated to the product based on product area as a fraction of facility production. All processes contributing to greater than 1% of the total environmental impact indicator for each impact is included in the inventory. All known materials and processes were included in the life cycle inventory.

2.4 Technical Data

Technical specifications and product performance testing results for the products are summarized in Table 1. Detailed product characteristics can be found at the manufacturer's website (www.kingspaninsulation.us).

Table 1. *Technical specifications for the Kingspan Kooltherm® K15 Rainscreen Board products.*

Property	Test Method	Result
Nominal Board Width		47.2 in
		1200 mm
Nominal Board Length		96.0 in
		2438 mm
Compressive Strength, Min. (@10% deflection)	ASTM D1621	16 psi
Water Absorption, Max. (% by volume)	ASTM C209	1.15 %
Water Vapor Permeance (perm)	ASTM E96	0.51
Density, Min.	ASTM D1622	2.0 lb/ft^3
		32.0 kg/m^3
Closed Cell Content (%)	ASTM D6226	94.7
Air Performance	ASTM E2178	0.002 L/(s m^2)@75 Pa
Flame Spread	ASTM E84	25 (Class A)
Smoke Developed	ASTM E84	20

2.5 Properties of Declared Product as Delivered

Kingspan Kooltherm® K15 Rainscreen Board is available in several R-values with varying thicknesses, specified in Table 2. The product is delivered in the specified R-value and packaged with plastic film.

Table 2. *R-Value availability for the Kingspan Kooltherm® K15 Rainscreen Board products.*

R-Value	Thickness (in)	Thickness (mm)	Scaling Factor
8.0	1.18	30	1.41
10.6	1.57	40	1.87
13.3	1,97	50	2.35
16.0	2.36	60	2.82
18.7	2.76	70	3.29
20.0	2.95	75	3.52
21.4	3.15	80	3.76
24.0	3.54	90	4.22
26.7	3.94	100	4.70

2.6 Scaling Factor Calculation

Because the study is based on the functional unit of 1 m^2 of insulation with a thickness that gives an average thermal resistance RSI = 1 m^2K/W, which is not an R-Value within the range of production, the representative Kooltherm® product is an average of all R-Values produced and scaled to the RSI = 1 m^2K/W required. Results for the facing material are reported separately as the square meter of facing material remain the same regardless of the R-Value. In order to facilitate understanding of the actual R-Values produced, scaling factors are provided to calculate the impacts of each R-Value. Calculating impacts using scaling factors requires multiplying the cradle-to-installation plus end-of-life results for the base functional unit (1 m^2 of RSI = 1 m^2K/W) by the appropriate scaling factor shown in Table 2. The calculation steps for the scaling factors is shown below.



Figure 1. *Scaling factor calculation for the Kooltherm® K15 Rainscreen Board.*

2.7 Material Composition

The primary materials include a blend of blowing agents, performance additives, resin, and facers sourced from various suppliers.

Table 3. *Material component summary for the Kooltherm® K15 Rainscreen Board.*

Material	Foam Core	
	kg/m^3	Percent
Resin	29.3	73.8%
Proprietary Additives	10.4	26.2%
Total:	**39.7**	**100%**
Material	**Facing**	
	kg/m^2	Percent
Facer material:	**0.514**	**100%**

2.8 Manufacture

Kingspan Kooltherm® is made through a manufacturing process in which a foam forms an insulating core between two facing elements. At the start of the process a mix of chemicals is added directly to the bottom layer of facing and then expands to meet the top layer of facing. As it dries, the foam becomes tacky and adheres itself to the facing, top and bottom. Once it has reached the necessary thickness the foam is cooked under pressure. It is then moved onto a secondary oven to cure and harden, becoming bright pink in color. The insulation boards are then cut into the necessary sizes, packaged and sent to the loading bay for distribution.

The Castleblaney facility uses a mix of grid electricity and on-site solar electricity generation. The Pembridge facility uses a mix of grid electricity, on-site solar electricity, and on-site anaerobic digestion electricity and heat. Renewable energy generation on-site at Castleblaney and Pembridge will be available for the entire period of the EPD validity.

Castleblayney in 2021 had a total site landfill avoidance of 71.6%. The landfill avoidance figure is representative of the following waste management routes: 65.5% to waste to energy recovery, 6% to external recycle, and 28.5% to landfill.

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Pembridge in 2021 had a total site landfill avoidance of 99.8%. The landfill avoidance figure is representative of the following waste management routes: 78.2% to waste to energy recovery, 20% to external recycle, 1.5% to compost, and 0.2% to landfill.

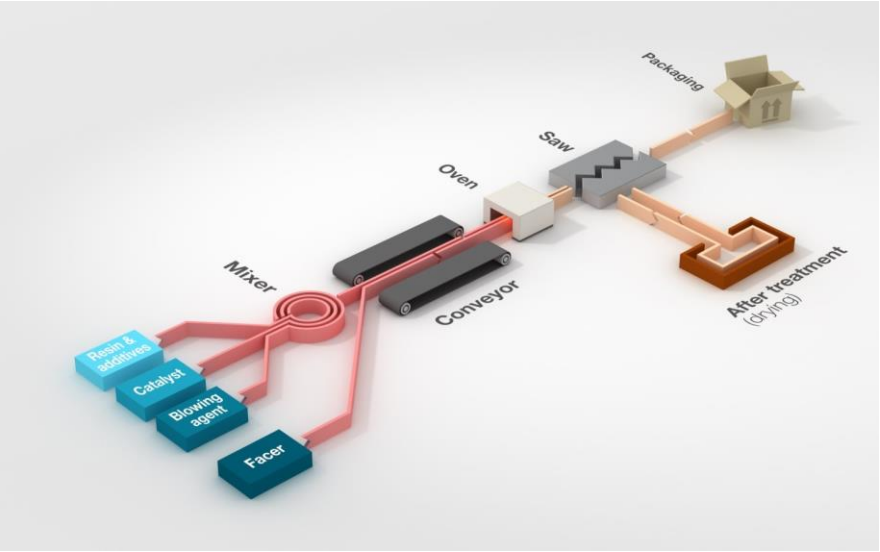


Figure 2. *Manufacturing diagram for Kingspan Kooltherm® K15 Rainscreen Board.*

2.9 Packaging

The Kingspan products are packaged for shipment using plastic wrap and wood pallets.

Table 4. *Material content of packaging for Kingspan Kooltherm® K15 Rainscreen Board, per square meter.*

Material	Kooltherm® K15 Packaging	
	kg/m²	Percent
Plastic film	0.052	39.8%
Wood pallet	0.079	60.2%
Total Packaging:	**0.131**	**100%**

2.10 Product Installation

Installation of the product requires a minimum of 4 fasteners to secure the insulation in place. Installation waste is assumed to be 5% of the product. The product installation also includes the disposal of the packaging waste. Transportation of the installation waste is assumed to be 50 km by truck.

2.11 Re-Use Phase

Kooltherm® K15 Rainscreen Board products are not re-used or recycled at the end-of-life.

2.12 Disposal

It is assumed the Kooltherm® K15 Rainscreen Board products are landfilled at end-of-life and should be disposed of according to local regulations. Transportation of the product at end-of-life is assumed to be 50 km by truck.

3. LCA: Calculation Rules

3.1 Functional Unit

The Kingspan Kooltherm® K15 Rainscreen Board products provide the primary function of thermal insulation. According to ISO 14044, the functional unit is "the quantified performance of a product system, for use as a reference unit." According to the PCR, the functional unit applicable to the insulation products, is 1 m^2 of insulation with a thickness required to provide a thermal resistance (R-value) of 1 m²K/W.

Table 5. *Functional unit and reference flows for the Kooltherm® K15 Rainscreen board products.*

Product Name	Functional Unit	Thickness to Achieve FU (m)	Reference flow (kg/m^2)	Facing Material (kg/m^2)
Kooltherm® K15 Rainscreen Board	1 m² of insulation with a thickness required for an average thermal resistance RSI = 1 m²K/W	0..016	0.850	0.514

3.2 System Boundary

The scope of the EPD is cradle-to-gate with options, including raw material extraction and processing, transportation, product manufacture, product delivery, installation, and product disposal. The life cycle phases included in the EPD scope are described in Table 6 and illustrated in Figure 3.

Table 6. *System boundary for the Kooltherm® K15 Rainscreen board products.*

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	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

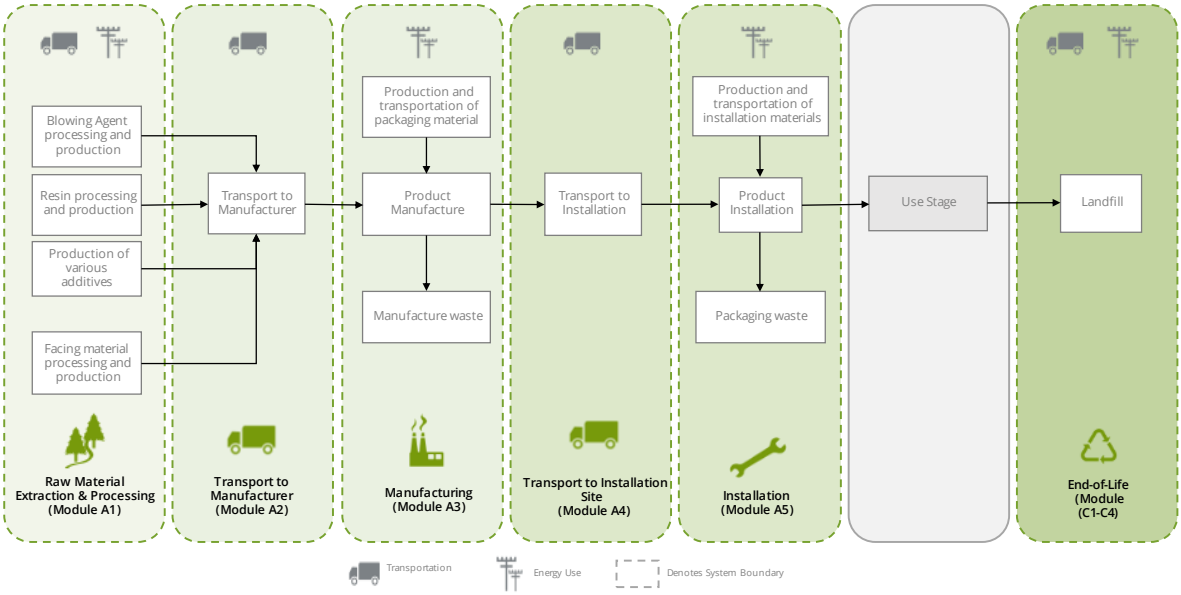


Figure 3. *Flow diagram representing the life cycle of the Kingspan Kooltherm® K15 Rainscreen board products.*

3.3 Estimates and Assumptions

- Specific data were not available on the proprietary additives in the product recipe. Secondary datasets were used from the Ecoinvent database.
- Transportation distance for one of the Blowing Agent raw materials was assumed to be 200 km by truck.
- The manufacturing waste management routes are assumed to be 78.2% to waste to energy recovery, 20% to external recycle, 1.5% to compost, and 0.2% to landfill.
- Manufacturing waste transport is assumed to be 50 km by truck.
- Packaging transport from suppliers to the manufacturing sites was assumed to be 100 km by truck.
- Installation of the Kooltherm® products is assumed to use 0.012 kg of steel fasteners per square meter, based on the installation instructions provided on the Kingspan Insulation website.
- Product waste from installation is assumed to be 5%.
- Transport of the packaging waste at installation is assumed to be 50 km by truck.
- Packaging waste disposal is assumed by packaging type according to the requirements of the Part A PCR.
- Transport of the product at end-of-life to waste processing and disposal is assumed to be 50 km by truck.
- For the product end-of-life, disposal of product is assumed to be inert in landfill per the Part A PCR product disposal assumptions by region.

3.4 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. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

3.5 Background Data

Primary data were provided by Kingspan for the Pembridge and Castleblaney manufacturing facilities. The sources of secondary LCI data are the Ecoinvent 3.9 database published in 2022.

3.6 Data Quality

Table 7. *Data quality assessment for the Kingspan Insulation product system.*

Data Quality Parameter	Data Quality Discussion
Time-related Coverage: Age of data and the minimum length of time over which data is collected	The manufacturer provided primary data on product manufacturing for the manufacturing facilities in Pembridge, UK and Castleblaney, Ireland on annual production for 2021. Representative datasets (secondary data) for upstream and background processes are generally less than 5 years old.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative datasets for the United Kingdom and Ireland represented in this study. Surrogate data used in the assessment are representative of global or European operations and are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative component datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
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 sources of similar quality and age are used; with a bias towards Ecoinvent v3.9 data where available. Different portions of the product life cycle are equally considered.
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	Based on the description of the data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturing facility represents a 12-month average and is considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.9 data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment methodology includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.7 Period under review

The period of review is calendar year 2021.

3.8 Allocation

Manufacturing resource use was allocated to the products based on product area as a fraction of annual facility production. Impacts from transportation were allocated based on the mass of material and distance transported.

3.9 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

4.1 Transport to the Building Site (A4)

Distribution of the product to point of sale is included in the model, based on primary data received from the manufacturer. The transportation of final products is done via diesel truck, freight train, and ocean freight container ship. Transportation parameters for modeling product distribution are summarized in Table 9.

Table 8. *Product distribution parameters, per functional unit.*

Name	Unit	Kooltherm® K15
Vehicle type	-	Truck
Fuel type	-	Diesel
Liters of fuel	l/100km	35
Transport distance	km	540
Capacity utilization	%	37
Gross density of products transported	kg/m^3	39.7
Capacity utilization volume factor	-	1
Name	**Unit**	**Kooltherm® K15**
Vehicle type	-	Train
Fuel type	-	Diesel
Liters of fuel	l/100km	797
Transport distance	km	442
Capacity utilization	%	n/a
Gross density of products transported	kg/m^3	39.7
Capacity utilization volume factor	-	1
Name	**Unit**	**Kooltherm® K15**
Vehicle type	-	Ship
Fuel type	-	Heavy Fuel Oil
Liters of fuel	l/100km	68,000
Transport distance	km	7467
Capacity utilization	%	n/a
Gross density of products transported	kg/m^3	39.7
Capacity utilization volume factor	-	1

4.2 Installation into the Building (A5)

Table 9. *Installation summary for Kingspan Kooltherm® K15 Rainscreen Board.*

Name	Unit	Kooltherm® K15 (per 1m² of RSI=1 m²K/W)
Ancillary materials (per m^2)	kg	0.012
Water consumption specified by water source and fate	m^3	0.00
Other resources	kg	0.00
Electricity consumption	kwh	0.00
Other energy carriers	MJ	0.00
Product loss per functional unit	kg	0.042 (insulation) 0.026 (facer)
Waste materials at the construction site before waste processing, generated by product installation	kg	0.199
Output materials resulting from on-site waste processing	kg	0.00
Mass of packaging waste specified by type	kg	0.131
Recycle	kg	*0.058*
Landfill	kg	*0.060*
Incineration	kg	*0.013*
Biogenic carbon contained in packaging	kg CO_2	0.144
Direct emissions to ambient air, soil, and water	kg	0.00
VOC content	$\mu g/m^3$	0.00

4.3 End-of-Life (C1-C4)

The disposal stage includes removal of the products (C1); transport of the products to waste treatment facilities (C2); waste processing (C3); and associated emissions as the product degrades in a landfill or is burned in an incinerator (C4). It is assumed the insulation products are landfilled at end-of-life. No emissions are generated during demolition (C1) while no waste processing (C3) is required for landfill disposal. Transportation of waste materials at end-of-life (C2) assumes a 50 km average distance to disposal.

Table 10. *End-of-Life summary for Kingspan Kooltherm® K15 Rainscreen Board.*

End-of-life		Unit	Kooltherm® K15 (per 1m² of RSI=1 m²K/W)
Assumptions for scenario development		Manual deconstruction, followed by 50 km truck transport to final disposal in landfill	
Collection process	Collected separately	kg	0
	Collected with mixed construction waste	Kg	0.850 (insulation) 0.514 (facer)
Disposition	Reuse	kg	0
	Recycling	kg	0
	Energy recovery	kg	0
	Landfill	Kg	0.850 (insulation) 0.514 (facer)
Removals of biogenic carbon (excluding packaging)		kg CO_2	0.00

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5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All values in the tables below are rounded to three significant digits. The following impact indicators, specified by the PCR, are reported below:

Table 11. *Life Cycle Impact Assessment Indicators and characterization methods used.*

Impact Category	Unit	Characterization Method
Global Warming Potential (GWP)	kg CO_2 eq	CML
Global Warming Potential (GWP)	kg CO_2 eq	TRACI
Ozone Depletion Potential (ODP)	kg CFC 11 eq	TRACI
Eutrophication Potential (EP)	kg N eq	TRACI
Acidification Potential (AP)	kg SO_2 eq	TRACI
Smog Formation Potential (SFP)	kg O_3 eq	TRACI
Abiotic Depletion Potential, fossil fuels (ADP_{fossil})	MJ eq	CML

Table 12. *Additional transparency indicators used.*

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	HWD: Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	NHWD: Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	RWD: High-level, intermediate, and low-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	CRU: Components for re-use	kg
SM: Secondary materials	kg	MR: Materials for recycling	kg
RSF: Renewable secondary fuels	MJ, LHV	MER: Materials for energy recovery	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	EE: Recovered energy exported from the product system	MJ, LHV
RE: Recovered energy	MJ, LHV		
FW: Use of net freshwater resources	m^3	-	-

These 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.

Table 13. *Life Cycle Impact Assessment (LCIA) results for the Kingspan Kooltherm® K15 Rainscreen Board products.*

Module	GWP (CML)	GWP (TRACI)	ODP	AP	EP	SFP	ADPF
	kg CO_2 eq	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg N^- eq	kg O_3 eq	MJ
A1	2.03	2.00	$4.34x10^{-8}$	0.009	0.005	0.100	50.3
A2	0.096	0.095	$1.69x10^{-9}$	0.001	$1.10x10^{-4}$	0.013	1.31
A3	0.319	0.315	$1.04x10^{-8}$	0.001	0.001	0.013	6.23
A1-A3 Total:	**2.45**	**2.41**	**$5.55x10^{-8}$**	**0.010**	**0.006**	**0.127**	**57.9**
A4	0.181	0.180	$3.04x10^{-9}$	0.002	$1.98x10^{-4}$	0.041	2.40
A5	0.190	0.188	$5.70x10^{-9}$	$7.50x10^{-4}$	$4.88x10^{-4}$	0.011	4.35
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.008	0.008	$1.41x10^{-10}$	$3.14x10^{-5}$	$7.56x10^{-6}$	$8.02x10^{-4}$	0.113
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.008	0.008	$1.41x10^{-10}$	$3.14x10^{-5}$	$7.56x10^{-6}$	0.001	0.113
Facing	1.68	1.67	$3.04x10^{-8}$	0.011	0.004	0.179	19.7

Table 14. *Additional resource use results for the Kingspan Kooltherm® K15 Rainscreen Board products.*

Module	RPR_E	RPR_M	$NRPR_E$	$NRPR_M$	SM	RSF	NRSF	RE	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	MJ	m^3
A1	1.10	0.00	52.7	0.00	0.00	0.00	0.00	0.00	0.032
A2	0.027	0.00	1.35	0.00	0.00	0.00	0.00	0.00	$2.03x10^{-4}$
A3	2.41	0.00	6.76	0.00	0.00	0.00	0.00	0.00	0.002
A1-A3 Total:	**3.54**	**0.00**	**60.8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.034**
A4	0.031	0.00	2.43	0.00	0.00	0.00	0.00	0.00	$2.77x10^{-4}$
A5	0.209	0.00	3.62	0.00	0.00	0.00	0.00	0.00	0.002
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.001	0.00	0.115	0.00	0.00	0.00	0.00	0.00	$1.45x10^{-5}$
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.001	0.00	0.115	0.00	0.00	0.00	0.00	0.00	$1.45x10^{-4}$
Facing	1.50	0.00	22.1	0.00	0.00	0.00	0.00	0.00	0.009

Table 15. *Additional waste and output results for the Kingspan Kooltherm® K15 Rainscreen Board products.*

Module	HWD	NHWD	HLRW/ILLRW	CRU	MR	MER	EE
	kg	kg	kg	kg	kg	kg	MJ, LHV
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.007	0.00	0.00	0.002	0.019	0.00
A1-A3 Total:	**0.00**	**0.007**	**0.00**	**0.00**	**0.002**	**0.019**	**0.00**
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	0.115	0.00	0.00	0.058	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	0.850	0.00	0.00	0.00	0.00	0.00
Facing	0.00	0.514	0.00	0.00	0.00	0.00	0.00

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6. LCA: Interpretation

The interpretation included the use of evaluation and sensitivity checks to steer the iterative process during the assessment, and a final evaluation including completeness, sensitivity, and consistency checks, at the end of the study.

The contributions to total indicator impacts for the Kooltherm® K15 Rainscreen boards are dominated by the raw material extraction and processing stage, and the product facing material. Product manufacture and distribution are generally the next highest contributor while contributions from the remaining life cycle stages are minimal.

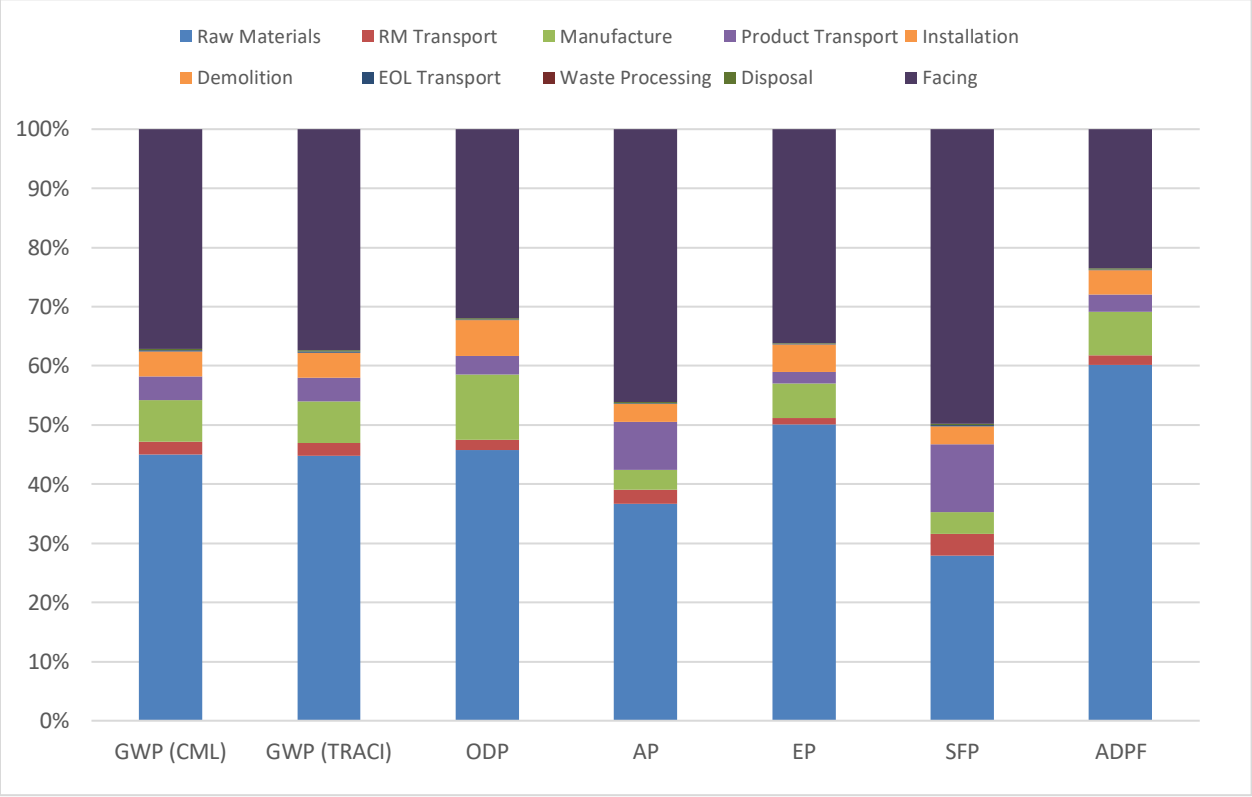


Figure 4. *Contribution analysis for the Kingspan Kooltherm® K15 Rainscreen Board products.*

7. Additional Environmental Information

7.1 Environment and Health during Manufacture

No environmental or health impacts are expected during the manufacture of the product.

7.2 Environment and Health during Installation

No environmental or health impacts are expected due to normal use of the products.

7.3 Extraordinary Effects

No environmental or health impacts are expected due to extraordinary effects including fire and/or water damage and unforeseeable mechanical destruction.

7.4 Environmental Activities and Certifications

Kingspan understands its impact on the environment, both in terms of the role its products can play in optimizing energy efficiency, and the responsibility the company has with a global footprint of over 159 manufacturing facilities and over 15,000 employees. Kingspan seeks to operate as sustainably as possible throughout its supply chain.

Planet Passionate is Kingspan's ambitious 10-year global sustainability strategy that will impact on three big global issues: climate change, circularity, and protection of our natural world. Through Planet Passionate Kingspan will contribute to the world's renewable energy mix, reduce carbon emissions, divert waste from landfill, conserve water, provide upcycling solutions for plastic waste and help clean the world's oceans and protect biodiversity.

The strategy is made up of 12 ambitious targets, addressing the impact of Kingspan's business operations and manufacturing on the four key areas of energy, carbon, circularity and water, with commitments by 2030 to include:

- Energy: powering 60% of all Kingspan operations directly from renewable energy with a minimum of 20% of this energy generated on manufacturing sites (up from 5.3% today). This will include install solar PV on all wholly owned facilities.
- Carbon: achieving net zero carbon manufacturing and a 50% reduction in product CO2 intensity from primary supply partners.
- Circularity: upcycling of 1 billion PET bottles per annum into insulation products plus zero company waste to landfill across all sites.
- Water: harvesting 100 million liters of Kingspan's water usage from rainwater with a goal of five active ocean clean-up projects by 2025.
- Waste: target of zero company waste sent to landfill.

7.5 Further Information

Further information on the product can be found on the manufacturers' website at www.kingspaninsulation.us.

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