RMK INDUSTRIES LLC

VERIFIED by SCS GLOBAL SERVICES
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner
RMK Industries L.L.C
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Products
Alcobond FR
Cladbond FR

Functional Unit
The functional unit is one square meter of aluminum composite panel product maintained for 75 years.

EPD Number and Period of Validity
SCS-EPD-06812
EPD Valid March 22, 2021 through March 21, 2026

Product Category Rule
ISO 21930:2017. Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.

Program Operator
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SCSglobal SERVICES

Declaration Owner:	RMK Industries L.L.C
Address:	Plot 5320169, Saih Shuaib 3, Dubai Industrial City (DIC), PO Box 37490, Dubai, UAE
Declaration Number:	SCS-EPD-06812
Declaration Validity Period:	March 22, 2021 through March 21, 2026
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, PhD.
LCA Software:	OpenLCA 1.10 with ecoinvent 3.7 database
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☒ internal ☐external
LCA Reviewer:	Tess Garvey, Ph.D., SCS Global Services
Product Category Rule:	ISO 21930:2017. Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.
PCR Review conducted by:	ISO Technical Committee
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Tom Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	

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.*

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.*

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.

1. About RMK

RMK Industries L.L.C. (RMK) is based in Dubai, United Arab Emirates. We are equipped with a state-of-the-art Aluminium Composite Panel (ACP) manufacturing facility, with a widespread network of affiliates to whom we supply premium quality architectural facade application and interior application products under 2 brands – ALCOBOND & CLADBOND.

Our researchers possess significant experience in the respective fields of metallurgy, polymers, copolymers, plastics and bonding of metals with plastics and other related materials. We develop a synergistic relationship with our clients by first evaluating their specific requirements, and by working together to study the local environment, geography, ambient conditions and commercial market situation.

Our production, which is carefully custom-designed to match our client's requirements, with machinery installation supervised by our highly skilled technicians guiding them upon the use of raw materials, ensuring only the best materials are used at every stage of the production process.

Our quality control system is a continuous and ongoing process that mandates that we conduct production and laboratory test information along with physical panel samples. We conduct our own laboratory tests, spot-checking random batches thus guaranteeing that the ACPs reaching you are always of the very highest quality. We are committed to value engineering with no compromise on quality.

2. Product

The scope of the EPD includes the products described below.

Product Models	Product Description
Alcobond FR Cladbond FR	Alcobond & Cladbond FR Aluminum Composite Panel is a sandwich panel structure consisting of a modified mineral core inserted in between two aluminum skins. • Alcobond & Cladbond FR Panels have passed the ASTM E84 test in Class A. • Alcobond & Cladbond FR Panels have been tested and have passed the NFPA 285 test • The Civil Defense of Dubai from the United Arab Emirates has certified the Alcobond & Cladbond FR Facade System.

RMK's aluminum composite panel products are manufactured at the company's production facility in Dubai, United Arab Emirates (UAE). The products are constructed from a variety of materials including aluminum, a mineral core, plastics and coatings sourced from various suppliers.

2.2 Application

The RMK aluminum composite panel (ACP) products provide the primary function of exterior wall cladding.

2.3 Technical Data

Technical specifications of the products included in the LCA scope, as well as product performance testing results are available on the manufacturer's website (www.alcobond.com).

2.4 Base Materials

The primary materials include aluminum, a modified mineral core, plastics and coatings sourced from various suppliers. Packaging materials consist of plastic and wood pallets.

Table 1. *Material content for the Alcobond FR and Cladbond FR panel products in kg per square meter and percent of total mass.*

Material	kg/m^2	Percent
Adhesive Film	0.100	1.3%
Exterior Al Skin	1.30	17%
Interior Al Skin	1.30	17%
Core - Halogen Free	4.99	65%
Total Product	**7.69***	**100%**

*Actual product weights may vary by +/- 0.5 kg/m^2. Value shown represents reference flow used in LCA model.

Table 2. *Material content for the Alcobond FR and Cladbond FR panel product packaging, per square meter.*

Material	kg/m^2	Percent
Plastic Protective Layer	$1.00x10^{-3}$	1.6%
Wooden Pallets	$6.00x10^{-2}$	98%
Total Packaging	**$6.10x10^{-2}$**	**100%**

2.5 Manufacture

RMK's Alcobond FR and Cladbond FR products are manufactured at the company's production facility in Dubai, UAE. Resource use at the production facility is allocated to the product based on product mass as a fraction of facility production volume (mass-based allocation).

2.6 Environment and Health during Manufacture

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

2.7 Product Processing/Installation

Typical installation is accomplished using hand tools.

2.8 Packaging

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

2.9 Condition of Use

No special conditions of use are noted.

2.10 Environment and Health during use

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

2.11 Reference Service Life

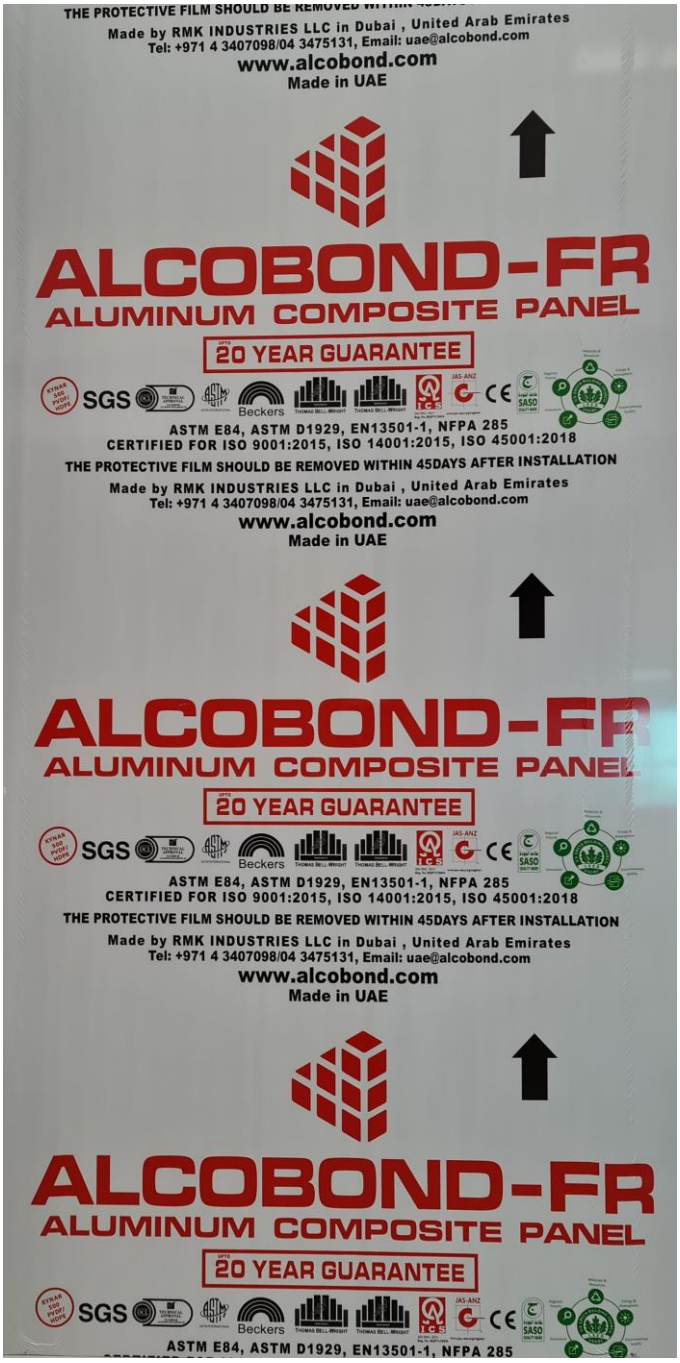
The Reference Service Life (RSL) of the panel system product is based on the manufacturer's estimated product lifetime of 25 years and is summarized in Table 3 below. The building Estimated Service Life (ESL) is 75 years, consistent with the PCR.

2.12 Extraordinary Effects

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

2.13 Further Information

Further information on the product can be found on the manufacturers' website at www.alcobond.com.



3. LCA: Calculation Rules

3.1 Functional Unit

The functional unit used in the study is defined as 1 m^2 of composite panel product maintained for 75 year. The reference flows for each product are summarized in Table 3.

Table 3. *Reference flows for the RMK Alcobond FR and Cladbond FR panel products, per square meter.*

Functional Unit	Reference flow (kg/m^2)	Reference Service Life – RSL (years)	Replacement Cycle (ESL/RSL-1)
1 m^2 panel surface	7.69	25	2.0

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 life cycle phases included in the EPD scope are described in Table 4 and illustrated in Figure 1.

Table 4. *The modules and unit processes included in the scope for the RMK Alcobond FR and Cladbond FR panel products.*

Module	Module description from the PCR	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Extraction and processing of raw materials for the product components.
A2	Transport (to the manufacturer)	Transport of component materials to the manufacturing facilities
A3	Manufacturing, including ancillary material production	Manufacturing of products and packaging (incl. upstream unit processes)
A4	Transport (to the building site)	Transport of product (including packaging) to the building site
A5	Construction-installation process	Impacts from the installation of product are assumed negligible. Only impacts from packaging disposal are included in this phase
B1	Product use	There are no impacts from the use of the wall system in a commercial building setting.
B2	Product maintenance	Maintenance of products over the 75-year ESL, including periodic cleaning. Impacts from product maintenance are assumed negligible
B3	Product repair	The products are not expected to require repair over its lifetime
B4	Product replacement	The materials and energy required for replacement of the product over the 75-year ESL of the assessment are included in this phase
B5	Product refurbishment	The products are not expected to require refurbishment over their lifetime
B6	Operational energy use by technical building systems	There is no operational energy use associated with the use of the product
B7	Operational water uses by technical building systems	There is no operational water use associated with the use of the product
C1	Deconstruction, demolition	Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts
C2	Transport (to waste processing)	Transport of the product to waste treatment at end-of-life
C3	Waste processing for reuse, recovery and/or recycling	The products are disposed of by landfilling or incineration which require no waste processing
C4	Disposal	Disposal of the product in a municipal landfill or incineration
D	Reuse-recovery-recycling potential	Module Not Declared

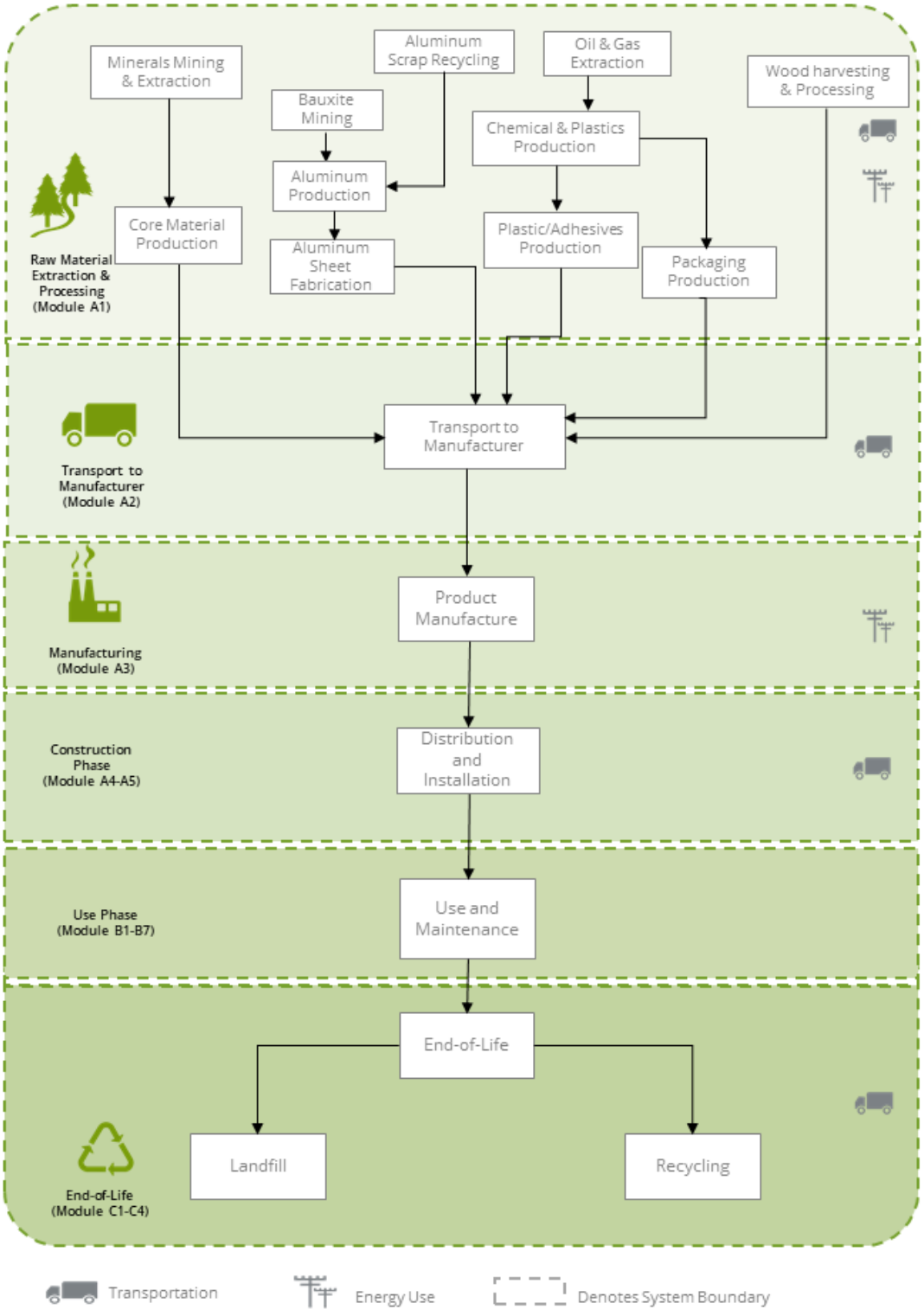


Figure 1. *Flow diagram representing the major unit operations in the life cycle of the RMK Alcobond FR and Cladbond FR panel products.*

3.3 Estimates and Assumptions

- The RMK manufacturing facility is located in Dubai, UAE. An Ecoinvent inventory dataset for the UAE regional electricity grid mix was used to estimate resource use and emissions from electricity use at the facility.
- Electricity and resource use at the production facility were allocated to the products based on the product mass as a fraction of total production volume utilizing annual facility data for calendar year 2020 provided by the manufacturer.
- Primary data for upstream component manufacture were not available. Representative LCI datasets from the ecoinvent database were used to model processing for aluminum and plastic material components.
- Although no specific data regarding the disposal of the product and packaging at end-of-life was available, it is reasonable to expect the aluminum components to be recycled, given the relatively high economic value of the material. The remaining materials are assumed landfilled.
- For final disposal of the product and packaging materials at end-of-life, all materials are assumed to be transported 20 miles by diesel truck to either a landfill, incineration facility, or material reclamation facility (for recycling). Datasets representing disposal in a landfill and waste incineration are from Ecoinvent.
- Modeling of recycled materials follows the recycled content method (also known as 100-0 method or cut-off method) whereby only the burdens of reprocessing the waste material are allocated to the system from the use of the recycled material.

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.

3.4 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 RMK for the Dubai, UAE manufacturing facility. The sources of secondary LCI data are the Ecoinvent database.

Table 4. *Data sources for the RMK Alcobond FR and Cladbond FR products.*

Component	Dataset	Data Source	Publication Date
PRODUCT			
Aluminum			
Interior/Exterior Skin	aluminium production, primary, ingot | aluminium, primary, ingot | Cutoff, S/RoW	EI v3.7	2020
	market for aluminium scrap, new | aluminium scrap, new | Cutoff, S/RoW	EI v3.7	2020
	polyvinylfluoride production | polyvinylfluoride | Cutoff, S/RoW	EI v3.7	2020
	sheet rolling, aluminium | sheet rolling, aluminium | Cutoff, S/RoW	EI v3.7	2020
Mineral core		EI v3.7	2020
Core - Halogen Free	magnesium oxide production | magnesium oxide | Cutoff, S/RoW	EI v3.7	2020
	polyethylene production, low density, granulate | polyethylene, low density, granulate | Cutoff, S/RoW	EI v3.7	2020
Adhesive			
Adhesive Film	acrylic binder production, product in 34% solution state | acrylic binder, without water, in 34% solution state | Cutoff, S/RoW	EI v3.7	*2020*
Plastics			
Protective coating	polyvinylfluoride production | polyvinylfluoride | Cutoff, S/RoW	EI v3.7	2020
	polyethylene terephthalate production, granulate, amorphous | polyethylene terephthalate, granulate, amorphous | Cutoff, S/RoW	EI v3.7	2020
PACKAGING			
Plastics			
Protective Layer	packaging film production, low density polyethylene | packaging film, low density polyethylene | Cutoff, S/RoW	EI v3.7	2020
Wood			
Wooden Pallets	EUR-flat pallet production | EUR-flat pallet | Cutoff, S/RoW	EI v3.7	2020
RESOURCES			
Grid Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, S/AE	EI v3.7	2020
Heat -fuel oil	heat production, light fuel oil, at industrial furnace 1MW | heat, district or industrial, other than natural gas | Cutoff, S/CA-QC	EI v3.7	2020
TRANSPORTATION			
Diesel truck	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, S/RoW	EI v3.7	2020
Ocean freighter	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S/GLO	EI v3.7	2020

3.6 Data Quality

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 5. *Data quality assessment for the Alcobond FR and Cladbond FR 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 most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old (typically 2016). All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2020.
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 data for the UAE. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations are considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
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 fabrication 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 or 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 v3.7 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 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 RMK's manufacturing facilities represents an annual average and are 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 v3.7 LCI 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 were not available 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 method required by the PCR 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 2020.

3.8 Allocation

Manufacturing resource use was allocated to the products based on mass. Impacts from transportation were allocated based on the mass of material and distance transported.

The product system includes some recycled materials, which were allocated using the recycled content allocation method (also known as the 100-0 cut-off method). Using the recycled content allocation approach, system inputs with recycled content do not receive any burden from the previous life cycle other than reprocessing of the waste material. At end-of-life, materials which are recycled leave the system boundaries with no additional burden.

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

Delivery and Installation stage (A4 - A5)

Distribution of the panel products to the point of installation is included in the assessment. Transportation parameters for modeling product distribution are summarized in Table 6, and represents product distribution to customers on the Middle East.

Table 6. *Product distribution parameters, per 1 m^2.*

Transport Parameter	Value
Diesel truck – Fuel utilization (L/100 km)	18.7
Diesel truck – Capacity utilization (%)	76%
Diesel truck – Distance (km)	1,120
Ocean freighter – Fuel utilization (g/tkm)	2.5
Ocean freighter – Capacity utilization (%)	65%
Ocean freighter – Distance (km)	1,230
Gross mass of products transported (including packaging) (kg)	7.75

The impacts associated with the product installation are assumed negligible. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

Table 7. *Installation parameters for the Alcobond FR and Cladbond FR products, per 1 m^2.*

Parameter		Value
Ancillary materials – Glass (kg)		-
Net freshwater consumption (m^3)		-
Electricity consumption (kWh)		-
Product loss per functional unit (kg)		negligible
Waste materials generated by product installation (kg)		negligible
Output materials resulting from on-site waste processing (kg)		na
Mass of packaging waste (kg)	Plastic	$1.00x10^{-3}$
	Wood	$6.00x10^{-2}$
Biogenic carbon contained in packaging (kg CO_2)		0.110
Direct emissions (kg)		-

Use and Maintenance stage (B1 - B2)

No impacts are associated with the use of the products. Impacts from routine cleaning and maintenance of the products are assumed negligible.

Repair/Refurbishment stage (B3; B5)

Product repair and refurbishment are not relevant during the lifetime of the product.

Replacement stage (B4)

The materials and energy required for replacement of the product over the 75-year ESL of the assessment are included in this stage.

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product.

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product.

Disposal stage (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 (C4). For the aluminum composite panel products, 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 20 mile (~32 km) average distance to disposal, consistent with assumptions used in the US EPA WARM model. No specific data are available regarding the recycling rate of materials in the product or packaging at end-of-life. However, it is reasonable to expect the aluminum components to be recycled, given the relatively high economic value of the material. The remaining materials are assumed landfilled.

The relevant disposal statistics used for the packaging are summarized in Table 8.

Table 8. *End-of-life disposal scenario parameters for the Alcobond FR and Cladbond FR products.*

Parameter		Value
Assumptions for scenario development		Recycling/Landfill
Collection process		-
Collected with mixed construction waste (kg)		7.9
Recovery		n/a
Disposal	Recycled (kg)	7.59
	Landfill (kg)	0.100
	Incineration (kg)	-
Removals of biogenic carbon (kg CO_2 eq)		n/a

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.

Table 9. *Life cycle phases included in the product system boundary.*

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	MND

X = Included in system boundary | MND = Module not declared

The following impact indicators, specified by the PCR, are reported below:

CML-IA Impact Category	Unit
Global Warming Potential (GWP)	kg CO_2 eq
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq
Acidification Potential of soil and water (AP)	kg SO_2 eq
Eutrophication Potential (EP)	kg PO_4^{3-} eq
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ, LHV

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.

The following inventory parameters, specified by the PCR, are also reported.

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	HLRW: High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	ILLRW: Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	CRU: Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	MR: Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	MER: Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	EE: Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Modules B1 through B7 are not associated with any impact and are therefore declared as zero. In addition, module C1 and C3 are likewise not associated with any impact as the products are expected to be manually deconstructed. Additionally, as the products do not contain significant amounts of bio-based materials, biogenic carbon emissions and removals are not declared. Module D is not declared. In the interest of space and table readability, these modules are not included in the results presented below.

Table 10. *CML-IA Life Cycle Impact Assessment (LCIA) results for one (1) square meter of the RMK Alcobond/Cladbond FR panel products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	GWP	ODP	AP	EP	POCP	ADPE	ADPF
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg $(PO_4)^{3-}$ eq	kg C_2H_4 eq	kg Sb eq	MJ eq
Total	158	$6.29x10^{-6}$	1.17	0.330	$6.16x10^{-2}$	$1.15x10^{-6}$	1,600
	100%	100%	100%	100%	100%	100%	100%
A1	49.1	$1.18x10^{-6}$	0.359	0.105	$1.96x10^{-2}$	$3.21x10^{-7}$	481
	31%	19%	31%	32%	32%	28%	30%
A2	0.710	$1.15x10^{-7}$	$1.71x10^{-2}$	$1.93x10^{-3}$	$4.38x10^{-4}$	$4.35x10^{-9}$	9.22
	0.45%	1.8%	1.5%	0.59%	0.71%	0.38%	0.58%
A3	0.713	$4.28x10^{-7}$	$1.74x10^{-3}$	$4.50x10^{-4}$	$1.40x10^{-4}$	$4.10x10^{-8}$	11.7
	0.45%	6.8%	0.15%	0.14%	0.23%	3.6%	0.73%
A4	1.86	$3.23x10^{-7}$	$9.16x10^{-3}$	$1.87x10^{-3}$	$2.87x10^{-4}$	$1.60x10^{-8}$	27.3
	1.2%	5.1%	0.79%	0.57%	0.47%	1.4%	1.7%
A5	$7.13x10^{-3}$	$5.90x10^{-10}$	$1.58x10^{-5}$	$1.64x10^{-4}$	$1.40x10^{-6}$	$2.09x10^{-11}$	$4.89x10^{-2}$
	0.00%	0.01%	0.00%	0.05%	0.00%	0.00%	0.00%
B1	0	0	0	0	0	0	0
B2	0	0	0	0	0	0	0
B3	0	0	0	0	0	0	0
B4	106	$4.20x10^{-6}$	0.777	0.220	$4.11x10^{-2}$	$7.68x10^{-7}$	1,070
	67%	67%	67%	67%	67%	67%	67%
B5	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0
B7	0	0	0	0	0	0	0
C1	0	0	0	0	0	0	0
C2	0.314	$5.45x10^{-8}$	$1.46x10^{-3}$	$3.14x10^{-4}$	$4.77x10^{-5}$	$1.09x10^{-9}$	4.29
	0.20%	0.87%	0.13%	0.09%	0.08%	0.09%	0.27%
C3	0	0	0	0	0	0	0
C4	$6.30x10^{-2}$	$2.81x10^{-10}$	$1.40x10^{-5}$	$2.56x10^{-4}$	$1.35x10^{-5}$	$3.29x10^{-11}$	$3.17x10^{-2}$
	0.04%	0.00%	0.00%	0.08%	0.02%	0.00%	0.00%
D	MND	MND	MND	MND	MND	MND	MND

Table 11. *Resource use for one (1) square meter of the RMK Alcobond/Cladbond FR panel products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	PERE	PERM	PENRE	PENRM	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
Total	42.1	0.00	INA	INA	2.85	0.00	0.00	6.21
	100%	0.00			100%	0.00	0.00	100%
A1	11.8	0.00	INA	INA	0.949	0.00	0.00	2.00
	28%	0.00			33%	0.00	0.00	32%
A2	$6.29x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$3.78x10^{-3}$
	0.15%	0.00			0.00%	0.00	0.00	0.06%
A3	1.81	0.00	INA	INA	0.00	0.00	0.00	$4.90x10^{-2}$
	4.3%	0.00			0.00%	0.00	0.00	0.79%
A4	0.302	0.00	INA	INA	0.00	0.00	0.00	$1.90x10^{-2}$
	0.72%	0.00			0.00%	0.00	0.00	0.31%
A5	$3.93x10^{-4}$	0.00	INA	INA	0.00	0.00	0.00	$2.78x10^{-5}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.00%
B1	0	0	0	0	0	0	0	0
B2	0	0	0	0	0	0	0	0
B3	0	0	0	0	0	0	0	0
B4	28.1	0.00	INA	INA	1.90	0.00	0.00	4.14
	67%	0.00%			67%	0.00%	0.00%	67%
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	0	0	0	0	0	0	0	0
C1	0	0	0	0	0	0	0	0
C2	$1.61x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.38x10^{-3}$
	0.04%	0.00%			0.00%	0.00%	0.00%	0.02%
C3	0	0	0	0	0	0	0	0
C4	$1.48x10^{-3}$	0.00	INA	INA	0.00	0.00	0.00	$8.01x10^{-5}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.00%
D	MND	MND	MND	MND	MND	MND	MND	MND

INA = Indicator not assessed

Table 12. *Waste and output flows for one (1) square meter of the RMK Alcobond/Cladbond FR panel products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	HWD	NHWD	RWD-HL	RWD-LL	CRU	MR	MER	EE
	kg	kg	kg	kg	kg	kg	kg	MJ
Total	$3.78x10^{-2}$	24.1	$5.27x10^{-4}$	$3.42x10^{-3}$	0.00	22.8	Neg.	Neg.
	100%	100%	100%	100%	0.00	100%	Neg.	Neg.
A1	$1.25x10^{-2}$	6.46	$1.73x10^{-4}$	$8.43x10^{-4}$	0.00	0.00	Neg.	Neg.
	33%	27%	33%	25%	0.00	0.00%	Neg.	Neg.
A2	$9.97x10^{-6}$	$6.82x10^{-2}$	$2.69x10^{-7}$	$6.43x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.03%	0.28%	0.05%	1.9%	0.00	0.00%	Neg.	Neg.
A3	$1.85x10^{-5}$	$6.49x10^{-2}$	$7.65x10^{-7}$	$2.04x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.05%	0.27%	0.15%	0.60%	0.00	0.00%	Neg.	Neg.
A4	$7.05x10^{-5}$	1.26	$1.42x10^{-6}$	$1.81x10^{-4}$	0.00	0.00	Neg.	Neg.
	0.19%	5.2%	0.27%	5.3%	0.00	0.00%	Neg.	Neg.
A5	$1.15x10^{-7}$	$6.13x10^{-2}$	$1.95x10^{-9}$	$3.32x10^{-7}$	0.00	0.00	Neg.	Neg.
	0.00%	0.25%	0.00%	0.01%	0.00	0.00%	Neg.	Neg.
B1	0	0	0	0	0	0	0	0
B2	0	0	0	0	0	0	0	0
B3	0	0	0	0	0	0	0	0
B4	$2.52x10^{-2}$	16.1	$3.51x10^{-4}$	$2.28x10^{-3}$	0.00	15.2	Neg.	Neg.
	67%	67%	67%	67%	0.00	67%	Neg.	Neg.
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	0	0	0	0	0	0	0	0
C1	0	0	0	0	0	0	0	0
C2	$1.16x10^{-5}$	$2.04x10^{-2}$	$7.11x10^{-8}$	$3.05x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.03%	0.08%	0.01%	0.89%	0.00%	0.00%	Neg.	Neg.
C3	0	0	0	0	0	0	0	0
C4	$1.12x10^{-7}$	0.100	$8.23x10^{-9}$	$1.67x10^{-7}$	0.00	7.59	Neg.	Neg.
	0.00%	0.42%	0.00%	0.00%	0.00%	33%	Neg.	Neg.
D	MND	MND	MND	MND	MND	MND	MND	MND

INA = Indicator not assessed | Neg. = Negligible

6. LCA: Interpretation

The interpretation phase conforms to ISO 14044 with further guidance from the ILCD General Guide for Life Cycle Assessment. 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.

Cradle-to-grave impact results are summarized by life cycle phase for the functional unit of one square meter of product maintained for 75 years. Results are also presented as a percentage of the total for each impact category indicator. The contributions to total indicator impacts, excluding product replacements, are dominated by the raw material extraction and processing stage. A review of the results indicate that nearly 80% of the impacts from the raw material extraction phase is due to the extraction and processing of the aluminum product components. Upstream material transport and product distribution are generally the next highest contributors while contributions from the remaining life cycle stages are minimal.

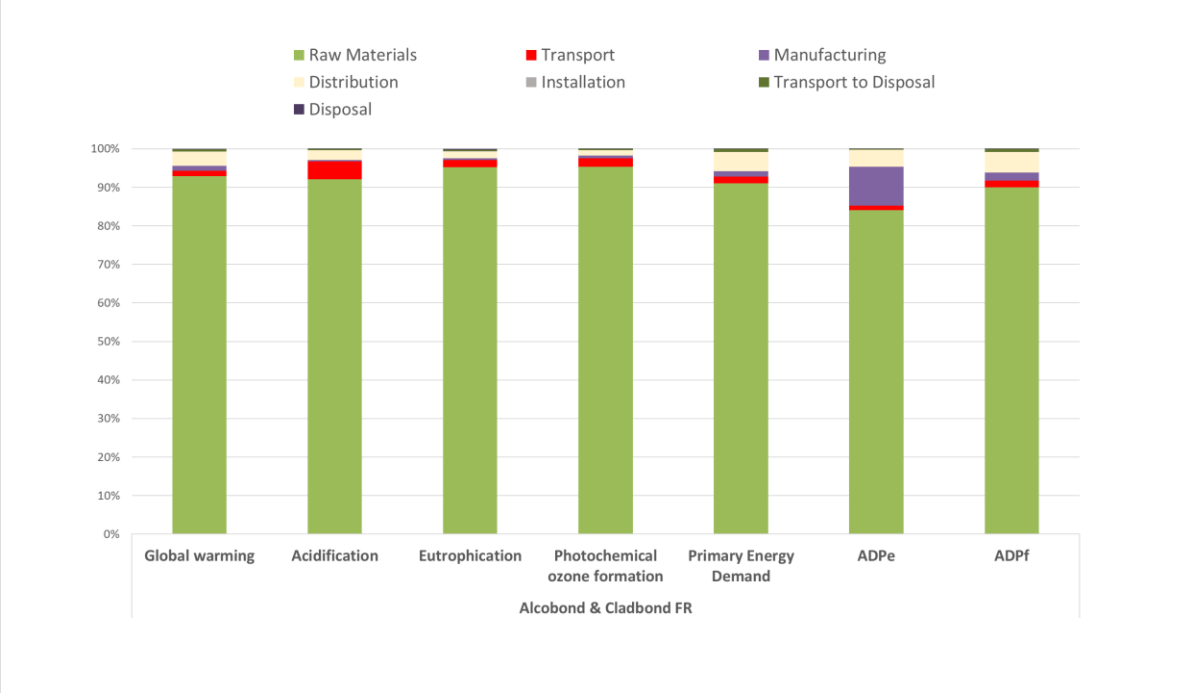


Figure 2. *Contribution analysis for the ACP products (excluding product replacements) – CML-IA.*

7. Additional Environmental Information

RMK Industries is certified to ISO 9001: 2015 and ISO 14001: 2015, both internationally recognized standards.

The certificate for ISO 9001: 2015 guarantees the implementation of a quality management system within our organization, based on process approach, risk management and continuous improvement. Quality management also supports the management of our products, employee involvement and customer focus.

In addition, the certificate for ISO 14001: 2015 guarantees the implementation of an environmental management system within our organization. A suitable environmental policy is implemented, based on sustainable processes and effort to continually improve. All this with a commitment to protecting the environment, responding to changing environmental conditions in balance with socio-economic needs.

International Certification Services (JAS-ANZ) assigned both certificates. In order to obtain and maintain this certificate, the various departments of RMK Industries are evaluated during an audit to determine whether the operation complies with the standards mentioned above.

8. References

1. Life Cycle Assessment of Aluminum Composite Panels. SCS Global Services Report. Prepared for RMK. February 2021.
2. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
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7. CML-IA Characterization Factors. Leiden University, Institute of Environmental Sciences. April 2013. http://cml.leiden.edu/software/data-cmlia.html
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