Due to brand protection the manufacturers name is hidden.
For verification please contact pj@vital-office.net

vitAcoustic®

According to ISO 14025 and ISO 21930

ENVIRONMENT PRODUCT DECLARATION (EPD)

ACOUSTIC PANEL(9MM/12MM/24MM)

Acoustic panel is made from 100% PET, by needle punching processing, The whole production process is complete physical and eco-friendly.

We provide high performance acoustic absorbers which are engineered to reduce unwanted reverberation and optimize sound for significantly improved acoustic comfort in any space. Experience this unique feature and learn why architects and interior designers prefer GREENISH as the first choice in many acoustic projects, such as architectural acoustics projects, industrial noise reduction projects, and machine noise reduction projects, etc.

Now we provide Environmental Product Declarations (EPDs) to document the sustainability of our products.

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

According to ISO 14025 and ISO 21930

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EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road, Northbrook, IL 60062 WWW.UL.COM SPOT.UL.COM
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	Program Operator Rules v2.7 2022
MANUFACTURER NAME AND ADDRESS	
DECLARATION NUMBER	4790586841.101.1
DECLARED PRODUCT & DECLARED UNIT OR DECLARED UNIT	Declared product: acoustic panel (9mm, 12mm, 24mm) Declared unit: 0.093 m^2
REFERENCE PCR AND VERSION NUMBER	Part A: Life Cycle Assessment Calculation Rules and Report Requirements, version 4.0, March 2022 Part B for Non-Metal Ceiling and Interior Wall Panel EPD Requirements, version 2.0, April 2021
DESCRIPTION OF PRODUCT APPLICATION/USE	acoustic panel is a type of building interior used in commercial offices, hotels, restaurants, retail, multifunctional hall, etc.
PRODUCT RSL DESCRIPTION (IF APPL.)	30 years
MARKETS OF APPLICABILITY	Europe, North America, Japan, Australia
DATE OF ISSUE	February 28, 2023
PERIOD OF VALIDITY	5 years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle to gate with options (A1, A2, A3, A4, A5, C1, C2, C3 C4)
YEAR(S) OF REPORTED PRIMARY DATA	July 2021 - June 2022
LCA SOFTWARE & VERSION NUMBER	Simapro 9.1.0
LCI DATABASE(S) & VERSION NUMBER	Ecoinvent 3.6
LCIA METHODOLOGY & VERSION NUMBER	IPCC AR5; CML-IA baseline 4.2; TRACI 2.1 v1.05

The sub-category PCR review was conducted by:	UL Environment PCR Review Panel epd@ul.com
This declaration was independently verified in accordance with ISO 21930:2017. ☐ INTERNAL ☒ EXTERNAL	Shanshan Zhao, UL Environment Shan shan Zhao
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG James A. Mellentine

LIMITATIONS

EXCLUSIONS: EPDS DO NOT INDICATE THAT ANY ENVIRONMENTAL OR SOCIAL PERFORMANCE BENCHMARKS ARE MET, AND THERE MAY BE IMPACTS THAT THEY DO NOT ENCOMPASS. LCAS DO NOT TYPICALLY ADDRESS THE SITE-SPECIFIC ENVIRONMENTAL IMPACTS OF RAW MATERIAL EXTRACTION, NOR ARE THEY MEANT TO ASSESS HUMAN HEALTH TOXICITY. EPDS CAN COMPLEMENT BUT CANNOT REPLACE TOOLS AND CERTIFICATIONS THAT ARE DESIGNED TO ADDRESS THESE IMPACTS AND/OR SET PERFORMANCE THRESHOLDS – E.G. TYPE 1 CERTIFICATIONS, HEALTH ASSESSMENTS AND DECLARATIONS, ENVIRONMENTAL IMPACT ASSESSMENTS, ETC.

ACCURACY OF RESULTS: EPDS REGULARLY RELY ON ESTIMATIONS OF IMPACTS; THE LEVEL OF ACCURACY IN ESTIMATION OF EFFECT DIFFERS FOR ANY PARTICULAR PRODUCT LINE AND REPORTED IMPACT.

COMPARABILITY: ENVIRONMENTAL DECLARATIONS FROM DIFFERENT PROGRAMS (ISO 14025) MAY NOT BE COMPARABLE.
COMPARISON OF THE ENVIRONMENTAL PERFORMANCE OF [NON-METAL CEILING AND INTERIOR WALL 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 THIS PCR.
FULL CONFORMANCE WITH THE PCR FOR [NON-METAL CEILING AND INTERIOR WALL 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 SUBCATEGORY PART B PCR, AND USE EQUIVALENT SCENARIOS WITH RESPECT TO CONSTRUCTION WORKS. HOWEVER, VARIATIONS AND DEVIATIONS ARE POSSIBLE". EXAMPLE OF VARIATIONS: DIFFERENT LCA SOFTWARE AND BACKGROUND LCI DATASETS MAY LEAD TO DIFFERENCES RESULTS FOR UPSTREAM OR DOWNSTREAM OF THE LIFE CYCLE STAGES DECLARED.

Due to brand protection the manufacturers name is hidden.
For verification please contact pj@vital-office.net

vitAcoustic®

According to ISO 14025 and ISO 21930

1. Product Definition and Information

1.1. Description of Company/Organization

is a market leader in manufacturing of PET (polyester fiber) sound absorbing materials. These recyclable panels are engineered to reduce unwanted reverberation and optimize sound for significantly improved acoustic comfort in any space. Experience this unique feature and learn why architects and interior designers prefer GREENISH as the first choice in many acoustic projects, such as architectural acoustics projects, industrial noise reduction projects, and machine noise reduction projects, etc.

The factory is located in the Suzhou, with convenient transportation and only one hour's drive from Shanghai.

1.2. Product Description

1.2.1. Product Identification

The sound-absorbing board is made of 100% PET and is processed by needle punching.

The porous nature of the sound-absorbing board makes its sound absorption, heat insulation and flame retardant effect reach ASTM E84 A level and EN13501 B level, and has passed OEKO-TEX100 certification. The details of ASTM and OEKO-TEX100 certification can be found at https://grspanel.com/

It blends perfectly with natural materials such as stone, concrete, and wood.

1.2.2. Product Specification

Product dimensions vary by installation. Standard sheet panel dimensions are summarized in Table 1.

Table 1. Standards required for acoustic panel

Name	Value	Unit
Sound absorption coefficient(NRC) (ASTM C234-17)	85	%
Surface burning characteristics of building materials (ASTME84)	Class A	Flame spread/smoke developed
Surface burning characteristics of building materials (EN 13501)	Class B	Flame spread/smoke developed

1.2.3. Product Average

The results of this declaration represent an average performance for the listed products.

The average product is calculated based on the weight of production.

1.3. Application

Acoustic panels are widely used in commercial offices, hotels, restaurants, retail, multifunctional hall, art gallery, library, gym, residential cinemas, theaters and auditoriums.

Figure 1. acoustic panel in its various application

1.4. Declaration of Methodological Framework

This declaration is a product-specific EPD and is cradle-to-gate with options, including modules A1-A5 and C1-C4. The underlying LCA upon which this EPD is based included the following life cycle modules: Raw Material supply (A1); Inbound Transportation (A2); Manufacturing (A3); Distribution (A4); Installation (A5); End-of-life, Deconstruction (C1); Transport (C2); Waste processing (C3) and End-of-life, Disposal (C4). No known flows have been deliberately excluded. The product is expected to perform as claimed for the 30-year reference service life if it remains clean and dry in its installed state.

1.5. Technical Requirements

The size of the product is strictly required, the length and width error is controlled within ±2mm, and the thickness error is ±5%. There are no streaks, stray threads, or needle-punched holes on the surface, and the color difference of each batch is controlled within the scope of international standards. The respective standard is listed in the table 1 in

Section 1.2 above for each attribute of the declared product.

ASTM E84-12 Standard Test Method for Surface Burning Characteristics of Building Materials

EN13501 Fire Classification of Construction Products and Building Elements

ASTM C423-17 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

1.6. Properties of Declared Product as Delivered

Table 2. acoustic panel products dimensions included in this EPD

Parameters	Thickness (cm)	Length (cm)	Width (cm)	Area (m^2)	Surface weight (kg/m^2)	Density (kg/m^3)
PET acoustic panel	0.9	244	122	2.97	1.9	2.11E+02
	1.2	280	122.5	3.43	2.4	2.00E+02
	2.4	244	122	2.98	3.5	1.46E+02

1.7. Material composition

The sound-absorbing board is made of 100% PET and is processed by needle punching.

Table 3. Raw material mass of declared unit product included in this EPD

Material	9 mm PET(kg)	12 mm PET(kg)	24mm PET(kg)

PET Fibers	1.77E-01	2.23E-01	3.26E-01

1.8. Manufacturing

Manufacturing Location

The factory that produces PET acoustic panels is located in
Suzhou, China, with convenient transportation, only one hour away from Shanghai. Resources use at the fabrication facilities is allocated to the product based on mass. Moreover, the PET used in the manufacture is virgin.

Manufacturing Process

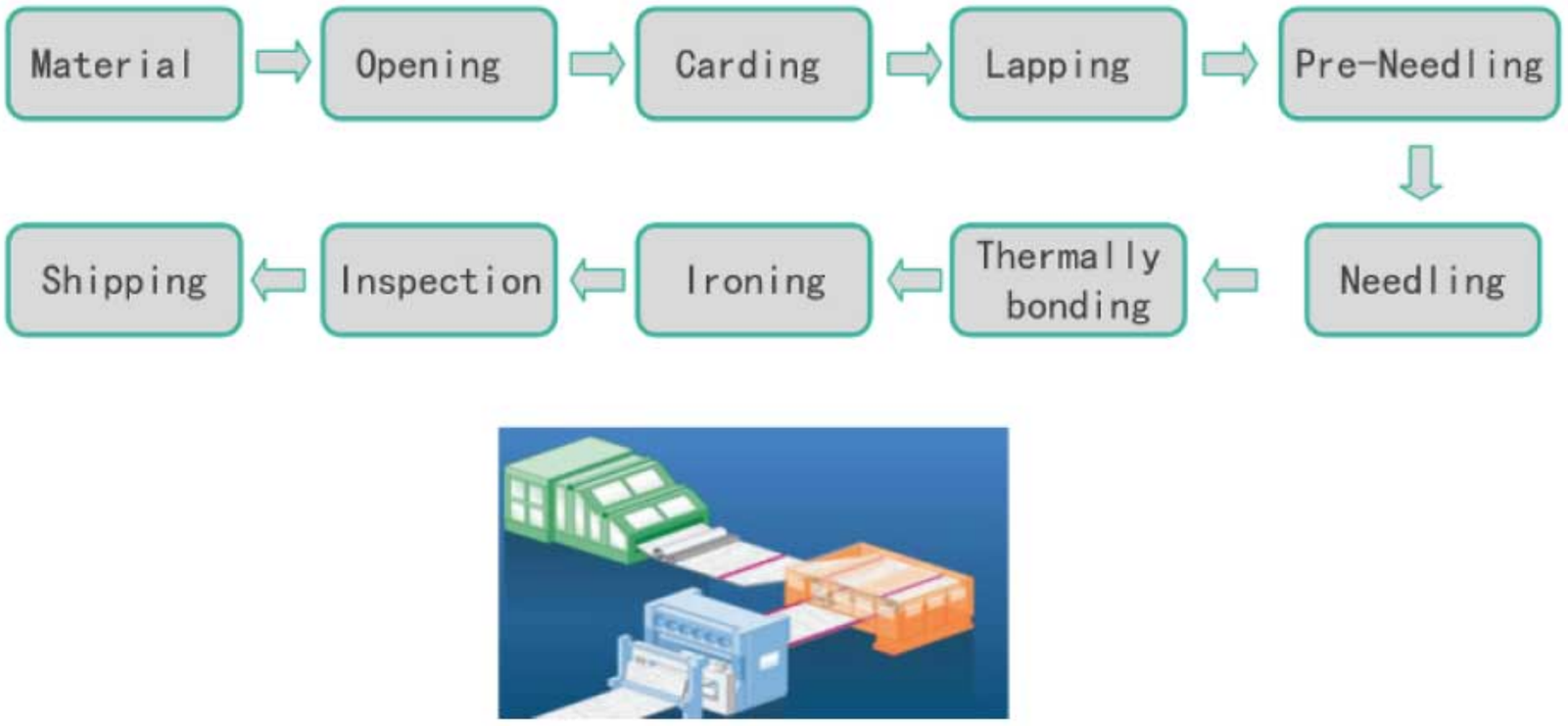

Figure 2. panel production process

1.9. Packaging

There are three main kinds of packaging materials: Paper board/Paper (carton), module label (namplate, barcode, color lable); PVC (Wrap film); Plywood (Pallet,plywood),PE (packaging bag).

1.10. Transportation

Transport distance (Ocean) uses weighted value, namely, Transport distance (Ocean)= ∑market ratio*market distance; the market ratio is 35% of products installed in the US market, 20% in Europe, 30% in Australia and 15% in Japan. The gross distance to the installation site is assumed to be an average of 920 km by truck. The distance from port of shanghai to centralized point of sale is shown in table 6, transported by ship.

1.11. Installation

Installation of the product is accomplished using hand tools with no associated emissions and negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements. Count the effect of 7% mounting scrap into module A5 according to PCR requirements. Therefore, 7% of A1+A2+A3+A4 inventory/impacts will be counted to A5.

1.12. Use and Maintenance

At end-of-life, the products may be recycled or disposed of in a landfill or via incineration.

1.13. Reference Service Life

The Reference Service Life (RSL) of the PET acoustic panels is 30 years.

1.14. Reuse, Recycling, and Energy Recovery

At end-of-life, the products may be recycled or disposed of in a landfill or via incineration.

1.15. Disposal

Due to the lack of reliable data on product waste treatment, we assume that users discard the waste sound-absorbing panels to a waste treatment plant and other waste for centralized processing, and use the assumed processing data in PCR. Since 35% of the products are installed in the US market, 20% are installed in Europe, 30% are installed in Australia, and 15% are installed in Japan. US treatment assumes 100% landfill, Europe treatment assumes 50% recycled, 37% landfill, 13% incineration, assuming that Australia is the same as Europe, Japan treatment assumes 53% recycled, 4% landfill, 43% incineration. Therefore, the waste treatment allocation scheme of this study was set as 32.95% recycling, 54.1% landfill, and 12.95% incineration.

2. Life Cycle Assessment Background information

The declared unit and declared unit provide a reference by means of which the material flows (input and output data) for each information module of a product are normalized (in mathematical sense) to produce data, expressed on a common basis. It is important that the declared units of these products are equivalent so that the results may be interpreted clearly.

In this report, the declared unit is defined as 0.093 m^2 of PET acoustic panel installed for use over a 30-year period.

2.1. 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 use, and product disposal. The life cycle phases included in the product system boundary are shown below.

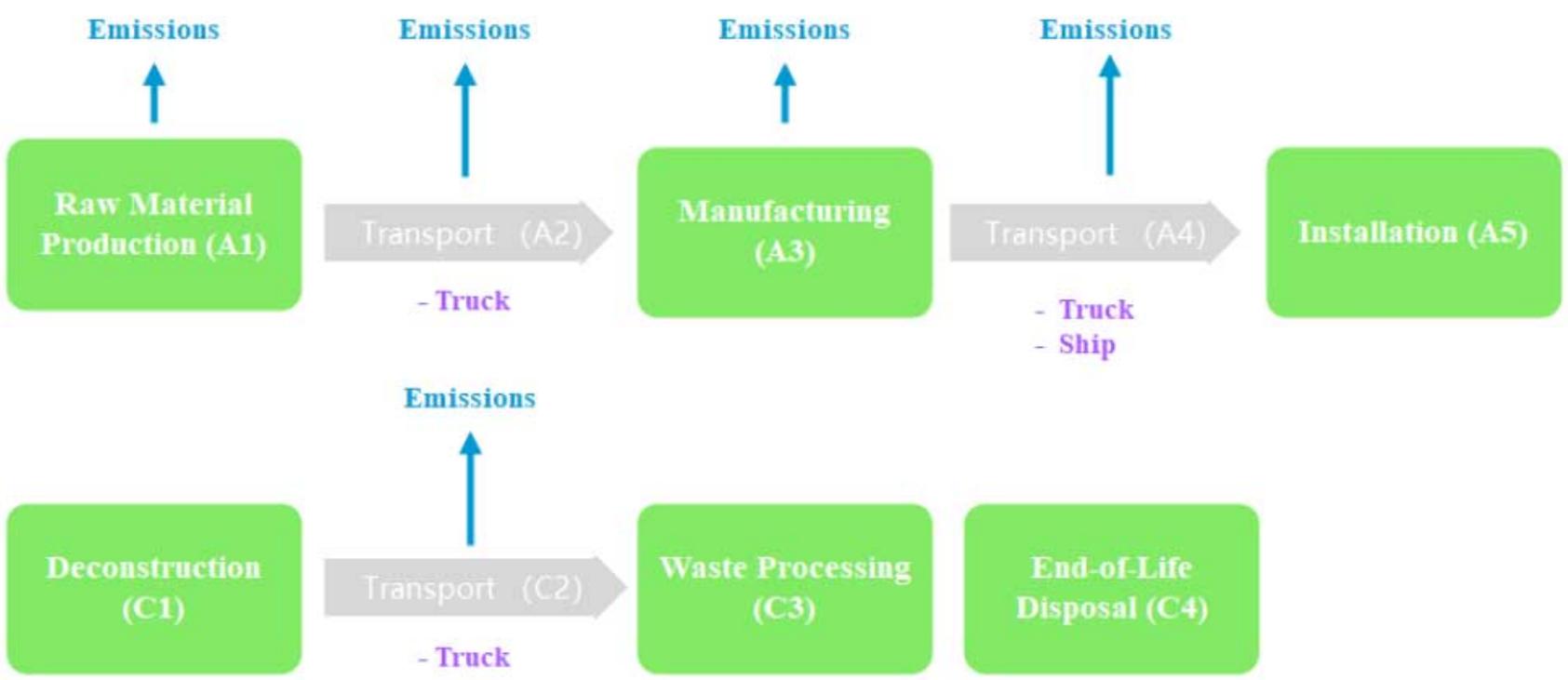

Figure 3. System boundaries

Table 4. Description of the system boundary modules

	Production Stage			Construction		Use							End of Life				Benefits and loads beyond the system boundary
	Raw material supply	Transport	Manufacture	Transport to site	Assembly/Install	Use	Maintance	Repair	Replacement	Refurbishment	Operational Energy use	Operational Water Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, recovery, recycling potential
EPD type	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

X = module included in EPD; MND = module not declared (does not indicate zero impact result)

According to the PCR, the life cycle stage must refer to segmentation in the following three processes:

The productoin stage: raw materials supply (A1), transportation (A2) and manufacture (A3) with the supply of the energy and water input.

The construction stage: transport to site (A4) and assembly/Install (A5).

The use stage: the use (B1), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5) and the operational energy use (B6) and water use (B7) during the RSL (30 years) period.

The end of life stage: deconstruction (C1), transport (C2), waste processing (C3) and disposal (C4).

The Benefits and loads beyond the system boundary: Reuse, recovery, recycling potential(D).

2.2. Excluded Processes

The following steps/stages were not included in the system boundary due to the reason that the elements below are considered irrelevant or not within the boundary to the LCA study of acoustic panels：

- the use (B1), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5) and the operational energy use (B6) and water use (B7).

2.3. Assumption and limitations

In order to carry out the LCA study, the following main assumptions were made:

- Material data for various components of the PET acoustic panel products were provided by the manufacturer. The extraction and processing of raw materials for the primary polyester component material could not be modeled with actual process information. Representative data from the Ecoinvent 3.6 LCI databases were utilized as appropriate.
- Assuming the distance from the plant to the port of Shanghai is 120km and the distance from the port of Shanghai the distance from centralized point of sale (Long Beach, Osaka, Rotterdam and Sydney) to the installation site is 800km. Therefore, The gross distance to the installation site is assumed to be an average of 920 km by truck. The distance from port of shanghai to centralized point of sale is shown in table 6, transported by ship.

- For final disposal of the product and packaging material at end-of-life, all materials are assumed to be transported 50 km by diesel truck to a disposal plant. Datasets representing disposal in a landfill and waste incineration are from Ecoinvent 3.6.
- Assuming that all material removed from the building is disposed of in accordance with the recommended disposal methods in PCR part A, 2.8.5.
- Assuming that all products will lose 5% during production, all waste PET material will be recycled by local companies.

2.4. Cut-off Criteria

According to PCR, for energy, mass and environmental impacts, the cut-off criteria were 1% per the standard. If a flow meets the above criteria for exclusion, yet is believed to potentially have a significant environmental impact, it is included.

Flows excluded for this study include infrastructure, capital goods and workforce burdens. Inputs and outputs associated with infrastructure (construction, maintenance and demolition of buildings/plants, road surfaces, transport equipment, etc.) are not included. This choice is based on experience from previous LCAs where the contribution from these items was negligible due to the long lifetime of the equipment compared to the high production volume of material during that lifetime

2.5. Allocation

Allocation refers to partitioning of input or output flows of a process or a product system between the product systems under study and one or more other product systems. In this study, there are three types of allocation procedures considered:

Multi-input processes

For data sets in this study, the allocation of the inputs from coupled processes is generally carried out via the mass. The consumption of raw materials is allocated by mass ratio. The transportation of raw materials is allocated by mass ratio.

Multi-output processes

In the production of acoustic panel, the total consumption of energy ancillary materials during manufacturing is equally allocated to per unit mass. No other by products are produced from the production, hence there is no production of by products that need to be used to allocate the situation.

Allocation for recovery processes

For the allocation of residuals, the model “allocation cut-off by classification” by Ecoinvent was used. The underlying philosophy of this approach is that primary (first) production of materials is always allocated to the primary user of a material. If a material is recycled, the primary producer does not receive any credit for the provision of any recyclable materials. Consequently, recyclable materials are available burden-free for recycling processes, and secondary (recycled) materials bear only the impacts of the recycling processes.

2.6. Period under Review

The study used primary data collected from July 2021 - June 2022.

2.7. Data Sources

provides preliminary data for the raw materials and energy in the production process, and the source of the secondary LCI data is the Ecoinvent 3.6 database. On-site data mainly include the types and usage of raw materials in raw material production, energy consumption in parts processing and product assembly, transportation data in sales and transportation, energy consumption in product use, and waste generation in

product disposal; Background data mainly include environmental impact factors in raw material production, parts processing and product assembly, sales and transportation, product use, and product disposal.

The raw material data comes from the factory's bill of material, the transportation data comes from the factory's logistics order records, and the energy consumption in the manufacturing process comes from the distribution of the company's electricity meter record data, which is verified by the calculation of equipment parameters.

2.8. Data Quality

The data quality requirements for this study were as follows:

- 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 10 years old (typically 2015 or more recent).
- Manufacturing data uses global data in the ecoinvent database. The surrogate data used in the evaluation is considered to be similar to the actual process.
- 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 of results are not quantified due to a lack of data.
- The LCA model included all known mass and energy flows for production of the panel products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model e.g. transport data from the plant to the installation point, which use the values suggested by PCR.
- 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.
- 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.
- Main data such as raw materials and transportation are provided by Company. The Ecoinvent database is used for secondary LCI datasets.
- These datasets contained relatively recent data (<10 years), but lacked geographical representativeness.

3. Life Cycle Assessment Scenarios

Table 5. Transport to the building site (A4 without ocean)

NAME	VALUE	UNIT
Fuel type	Diesel	
Liters of fuel	6.48E-03	l/100km
Vehicle type	Lorry	
Transport distance	920	km
Capacity utilization (including empty runs mass based)	90	%
Gross density of products transported	N/A	kg/m^3
Capacity utilization volume factor (factor: =1 or <1 or ≥1 for compressed or nested packaging products)	=1	-

Table 6. Transport to the building site(A4 ocean)

NAME	VALUE	VALUE	VALUE	VALUE	UNIT

Destination	Long Beach	Osaka	Rotterdam	Sydney	
Fuel type	Heavy oil	Heavy oil	Heavy oil	Heavy oil	
Liters of fuel	1.37E-03	1.37E-03	1.37E-03	1.37E-03	L/100km
Vehicle type	ship	ship	ship	ship	
Transport distance	11112	1513	19448	8619	km
Capacity utilization (including empty runs mass based)	95	95	95	95	%
Gross density of products transported	N/A	N/A	N/A	N/A	kg/m^3
Capacity utilization volume factor (factor: =1 or <1 or ≥1 for compressed or nested packaging products)	=1	=1	=1	=1	-

Table 7. Installation into the building (A5)

Name	Value			Unit
Ancillary materials	0.00E+00			kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	0.00E+00			m^3
Other resources	0.00E+00			kg
Electricity consumption	0.00E+00			kWh
Other energy carriers	0.00E+00			MJ
Product loss per declared unit	9mm: 1.24E-02 12mm: 1.57E-02 24mm: 2.28E-02			kg
Waste materials at the construction site before waste processing, generated by product installation	9mm: 1.24E-02 12mm: 1.57E-02 24mm: 2.28E-02			kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)	Disposal- 9mm: 9.30E-03 Disposal- 12mm: 1.17E-02 Disposal- 24mm: 1.71E-02			kg
Mass of packaging waste specified by type		9mm	12mm	24mm	kg
	Paper	1.02E-02	1.12E-02	1.84E-02	
	Packaging bag	2.60E-03	2.85E-03	4.69E-03	
	Stretch film	5.17E-05	5.65E-05	9.30E-05	
	Wood	1.93E-07	2.11E-07	3.47E-07	
Biogenic carbon contained in packaging	-			$kg\ CO_2$
Direct emissions to ambient air, soil and water	0.00E+00			kg
VOC emissions	0.00E+00			$\mu g/m^3$

Table 8. Packaging Disposal Assumptions by Region

Name	Coutry	Material Type	recycling	Landfill	Incineration
Packaging Disposal Assumptions by Region	United States	Paper	68%	20%	5%
		Plastic	9%	68%	17%
		Wood(EU)	31.1%	68.9%	25.7
	Europe	Paper	82.3%	17.7%	7.8%
		Plastic	41%	39%	31.0%

		Wood	31.1%	68.9%	25.7
	Japan	Paper	21%	1%	78%
		Plastic	21%	1%	78%
		Wood	21%	1%	78%
	Australia	Paper(EU)	82.3%	17.7%	7.8%
		Plastic(EU)	41%	39%	31.0%
		Wood(EU)	31.1%	68.9%	25.7
	Total	Paper	66.75%	16.00%	17.35%
		Plastic	26.80%	43.45%	35.15%
		Wood	29.59%	58.72%	25.70%

Table 9. End of life (C1-C4)

Name		Value		Unit
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		See description above		
Collection process (specified by type)	Collected separately	-		kg
	Collected with mixed construction waste	9mm	1.90E+00	kg
		12mm	2.40E+00	kg
		24mm	3.50E+00	kg
Recovery (specified by type)	Reuse	-		kg
	Landfill	9mm	1.03E+00	kg
		12mm	1.30E+00	kg
		24mm	1.03E+00	kg
	recycling	9mm	6.30E-01	kg
		12mm	7.91E-01	kg
		24mm	6.30E-01	kg
	Incineration	9mm	2.48E-01	kg
		12mm	3.11E-01	kg
		24mm	2.48E-01	kg
	Incineration with energy recovery	-		kg
	Energy conversion efficiency rate	-		kg
Disposal (specified by type)	Product or material for final deposition	0		kg
Removals of biogenic carbon (excluding packaging)		0		kg CO_2

4. Life Cycle Assessment Results

4.1. Carbon emissions and uptake

The uptake and emissions of product and packaging material is depicted in the table below.

Table 10. Carbon emissions and uptake(9mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Biogenic Carbon Removal from Product(BCRP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Product (BCEP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic Carbon Removal from Packaging(BCRK)	kg CO2	0.00E+00	0.00E+00	1.88E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Packaging(BCEK)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E-04	0.00E+00	0.00E+00
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes(BCEW)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcination Carbon Emissions(CCE)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbonation Carbon Removals(CCR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes(CWNR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.45E-05	0.00E+00	0.00E+00

Table 11. Carbon emissions and uptake(12mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Biogenic Carbon Removal from Product(BCRP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Product (BCEP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Removal from Packaging(BCRK)	kg CO2	0.00E+00	0.00E+00	2.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Packaging(BCEK)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E-04	0.00E+00	0.00E+00
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes(BCEW)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcination Carbon Emissions(CCE)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbonation Carbon Removals(CCR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes(CWNR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.32E-04	0.00E+00	0.00E+00

Table 12. Carbon emissions and uptake(24mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Biogenic Carbon Removal from Product(BCRP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Product (BCEP)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Removal from Packaging(BCRK)	kg CO2	0.00E+00	0.00E+00	3.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission from Packaging(BCEK)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.86E-04	0.00E+00	0.00E+00
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes(BCEW)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcination Carbon Emissions(CCE)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Carbonation Carbon Removals(CCR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes(CWNR)	kg CO2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.76E-04	0.00E+00	0.00E+00

4.2. Life Cycle Impact Assessment Results

Table 13. North American Impact Assessment Results (9mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO_2 eq	5.87E-01	3.96E-03	9.09E-02	3.57E-02	5.51E-02	1.45E-03	6.40E-02
Acidification	kg SO_2 eq	2.34E-03	1.80E-05	4.21E-04	5.15E-04	2.32E-04	6.60E-06	2.07E-05
Eutrophication	kg N eq	1.39E-03	4.46E-06	1.68E-04	5.59E-05	1.41E-04	1.65E-06	1.25E-03
Ozone depletion	kg CFC-11 eq	3.55E-08	1.01E-09	2.15E-09	8.20E-09	3.30E-09	3.57E-10	5.13E-10
Smog	kg O_3 eq	2.91E-02	4.31E-04	6.28E-03	8.32E-03	3.12E-03	1.58E-04	5.35E-04
Abiotic depletion (fossil fuels)	MJ	1.27E+01	6.26E-02	9.56E-01	5.21E-01	9.99E-01	2.21E-02	3.59E-02

Table 14. International Impact Assessment Results (9mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO2 eq	5.87E-01	3.96E-03	9.09E-02	3.57E-02	5.51E-02	1.45E-03	6.40E-02
Ozone layer depletion (ODP)	kg CFC-11 eq	2.76E-08	7.62E-10	1.31E-09	6.17E-09	2.53E-09	2.68E-10	4.00E-10
Acidification	kg SO2 eq	2.32E-03	1.56E-05	3.91E-04	5.01E-04	2.27E-04	5.68E-06	1.64E-05
Eutrophication	kg PO_4^{-3} eq	7.10E-04	3.60E-06	9.97E-05	5.99E-05	7.16E-05	1.33E-06	4.64E-04
Photochemical oxidation	kg C2H4 eq	1.31E-04	6.50E-07	1.60E-05	1.67E-05	1.21E-05	2.40E-07	1.94E-06

Table 15. North American Impact Assessment Results (12mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO_2 eq	7.42E-01	5.00E-03	1.03E-01	4.51E-02	6.80E-02	1.83E-03	8.08E-02
Acidification	kg SO_2 eq	2.95E-03	2.28E-05	4.78E-04	6.51E-04	2.89E-04	8.33E-06	2.62E-05
Eutrophication	kg N eq	1.75E-03	5.64E-06	1.90E-04	7.06E-05	1.72E-04	2.08E-06	1.58E-03
Ozone depletion	kg CFC-11 eq	4.48E-08	1.28E-09	2.41E-09	1.04E-08	4.15E-09	4.50E-10	6.48E-10
Smog	kg O_3 eq	3.67E-02	5.44E-04	7.13E-03	1.05E-02	3.88E-03	2.00E-04	6.76E-04
Abiotic depletion (fossil fuels)	MJ	1.60E+01	7.90E-02	1.08E+00	6.58E-01	1.25E+00	2.79E-02	4.54E-02

Table 16. International Impact Assessment Results (12mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO2 eq	7.42E-01	5.00E-03	1.03E-01	4.51E-02	6.80E-02	1.83E-03	8.08E-02
Ozone layer depletion (ODP)	kg CFC-11 eq	3.48E-08	9.62E-10	1.46E-09	7.80E-09	3.17E-09	3.39E-10	5.05E-10

Acidification	kg SO2 eq	2.93E-03	1.97E-05	4.44E-04	6.33E-04	2.83E-04	7.18E-06	2.07E-05
Eutrophication	kg PO_4^{-3} eq	8.97E-04	4.55E-06	1.13E-04	7.57E-05	8.77E-05	1.68E-06	5.86E-04
Photochemical oxidation	kg C2H4 eq	1.66E-04	8.21E-07	1.81E-05	2.11E-05	1.51E-05	3.03E-07	2.45E-06

Table 17. North American Impact Assessment Results (24mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO_2 eq	1.08E+00	7.29E-03	2.79E-01	6.57E-02	1.10E-01	2.67E-03	1.18E-01
Acidification	kg SO_2 eq	4.30E-03	3.32E-05	1.30E-03	9.49E-04	4.64E-04	1.21E-05	3.82E-05
Eutrophication	kg N eq	2.56E-03	8.22E-06	4.82E-04	1.03E-04	2.60E-04	3.04E-06	2.31E-03
Ozone depletion	kg CFC-11 eq	6.54E-08	1.87E-09	5.67E-09	1.51E-08	6.20E-09	6.57E-10	9.45E-10
Smog	kg O_3 eq	5.36E-02	7.93E-04	1.95E-02	1.53E-02	6.30E-03	2.92E-04	9.86E-04
Abiotic depletion (fossil fuels)	MJ	2.34E+01	1.15E-01	2.74E+00	9.60E-01	1.91E+00	4.07E-02	6.62E-02

Table 18. International Impact Assessment Results (24mm)

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
Global warming (GWP100a)	kg CO_2 eq	1.08E+00	7.29E-03	2.79E-01	6.57E-02	1.10E-01	2.67E-03	1.18E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	5.08E-08	1.40E-09	3.19E-09	1.14E-08	4.71E-09	4.94E-10	7.37E-10
Acidification	kg SO_2 eq	4.27E-03	2.87E-05	1.21E-03	9.23E-04	4.53E-04	1.05E-05	3.02E-05
Eutrophication	kg PO_4^- eq	1.31E-03	6.64E-06	2.92E-04	1.10E-04	1.35E-04	2.45E-06	8.54E-04
Photochemical oxidation	kg C2H4 eq	2.42E-04	1.20E-06	4.78E-05	3.08E-05	2.36E-05	4.42E-07	3.57E-06

4.3. Life Cycle Inventory Results

Table 19. Resource use for the 9mm PET acoustic panel product.

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ	1.34E+01	6.35E-02	1.01E+00	5.38E-01	1.06E+00	2.24E-02	3.71E-02
RPR_E:Renewable primary energy used as energy carrier (fuel)	MJ	3.82E-01	6.35E-04	1.71E-01	9.32E-03	3.95E-02	2.21E-04	8.42E-04
$NRPR_M$:Non-renewable primary resources with energy content used as material	MJ	6.86E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RPR_M:Renewable primary resources with energy content used as material	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW:Use of net fresh water	m^3	2.58E-01	4.74E-04	1.42E-02	3.65E-03	1.96E-02	1.54E-04	4.38E-03
SM: Use of secondary raw materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF:Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF:Use of none renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20. Output Flows and Waste Categories for the 9mm PET acoustic panel product.

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C1	C2	C4

HWD: Hazardous waste disposed	kg	5.48E-05	3.68E-08	1.33E-06	3.15E-07	3.96E-06	0.00E+00	1.42E-08	5.38E-08
NHWD: Non-hazardous waste disposed	kg	5.44E-02	5.39E-03	8.07E-03	2.03E-02	9.04E-03	0.00E+00	1.05E-03	9.67E-02
HLRW: High-level radioactive waste, conditioned, to final repository	kg	1.94E-06	3.60E-09	1.00E-07	6.54E-08	1.48E-07	0.00E+00	1.13E-09	4.13E-09
ILLRW: Intermediate and low-level radioactive waste, conditioned, to final repository	kg	1.43E-05	4.26E-07	6.51E-07	3.50E-06	1.33E-06	0.00E+00	1.50E-07	1.83E-07
CRU: Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE: Exported thermal energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE: Exported electricity energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER: materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR: materials for recycling	kg	0.00E+00	0.00E+00	3.06E-03	0.00E+00	6.83E-03	6.30E-01	0.00E+00	0.00E+00

Table 21. Resource use for the 12mm PET acoustic panel product.

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C2	C4
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ	1.70E+01	8.02E-02	1.14E+00	6.80E-01	1.32E+00	2.83E-02	4.68E-02
RPR_E:Renewable primary energy used as energy carrier (fuel)	MJ	4.83E-01	8.02E-04	1.91E-01	1.18E-02	4.81E-02	2.79E-04	1.06E-03
$NRPR_M$:Non-renewable primary resources with energy content used as material	MJ	8.68E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RPR_M:Renewable primary resources with energy content used as material	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW:Use of net fresh water	m^3	3.25E-01	5.99E-04	1.59E-02	4.61E-03	2.45E-02	1.94E-04	5.53E-03
SM: Use of secondary raw materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF:Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF:Use of none renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 22. Output Flows and Waste Categories for the 12mm PET acoustic panel product.

IMPACT CATEGORY	UNIT	A1	A2	A3	A4	A5	C1	C2	C4
HWD: Hazardous waste disposed	kg	6.93E-05	4.65E-08	1.51E-06	3.98E-07	4.99E-06	0.00E+00	1.79E-08	6.80E-08
NHWD: Non-hazardous waste disposed	kg	6.87E-02	6.81E-03	9.14E-03	2.57E-02	1.09E-02	0.00E+00	1.33E-03	1.22E-01
HLRW: High-level radioactive waste, conditioned, to final repository	kg	2.44E-06	4.55E-09	1.13E-07	8.26E-08	1.85E-07	0.00E+00	1.43E-09	5.21E-09
ILLRW: Intermediate and low-level radioactive waste, conditioned, to final repository	kg	1.81E-05	5.38E-07	7.29E-07	4.42E-06	1.67E-06	0.00E+00	1.89E-07	2.31E-07
CRU: Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE: Exported thermal energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE: Exported electricity energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER:materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR: materials for recycling	kg	0.00E+00	0.00E+00	3.86E-03	0.00E+00	7.47E-03	1.17E-03	0.00E+00	0.00E+00

Table 23. Resource use for the 24mm PET acoustic panel product.

Impact Category	Unit	A1	A2	A3	A4	A5	C2	C4
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ	2.48E+01	1.17E-01	2.88E+00	9.91E-01	2.02E+00	4.13E-02	6.83E-02
RPR_E:Renewable primary energy used as energy carrier (fuel)	MJ	7.04E-01	1.17E-03	4.11E-01	1.72E-02	7.95E-02	4.07E-04	1.55E-03
$NRPR_M$:Non-renewable primary resources with energy content used as material	MJ	1.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RPR_M:Renewable primary resources with energy content used as material	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW:Use of net fresh water	m^3	4.74E-01	8.74E-04	3.76E-02	6.72E-03	3.69E-02	2.84E-04	8.07E-03
SM: Use of secondary raw materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF:Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF:Use of none renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 24. Output Flows and Waste Categories for the 24mm PET acoustic panel product.

Impact Category	Unit	A1	A2	A3	A4	A5	C1	C2	C4
HWD: Hazardous waste disposed	kg	1.01E-04	6.79E-08	4.16E-06	5.81E-07	7.41E-06	0.00E+00	2.61E-08	9.91E-08
NHWD: Non-hazardous waste disposed	kg	1.00E-01	9.94E-03	2.44E-02	3.75E-02	1.64E-02	0.00E+00	1.94E-03	1.78E-01
HLRW: High-level radioactive waste, conditioned, to final repository	kg	3.57E-06	6.64E-09	2.77E-07	1.20E-07	2.78E-07	0.00E+00	2.08E-09	7.60E-09
ILLRW: Intermediate and low-level radioactive waste, conditioned, to final repository	kg	2.64E-05	7.84E-07	1.69E-06	6.45E-06	2.48E-06	0.00E+00	2.75E-07	3.37E-07
CRU: Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE: Exported thermal energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE: Exported electricity energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER:materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR: materials for recycling	kg	0.00E+00	0.00E+00	5.64E-03	0.00E+00	1.23E-02	1.71E-03	0.00E+00	0.00E+00

5. LCA Interpretation

5.1. 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 evaluationat the end of the study.

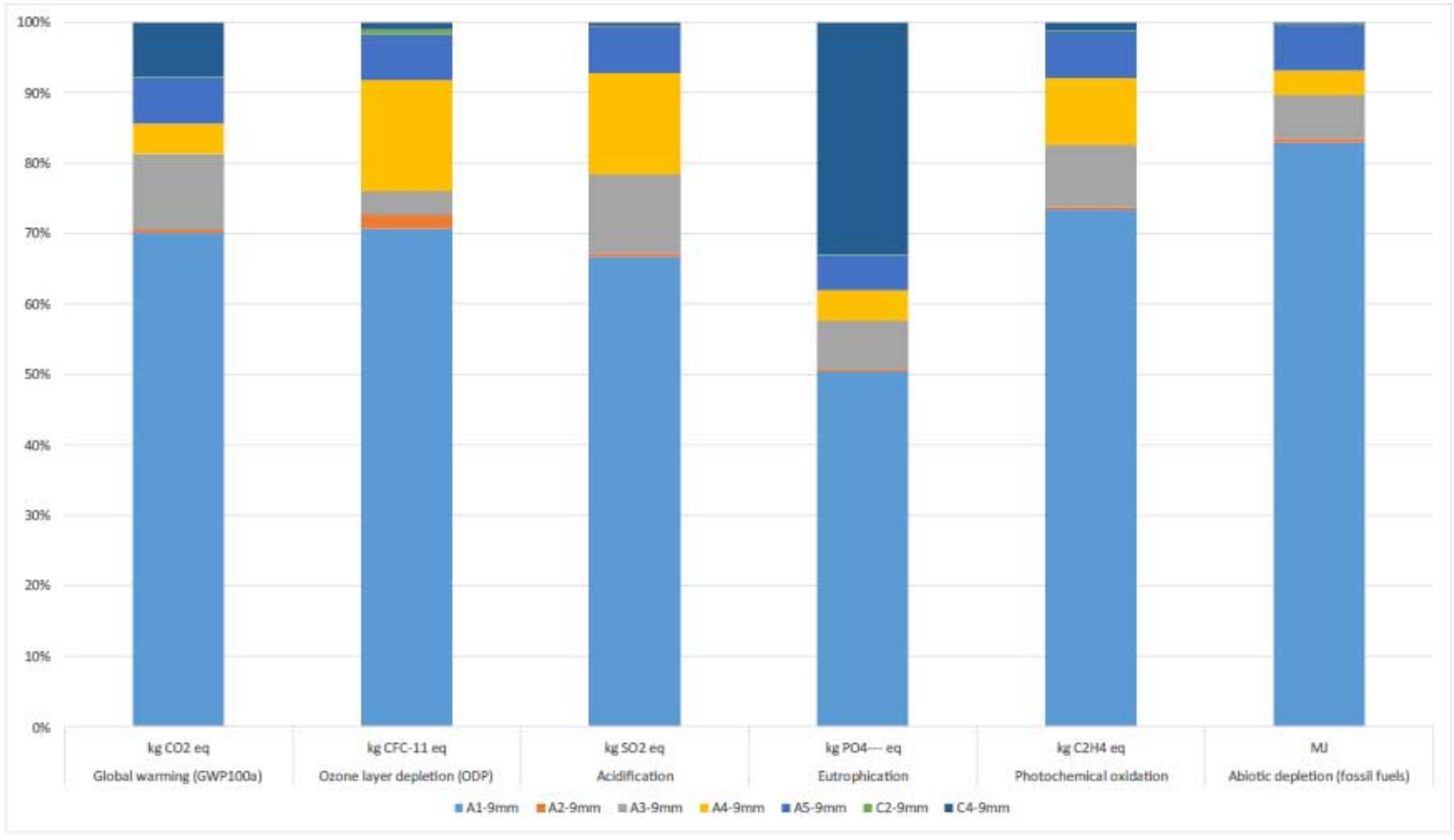

Figure 4. Life Cycle Impact Assessment of 9 mm PET acoustic panel product relative importance in percentage terms for the different life stages. [Based on CML-IA baseline V4.2 / EU25]

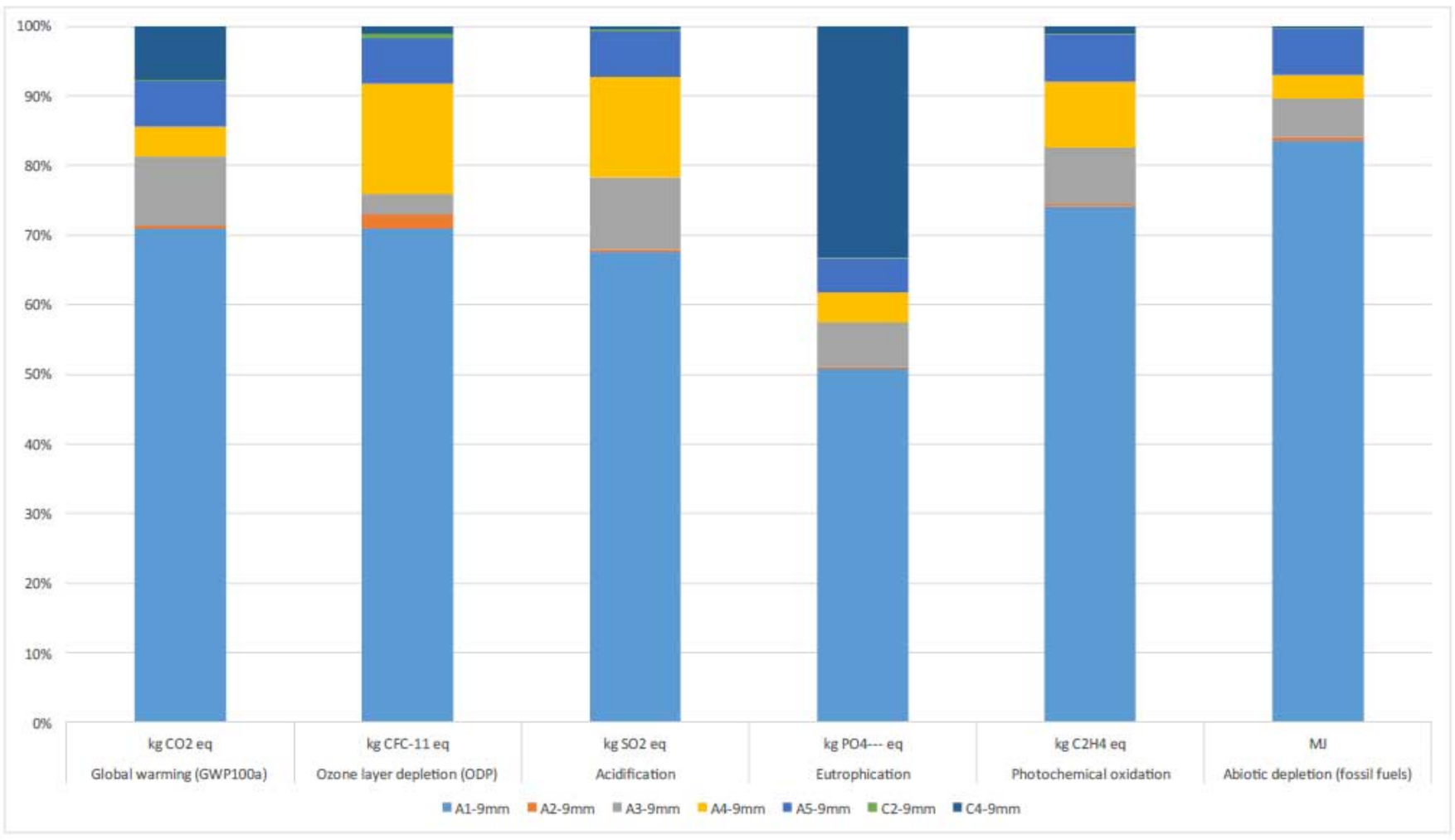

Figure 5. Life Cycle Impact Assessment of 12 mm PET acoustic panel product relative importance in percentage terms for the different life stages. [Based on CML-IA baseline V4.2 / EU25]

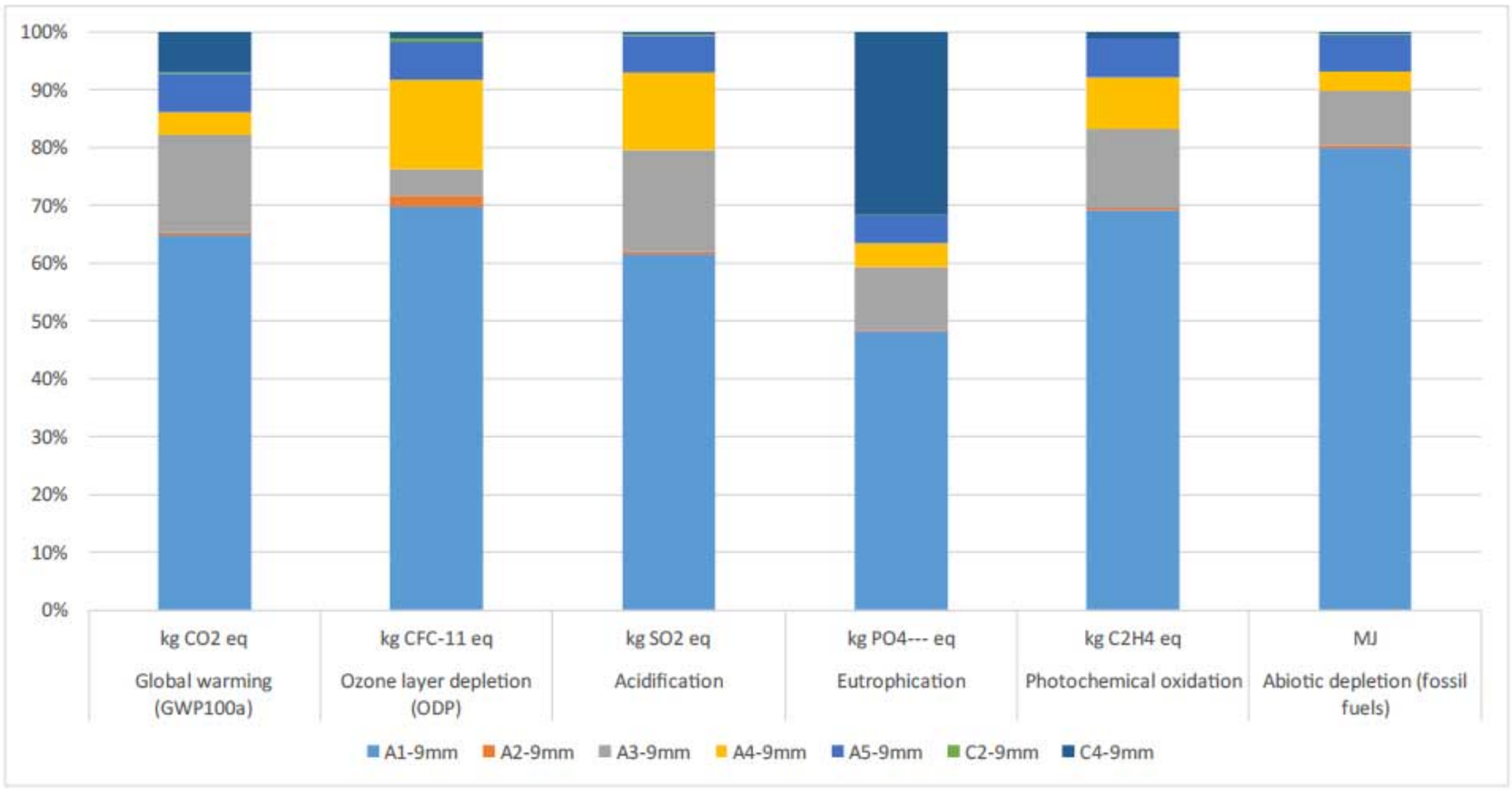

Figure 6. Life Cycle Impact Assessment of 24 mm PET acoustic panel product relative importance in percentage terms for the different life stages. [Based on CML-IA baseline V4.2 / EU25]

According to the impact assessment results, it can be seen that the production stage (A1-A3) of PET acoustic panel products is the main source of environmental contribution, contributed over 80% of environmental impact in all categories except Eutrophication. The results also consistent with the expected inventory analysis. The transportation of the product to the installation site (A4) has the second highest environmental impact. The disposal process of products has a large environmental contribution to Eutrophication.

The environmental impact of 24mm PET acoustic panel is higher than that of 9mm and 12mm acoustic panel product, and the contribution distributions of different processes are similar. This is consistent with the expected result.

6. Additional Environmental Information

6.1. Environment and Health During Manufacturing

has a comprehensive environmental, health, and safety management program. All products go through a safety, health, and environmental review prior to sale. No environmental or health impacts are expected during the manufacture of the PET acoustic panels. According to the requirements of PCR, other packaging is discarded after recycling once.

6.2. Delayed Emissions

No delayed emissions are expected from this product.

6.3. Further Information

Additional information about acoustic panel can be found on the website:

7. References

PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment (March 2022, version 4.0)

PCR Part B: Non-Metal Ceiling and Interior Wall Panel EPD Requirements, Version 2.0, UL Environment, April 2021

ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and Framework

ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.

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

US EPA, ORD/NRMRL/Sustainable Technology Division, Systems Analysis Branch, SOP No. S-10637-OP-1-0- Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI), Software Name and

Version Number: TRACI version 2.1, USER'S MANUAL, 24 July 2012

CML: Developed by the Center of Environmental Science of Leiden University.

Ecoinvent: high-quality data for sustainability assessments worldwide

ASTM E84-12 Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM C518-10 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow

ASTM C636 / C636M-08 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

ASTM C423-09a Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E1414 / E1414M-11a Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

ASTM E1110-06 (2011) Standard Classification for Determination of Articulation Class

ASTM E1111 (2007) T est Method for Measuring the Interzone Attenuation of Ceiling System

8. Contact Information

8.1. Report Owner

8.2. LCA practitioner

SRF testing and certification (Changzhou) Co., Ltd.
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