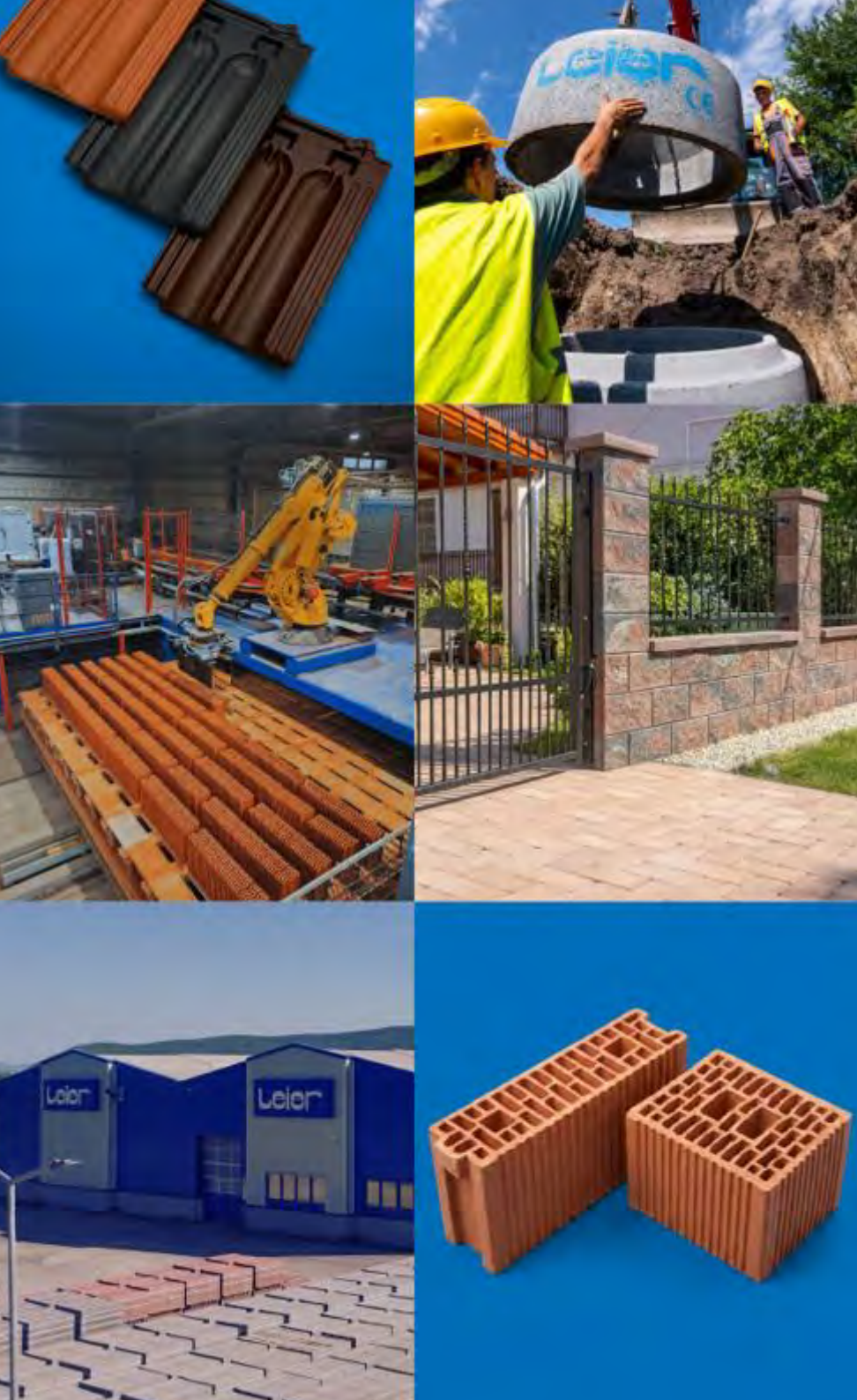




ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

LEIER CERAMIC ROOF TILES

LEIER ROM SRL



EPD HUB, HUB-6975

Published on 17.07.2026, last updated on 17.07.2026, valid until 16.07.2031

Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1.



Created with One Click LCA



GENERAL INFORMATION

MANUFACTURER

Manufacturer	Leier Rom SRL
Address	14 Cîbinului Street, 400615, Cluj-Napoca, Cluj County, Romania
Contact details	info@leier.ro
Website	www.leier.ro

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804:2012+A2:2019/AC:2021 and ISO 14025
PCR	EPD Hub Core PCR Version 1.2, 24 Mar 2025
Sector	Construction product
Category of EPD	Third party verified EPD
Parent EPD number	-
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Stefan Cosuta, Envirocert SRL
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☒ External verification
EPD verifier	Haiha Nguyen as an authorized verifier for EPD Hub

This EPD is intended for business-to-business and/or business-to-consumer communication. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	Leier ceramic roof tiles
Additional labels	-
Product reference	-
Place(s) of raw material origin	Romania
Place of production	Romania, Sighisoara (Mures County)
Place(s) of installation and use	Romania
Period for data	calendar year 2025
Averaging in EPD	Multiple products
Variation in GWP-fossil for A1-A3 (%)	<0.01%
GTIN (Global Trade Item Number)	-
NOBB (Norwegian Building Product Database)	-
A1-A3 Specific data (%)	94,1

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 tonne
Declared unit mass	1000 kg
Mass of packaging	3,629 kg
GWP-fossil, A1-A3 (kgCO ₂ e)	319
GWP-total, A1-A3 (kgCO ₂ e)	315
Secondary material, inputs (%)	0,07
Total energy use, A1-A3 (kWh)	1470
Net freshwater use, A1-A3 (m ³)	1,2



PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Company Overview

Founded in 1965, the Leier Group possesses over 60 years of experience and history in operating at full capacity within the construction materials industry across Europe. Present on the Romanian market since 2005 through LEIER ROM S.R.L., the group has established itself as a leading manufacturer of primary importance nationwide. Following a continuous strategy of reinvesting profits into plant modernization, technological upgrades, and production capacity expansion, Leier supports regional economic and social progress by driving private investment and creating numerous stable jobs.

Production Facilities and Strategic Presence

To ensure efficient distribution and to meet nationwide demand, Leier operates advanced, highly performing industrial facilities in strategic locations throughout Romania. The company's production footprint includes major manufacturing plants in Unirea (Alba County), Iași, Câțcău (Cluj County), Sighisoara (Mures County), and Feldioara (Brașov County). These modern units utilize advanced technologies and high-capacity machinery to deliver a comprehensive and diverse portfolio of construction materials that strictly comply with applicable European quality standards.



LEIER GROUP Eastern Europe plant network

PRODUCT DESCRIPTION

This Environmental Product Declaration covers the ceramic roofing tiles product ranges manufactured by LEIER ROM S.R.L. exclusively within its designated production plant in Sighisoara, Mures County. The Leier ceramic roofing line consists of various clay roofing tiles (including models such as Marsilia, Francia, Baltica, Bavaria, Bavaria Duo, Portugheza, Valahia, and Andalusia) designed for residential and commercial sloped roofing applications, defined by a weather-resistant configuration engineered to optimize structural durability, water impermeability, and acoustic comfort. As the raw clay mix, manufacturing methodology, and essential raw materials are standardized across the designated production line—the environmental impact results are presented for 1 ton (1,000 kg) of finished product. Additionally, the Annex to this EPD presents the specific GWP (Global Warming Potential) values obtained individually for each of the manufacturing configurations (including natural and engobed options)

Reference standard: EN 1304: 2013

Product Name	Dimensions (mm)	Pcs / sqm	Available colours
Francia	492x295	9.9	Natural, Brown, Antracythe black
Marsilia	390x240	15.5	Natural, Brown, Antracythe black
Bavaria	380x180	34	Natural
Bavaria Duo	445x292	12.25	Natural
Portugheza	385x242	16	Natural
Baltica	492x300	9.8	Natural
Valahia	390x216	16.4	Natural
Andalusia	300x130x170	48	Natural
	350x140x175	38	

Construction and Materials

Leier ceramic roofing tiles are engineered using specialized, optimized clay

mixtures and burning processes to establish a highly durable, structurally stable, and weather-resistant configuration:

- Fired Clay Core Matrix: Formulated from 100% natural and ecological clay reserves, burned at high industrial temperatures to guarantee excellent mechanical resistance, high frost-thaw stability, and prolonged service longevity.
- Optimized Interlocking Profile: Designed with advanced double or single interlocking geometries and specialized drainage channels to secure excellent water tightness, wind suction resistance, and precise alignment.
- Angobe Surface Enhancements (Optional): Utilizes a 100% natural liquid clay-based coloring coating applied before firing. Through firing, it integrates into the ceramic matrix, providing superior resistance against UV radiation, weather wear, dust accumulation, and moss formation, available in premium finishes such as Brown and Anthracite Black.

Manufacturing and Sustainability

Operating under standardized, high-performance industrial procedures at the Sighisoara factory—a site with a manufacturing tradition of over 100 years—the production process relies on local mineral-based raw materials. The high-temperature firing utilizes modern, energy-efficient methodologies that significantly lower the carbon footprint compared to alternative roofing materials, establishing a chemically stable, inert, and ecological material profile.

Product Benefits

- Optimized Thermal & Acoustic Performance: Due to the natural thermal capacity of fired clay, the tiles reduce summer heat transfer into the attic space. Furthermore, the high mass of the clay structure effectively minimizes external environmental noise caused by heavy rain or hail, ensuring an exceptionally quiet indoor microclimate.
- Microclimate & Health Safety: Fired at extreme temperatures, the clean mineral profile achieves a Euroclass A1 reaction to fire without containing or emitting any hazardous organic compounds (VOCs), toxic smoke, or pollutants during fire exposure.

Longevity & Circular Economy: Backed by a 40-year warranty, the

exceptional mechanical stability ensures a lifecycle spanning over decades. At the end of the building building lifecycle, the tiles can be fully crushed, recycled, and re-fed into secondary aggregate loops or naturally integrated back into the eco-system without leaving any toxic waste.

- Precision & Execution Efficiency: Manufactured to strict dimensional standards, larger format models (such as Francia and Baltica) provide lightweight benefits per square meter, rapid layout locking alignments, and decreased roof substructure resource expenditures, optimizing building-site timelines and generating zero hazardous waste

Further information can be found at:

www.leier.ro

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass %	Material origin
Metals	-	-
Minerals	100	Romania
Fossil materials	-	-
Bio-based materials	-	-

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0,01
Biogenic carbon content in packaging, kg C	1,2

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 tonne
Mass per declared unit	1000 kg
Functional unit	-
Reference service life	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
x	x	x	x	x	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Not declared = ND.

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

A market-based approach is used in modelling the electricity mix utilized in the factory.

A1 – Raw material supply

This stage includes the extraction, processing, and delivery of the primary materials that form the Leier ceramic roofing tiles. The product is based on a natural mineral composition consisting exclusively of clay as the structural raw material base. Two distinct clay types are sourced from two dedicated quarries within Romania. The environmental burdens of all material inputs, including upstream extraction and processing impacts, are allocated to the declared unit of 1 tonne (1,000 kg) of finished product.

A2 – Transport to factory

This stage covers the transportation of raw materials from the Leier Rom SRL-owned quarries and other suppliers to the manufacturing plant in Sighișoara, Mureș County. Transport distances are derived from the company's internal logistics records, while vehicle types, load factors, and fuel consumption are defined based on actual operational data. Assumptions on empty-return trips and load consolidation are specified in the LCA modelling to accurately reflect the regional transport infrastructure.

A3 – Manufacturing, Finishing and Packaging

In this stage, the raw materials are transformed into finished ceramic roofing tiles. Key processes at the Leier manufacturing facility in Sighișoara include:

- Preparation and Mixing: the two clay types are first subjected to crushing and grinding to achieve the required particle size distribution, followed by precise dosing, water addition, and intensive mixing to produce a homogeneous ceramic body composition.
- Shaping: the prepared clay mass is formed and shaped into the specific tile geometries corresponding to each product model (Marsilia, Francia, Baltica, Bavaria, Bavaria Duo, Portugheza, Valahia, Andalusia) using gypsum moulds.

The use of gypsum moulds has a significant positive impact on the surface quality of the finished tiles, resulting in a smooth, precise surface finish that enhances both the aesthetic appearance and the weathering performance of the final product.

- Engobe application (where applicable): a natural liquid clay-based slip is applied to the tile surface prior to firing for engobed product configurations, providing enhanced weather resistance and colour stability.
- Drying and Firing: the shaped tiles undergo controlled drying to remove residual moisture, followed by high-temperature firing in industrial kilns, where structural sintering and full ceramic bonding occur.
- Quality Control and Sorting: final inspection, dimensional verification, and sorting of finished tiles prior to packaging and storage.

The facility's electricity mix incorporates grid supply from the Romanian residual mix alongside on-site photovoltaic generation. All self-generated solar power is consumed entirely within the production facility, with zero electricity exported to the national grid.

Packaging: Includes the use of wood pallets, protective plastic stretch film, PP strapping bands, and cardboard sheets placed between tile layers to prevent surface damage during transport and handling. Together, these packaging components ensure safe transport, stable stacking, and weather-protected handling of the finished product.

Waste management: Manufacturing waste, including tile breakage and packaging discards, is recorded and handled in accordance with internal environmental procedures. Waste streams are collected and transported to authorized local treatment facilities for recovery and recycling, with all transport distances not exceeding 50 km from the facility.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

A4 – Transport to Building Site

This stage covers the transportation of finished Leier ceramic roofing tiles from the manufacturing facility in Sighișoara, Mureș County, to the construction site. Finished tiles are palletised and secured at the factory gate using wood pallets, plastic stretch film, PP strapping bands, and cardboard interlayer sheets prior to dispatch. Transport modelling is based on road freight using heavy-duty lorries (>32 metric tons, diesel, EURO 5), with an average delivery distance of 181 km derived from internal logistics records reflecting regional distribution routes. The transport stage ends upon delivery of the product to the construction site, with all packaging materials remaining associated with the product up to this point.

A5 – Installation into the Building / Infrastructure

This stage covers the on-site installation of Leier ceramic roofing tiles. The installation scenario is defined as follows:

- On-site handling: the installation process involves the unpacking and manual positioning of the ceramic tiles onto the roof substructure by qualified roofing workers, following standard sloped roof assembly procedures. No mechanical equipment or power tools are required for tile placement.
 - Energy consumption: since tile installation is carried out entirely manually, energy consumption during the installation phase is considered negligible and is excluded from the scope of this module.
 - Installation losses: based on representative construction site assumptions, a product material loss rate of 2% is factored into this module, accounting for breakage and scrap generation during the manual laying phase.
- Waste Management of Packaging:** accounts for the collection and processing of all packaging materials removed on-site during installation, including wood pallets, plastic stretch film, PP strapping bands, and cardboard interlayer sheets. The end-of-life treatment for these materials is modelled using a split scenario to reflect regional waste management practices:

Wood packaging: 32% is recycled, 30% is directed to energy recovery (incineration), and 38% is landfilled;
 Cardboard packaging: 83% is recycled, 8% is directed to energy recovery (incineration), and 9% is landfilled;
 Plastic packaging (stretch film and PP strapping): 40% is recycled, 37% is directed to energy recovery (incineration), and 23% is landfilled.
 All packaging waste and installation material losses are assumed to be transported over a representative distance of 50 km from the construction site to authorized regional waste management facilities.

PRODUCT END OF LIFE (C1-C4, D)

C1 – Deconstruction / Disassembly

At the end of its service life, the Leier ceramic roof tiles are removed during building deconstruction or roof replacement, primarily through manual dismantling operations. The specific scenario accounts for the deconstruction of 1 tonne of finished ceramic tiles per declared unit. The energy demand for removal and sorting of the tiles on-site is considered minimal, and since the fired ceramic material is chemically inert and fully stable, no hazardous emissions or volatile compounds are released during disassembly.

C2 – Transport to Waste Processing Facilities

Following removal, the ceramic tile waste is transported to authorized regional collection points, recycling centres, or treatment facilities. Transport is assumed to occur via standard heavy-duty road vehicles over a representative average distance of 50 km. Fuel consumption and logistics emissions are calculated based on the total mass of the waste material, utilizing standard transport datasets from Ecoinvent to reflect regional waste logistics infrastructure.

C3 – Waste Processing

This stage involves the physical sorting, crushing, and preparation of the

discarded ceramic roofing tiles. The inert material is directed towards authorized construction and demolition waste processing facilities, where it undergoes mechanical crushing and screening to produce secondary mineral aggregates suitable for recycling or further use in construction applications.

C4 – Final Disposal

The disposal scenario is defined according to representative regional construction and demolition waste practices. The processed inert mineral waste is handled through compliant non-hazardous pathways. Fired ceramic tiles are non-leaching, chemically stable materials that do not undergo biochemical degradation; therefore, they do not generate greenhouse gas emissions, leachate, or environmental contamination when directed to compliant landfills or inert mineral storage facilities.

Module D – Benefits and Loads Beyond the System Boundary

The recovery of materials and energy at the end of life provides net benefits beyond the system boundary, reported as negative environmental impacts in Module D.

Net Flow Calculation: Net flows for recycling and recovery are determined by subtracting any secondary material inputs used in the production stage (A1–A3) from the total waste flows directed to recovery. The calculations in this module account for the benefits derived from the recycling of ceramic tile waste, alongside the recovery of packaging materials consisting of wood pallets, cardboard sheets, plastic stretch film, and PP strapping bands.

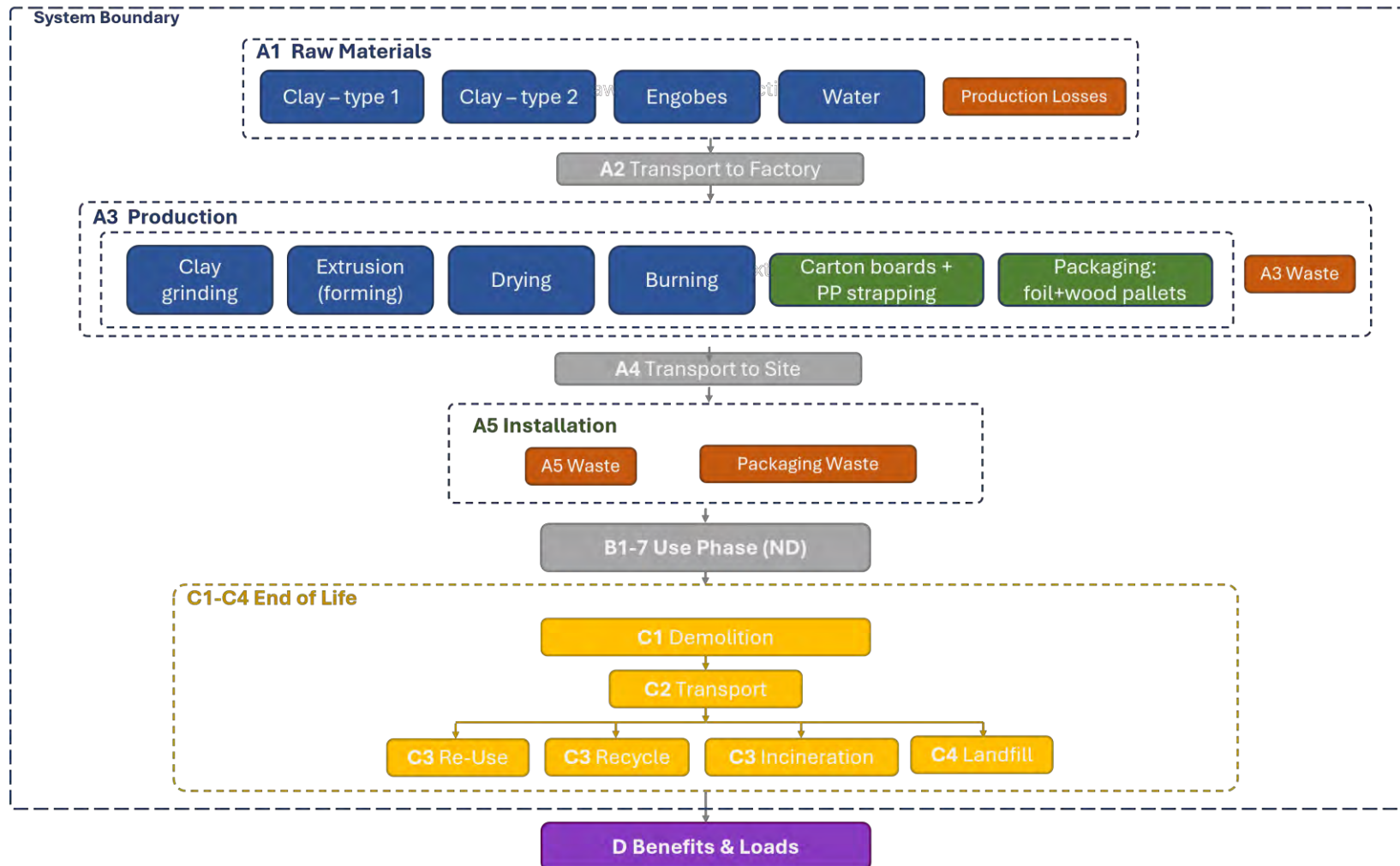
Mineral Recycling Credits: The mechanical processing of ceramic tile waste yields secondary recycled mineral aggregates. These secondary materials replace the need for extraction and production of virgin primary aggregates (such as natural gravel or crushed stone) in local road infrastructure and construction applications.

Packaging Recovery and Recycling: Benefits are also accounted for the recycling and energy recovery of packaging materials collected during the installation stage (Module A5). Credits are calculated for the avoided production of virgin raw materials, based on the specific recovery and split

scenarios. The thermal treatment fraction replaces primary fossil fuels in regional energy networks, while the recycled fraction replaces virgin polymer, timber, and paper fibre production respectively.



MANUFACTURING PROCESS AND SYSTEM BOUNDARY



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

In accordance with the PCR and EN 15804+A2 cut-off criteria, the following processes and infrastructure components have been excluded from the system boundaries of this study:

- Capital goods and infrastructure: the manufacturing, maintenance, and disposal of production machinery, industrial buildings, kilns, and other capital equipment at the Sighișoara facility.
- Corporate overheads: administrative activities, corporate office energy consumption, business travel, and R&D activities not directly tied to the shop-floor manufacturing line.
- C1 Deconstruction energy: the mechanical energy and fuel consumption associated with tile removal during roof deconstruction, as the ceramic tile fraction's share is considered negligible and falls below the cut-off thresholds.
- Minor auxiliary inputs: minor material or energy flows that contribute less than 1% to the total input mass or energy, and whose cumulative exclusion does not exceed 5% of any given inventory module.

VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product's manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	Physical Properties
Packaging material	Physical Properties
Ancillary materials	Physical Properties
Manufacturing energy and waste	Physical Properties

Where primary operational data was unavailable, conservative engineering estimates and standard scenarios based on the Product Category Rules (PCR) were applied:

- Installation Scenario (Module A5): the installation of Leier ceramic roofing tiles onto the roof substructure is assumed to be entirely manual, requiring no mechanical energy inputs. A product material loss rate of 2% is applied to account for breakage and scrap generation during the manual laying phase.

- Deconstruction Scenario (Module C1): the roof dismantling process is assumed to be primarily manual in nature. The specific energy and fuel share allocated to the ceramic tile fraction per declared unit is considered negligible and falls below the cut-off criteria thresholds, resulting in no direct fuel inputs modelled for this stage.
- Gypsum Mould Consumption (Module A3): the consumption of gypsum (plaster of Paris) used for the production and periodic replacement of tile shaping moulds is explicitly included as an ancillary material input within the manufacturing stage (A3). The quantity of gypsum consumed is based on site-specific operational data from the Sighișoara facility for the reference year 2025, allocated per declared unit of 1 tonne of finished ceramic roofing tiles.

PRODUCT & MANUFACTURING SITES GROUPING

Type of grouping	Multiple products
Grouping method	Based on average results of product group - by total mass
Variation in GWP-fossil for A1-A3, %	<0.01%

This EPD represents a weighted average of the covered 8 ceramic tile models and their respective surface configurations (natural and engobed), manufactured at a single production facility in Sighișoara. The average has been calculated based on the actual production volumes of each model and finish for the reference year 2025. All primary data used in the LCA are site-specific and fully representative of the declared product range and

manufacturing conditions. The maximum variation in GWP-fossil (A1–A3) between the individual products within this range is 0.01% (which is well below the 10% threshold)

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator for EPD Hub V3 and EPD Process Certification v3.2.5. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10.1/3.11/3.12 and One Click LCA databases as sources of environmental data. Allocation used in Ecoinvent 3.10.1/3.11/3.12 environmental data sources follow the methodology 'allocation, Cut-off, EN 15804+A2'.

- EN 15804:2012+A2:2019/AC:2021 – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
- ISO 14025:2006 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures.
- EN 1304:2013 – Clay roofing tiles and fittings – Product definitions and specifications.
- EPD Hub Core PCR Version 1.2, 24 March 2025.
- Primary operational data from Leier Rom S.R.L. for the calendar year 2025 (internal bills of materials, energy logs, transport records, and waste data for the Sighișoara manufacturing facility).
- Ecoinvent v3.10.1/3.11/3.12 database and One Click LCA platform – background datasets used for upstream raw materials, energy grids, transport logistics, and end-of-life scenarios.

ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	1,37E+01	1,88E+01	2,82E+02	3,15E+02	2,02E+01	9,50E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	9,52E+00	1,16E+01	2,94E+00	-9,54E+00
GWP – fossil	kg CO ₂ e	1,36E+01	1,88E+01	2,87E+02	3,19E+02	2,02E+01	7,93E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	9,51E+00	1,15E+01	2,92E+00	-7,60E+00
GWP – biogenic	kg CO ₂ e	3,37E-02	4,31E-03	-4,31E+00	-4,28E+00	4,64E-03	1,57E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	6,08E-03	2,96E-02	1,32E-02	-1,93E+00
GWP – LULUC	kg CO ₂ e	1,62E-02	8,37E-03	6,22E-02	8,68E-02	8,99E-03	2,09E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,16E-03	1,82E-02	7,35E-04	-2,24E-03
Ozone depletion pot.	kg CFC-11e	4,35E-06	2,73E-07	3,37E-05	3,83E-05	2,93E-07	7,76E-07	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,07E-07	1,88E-07	9,83E-08	-8,62E-08
Acidification potential	mol H ⁺ e	1,26E-01	6,53E-02	2,26E+00	2,45E+00	7,01E-02	5,24E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,05E-02	8,75E-02	3,29E-02	-4,62E-02
EP-freshwater ²⁾	kg Pe	1,08E-03	2,04E-03	1,31E-02	1,62E-02	2,19E-03	5,04E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	6,49E-04	6,25E-03	5,03E-03	-3,02E-03
EP-marine	kg Ne	3,30E-02	2,16E-02	5,50E-01	6,04E-01	2,32E-02	1,37E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,03E-02	2,95E-02	8,21E-03	-1,15E-02
EP-terrestrial	mol Ne	4,07E-01	2,34E-01	5,98E+00	6,62E+00	2,51E-01	1,45E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,12E-01	3,20E-01	8,84E-02	-1,35E-01
POCP (“smog”) ³⁾	kg NMVOCe	1,06E-01	9,58E-02	1,68E+00	1,88E+00	1,03E-01	4,21E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	4,63E-02	1,04E-01	3,20E-02	-3,96E-02
ADP-minerals & metals ⁴⁾	kg Sbe	6,10E-04	5,38E-05	2,03E-04	8,67E-04	5,77E-05	1,92E-05	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,28E-05	2,95E-05	5,07E-06	-4,26E-05
ADP-fossil resources	MJ	1,65E+02	2,68E+02	4,63E+03	5,06E+03	2,88E+02	1,11E+02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,35E+02	1,83E+02	6,91E+01	-1,08E+02
Water use ⁵⁾	m ³ e depr.	5,87E+00	1,56E+00	5,42E+01	6,17E+01	1,68E+00	1,40E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	7,07E-01	3,87E+00	3,27E+00	-1,01E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO₄e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	2,22E-06	1,84E-06	1,06E-05	1,47E-05	1,98E-06	4,83E-07	ND	ND	ND	ND	ND	ND	ND	0,00E+00	7,60E-07	6,96E-06	5,00E-07	-6,88E-07
Ionizing radiation ⁶⁾	kBq 11235a	8,25E-01	2,25E-01	3,41E+01	3,52E+01	2,41E-01	7,16E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,61E-01	3,63E-01	8,73E-02	-6,10E-01
Ecotoxicity (freshwater)	CTUe	1,14E+03	5,56E+01	3,77E+02	1,57E+03	5,97E+01	1,22E+02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,14E+02	5,70E+03	3,70E+03	-1,91E+02
Human toxicity, cancer	CTUh	3,58E-08	2,95E-09	2,71E-08	6,58E-08	3,17E-09	1,57E-09	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,63E-09	2,71E-09	1,18E-09	-1,87E-09
Human tox. non-cancer	CTUh	2,18E-06	1,67E-07	4,46E-07	2,80E-06	1,79E-07	6,60E-08	ND	ND	ND	ND	ND	ND	ND	0,00E+00	8,44E-08	1,09E-07	7,38E-08	-5,55E-08
SQP ⁷⁾	-	1,02E+02	2,67E+02	4,00E+02	7,70E+02	2,87E+02	2,62E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	7,97E+01	2,16E+02	1,71E+02	-1,90E+02

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	1,10E+01	3,73E+00	2,35E+02	2,50E+02	4,00E+00	-3,68E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,20E+00	5,66E+00	1,33E+00	-2,02E+01
Renew. PER as material	MJ	0,00E+00	0,00E+00	4,11E+01	4,11E+01	0,00E+00	-4,11E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,94E+01
Total use of renew. PER	MJ	1,10E+01	3,73E+00	2,76E+02	2,91E+02	4,00E+00	-7,78E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,20E+00	5,66E+00	1,33E+00	-7,43E-01
Non-re. PER as energy	MJ	1,63E+02	2,68E+02	4,60E+03	5,04E+03	2,88E+02	7,95E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,35E+02	1,83E+02	6,91E+01	-1,08E+02
Non-re. PER as material	MJ	3,93E-01	0,00E+00	2,69E+01	2,73E+01	0,00E+00	-2,69E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	-2,75E-01	-1,18E-01	1,34E+01
Total use of non-re. PER	MJ	1,63E+02	2,68E+02	4,63E+03	5,06E+03	2,88E+02	5,26E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,35E+02	1,82E+02	6,90E+01	-9,45E+01
Secondary materials	kg	6,51E-01	1,12E-01	1,27E+00	2,03E+00	1,20E-01	4,61E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	6,03E-02	6,84E-02	2,21E-02	8,62E-01
Renew. secondary fuels	MJ	2,41E-03	1,46E-03	1,06E+00	1,06E+00	1,57E-03	2,13E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	7,91E-04	8,13E-04	4,18E-04	-1,05E-02
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	2,01E-01	3,85E-02	9,57E-01	1,20E+00	4,13E-02	5,35E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,63E-02	-1,02E+00	-8,26E-01	-2,43E-01

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	2,27E+00	1,71E+00	6,16E+00	1,01E+01	1,84E+00	2,66E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,93E-01	4,54E-01	1,09E-01	-6,64E-01
Non-hazardous waste	kg	2,05E+01	3,39E+01	2,08E+02	2,63E+02	3,64E+01	2,92E+01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	4,14E+00	7,48E+02	9,75E+02	-2,36E+01
Radioactive waste	kg	7,19E-04	5,38E-05	1,25E-02	1,33E-02	5,77E-05	2,68E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,97E-05	8,86E-05	2,10E-05	-1,47E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,75E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	7,00E+02	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,88E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,32E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,57E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

ADDITIONAL INDICATOR – GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG ⁹⁾	kg CO ₂ e	1,36E+01	1,88E+01	2,87E+02	3,19E+02	2,02E+01	7,93E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	9,51E+00	1,15E+01	2,92E+00	-7,60E+00

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH₄ fossil, CH₄ biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO₂ is set to zero

SCENARIO DOCUMENTATION

DATA SOURCES

Manufacturing energy scenario documentation

1. Natural gas (Industrial furnace >100 kW), World, One Click LCA, 0.25 kgCO₂e/kWh
2. Electricity, medium voltage, residual mix, Romania, Ecoinvent, 0.33 kgCO₂e/kWh
3. Electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, Romania, Ecoinvent, 0.0770 kgCO₂e/kWh
4. Market for diesel, burned in building machine, World, Ecoinvent, 0.10 kgCO₂e/MJ

Transport scenario documentation - A4 (Transport resources)

1. Market for transport, freight, lorry, >32 metric ton, diesel, EURO 5, 181.0 km

Transport to the building site (A4) - Scenario documentation

Scenario parameter	Value
Capacity utilization (including empty return) %	85
Bulk density of transported products	1500
Volume capacity utilization factor	<1

Installation at the building site (A5) - Scenario documentation

Scenario parameter	Value
Energy: type and consumption	-
Water use (m ³)	-
Ancillary materials:	-
Waste materials: type and mass (kg)	20 kg - ceramic roof tiles 1.83 kg - wood pallets 0.76 kg - plastic packaging 1.04 kg - paper packaging
Waste materials: output routes	Ceramic waste: 70% recycled, 30% landfill Wood packaging: 32% recycled, 30% incineration, 38% landfill Plastic packaging: 40% recycled, 37% incineration, 23% landfill Paper packaging: 83% recycled, 8% incineration, 9% landfill
Direct emissions (kg)	-

End of life (C1-C4) - Scenario documentation

Scenario information	Value
Collection process: collected separately (kg)	1000 kg
Collection process: Mixed waste (kg)	0
Recovery: re-use (kg)	0
Recovery: recycling (kg)	700
Recovery: energy recovery (kg)	0
Disposal (kg)	300
Scenario assumptions e.g. transportation (mode, km) & other	Landfill: 50 km, Recycling: 50 km

THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15804+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.

The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO

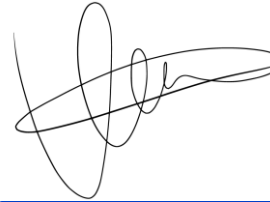
14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

Verified tools

Tool verifier: Magaly Gonzalez Vazquez

Tool verification validity: 27 March 2025 - 26 March 2028

Haiha Nguyen as an authorized verifier for EPD Hub Limited 17.07.2026



ANNEX 1 – GWP VARIATION ACROSS PRODUCTS

This annex provides the specific carbon footprint for each individual product under the Leier clay roofing tile range. The impact per tonne of fired clay matrix remains identical across the production line; however, the specific carbon footprint of each model varies due to the mass per square meter (kg/m^2) of each specific tile profile. The different product names within this annex represent distinct aesthetic profiles and geometric designs, with their A1-A3 carbon footprint differences resulting directly from the specific product weight needed to cover a square meter of roofing area.

Product name	Mass (kg/m ²)	GWP Fossil KgCO ₂ e/m ²	GWP Total KgCO ₂ e/m ²
Leier Francia	43	13.7	13.5
Leier Marsilia	43	13.8	13.7
Leier Valahia	39	12.6	12.4
Leier Bavaria	60	19.0	18.7
Leier Bavaria Duo	49	15.6	15.4
Leier Andalusia	64	20.5	20.3
Leier Portugheza	45	14.3	14.1
Leier Baltica	42	13.5	13.3



LEIER ROM Sighisoara plant