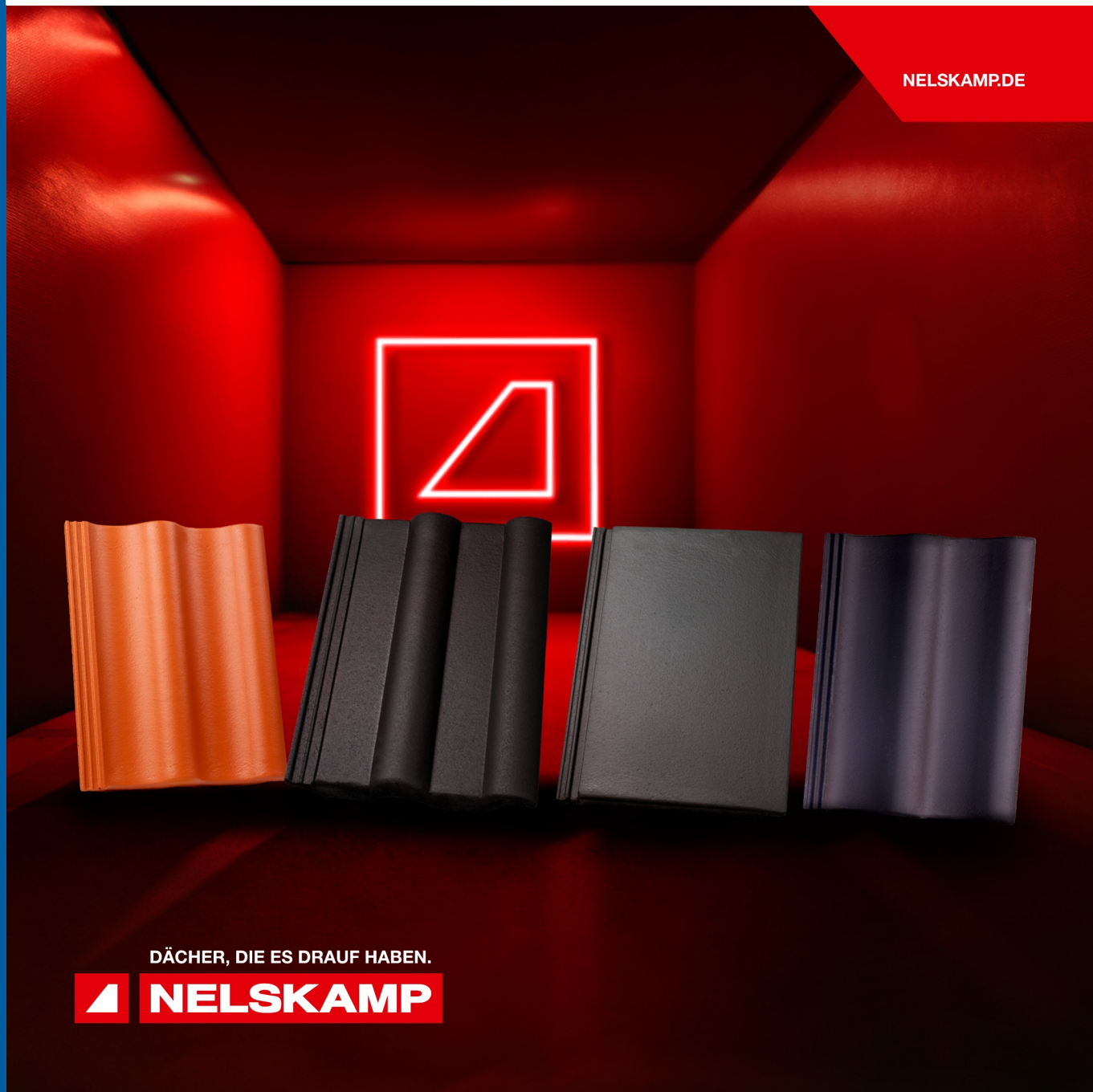
Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804+A2:2019

NELSKAMP Concrete Roof tiles

Registration number:	EPD-Kiwa-EE-241888-EN
Issue date:	04-06-2026
Valid until:	04-06-2031
Declaration owner:	Dachziegelwerke Nelskamp GmbH
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Status:	verified



1 General information

1.1 PRODUCT

NELSKAMP Concrete Roof tiles

1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-241888-EN

1.3 VALIDITY

Issue date: 04-06-2026

Valid until: 04-06-2031

1.4 PROGRAMME OPERATOR

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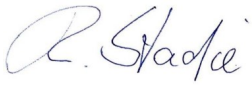

Dr. Ronny Stadie

(Verification body, Kiwa-Ecobility Experts)

1.5 OWNER OF THE DECLARATION

Declaration owner: Dachziegelwerke Nelskamp GmbH

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E-mail: vertrieb@nelskamp.de

Website: www.nelskamp.de

Production location: Dachziegelwerke Nelskamp GmbH Gartrop

Address production location: Gahlener Str. 158, 46569 Hünxe, DE

1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Vijay Thakur, Vijay Thakur

1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

1.8 PRODUCT CATEGORY RULES

Kiwa-EE GPI R.4.0
Kiwa-Ecobility Experts, General Programme Instructions “Product Level”, SOP EE 1203_R. 4.0 (18.12.2025)

Kiwa-EE GPI R.4.0 Annex B1
Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 4.0 (18.12.2025)

PCR B
Institut Bauen und Umwelt e.V. - Part B: Requirements on the EPD for Concrete roofing tiles - v11 (2024-08-01)

1 General information

1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804+A2:2019. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPD program operators may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2:2019 and ISO 14025.

1.10 CALCULATION BASIS

LCA method R<THINK: Ecobility Experts | EN15804+A2

LCA software*: Simapro 9.6

Characterization method: RETHINK characterization method (see references for more details)

LCA database profiles: ecoinvent (for version see references)

Version database: v3.20f (20260507)

** Simapro is used for calculating the characterized results of the Environmental profiles within R<THINK.*

1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'NELSKAMP Concrete Roof tiles' with the calculation identifier ReTHiNK-141888.

2 Product

2.1 PRODUCT DESCRIPTION

This average EPD refers to concrete roof tiles produced by Dachziegelwerke Nelskamp GmbH, including the following types:

- Finkenberger: TOP 2000 S, LongLife & ClimaLife
- S-pan: TOP 2000 S, LongLife & ClimaLife
- Sigma: TOP 2000 S, LongLife & EasyLife
- Planum: LongLife

Nelskamp produces concrete roof tiles at three production sites: Gartrop, Dieburg, and Schönerlinde. The production processes and suppliers are consistent across all sites, with the exception of sand sourcing. For sand, generic data on sand extraction in Germany has been applied. Among the three locations, Gartrop is considered the most representative production facility, as it has the highest production capacity. Consequently, process-specific data from the Gartrop production site were collected and averaged over the annual production volumes. Finkenberger, S-Pan, Sigma, and Planum are different concrete roof tile profiles: Finkenberger with a classic wave shape, S-Pan with an S-profile, Sigma with a double curve profile, and Planum with a flat, modern design. All are produced using the same basic formulation as the TOP 2000 S, which is Nelskamp's standard concrete roof tile line. LongLife, ClimaLife, and EasyLife are special variants with modified formulations or coatings: LongLife offers enhanced durability and colour stability through its coating, ClimaLife provides an air-purifying function due to titanium dioxide pigments in the concrete and the coating, and the EasyLife roof tile is about one-third lighter than standard Nelskamp tiles, thanks to a specially developed lightweight aggregate.

The UN CPC-Code of the products refers to 37540 - Tiles, flagstones, bricks and similar articles, of cement, concrete or artificial stone.

Name		Roof tile weight (kg/piece)
Finkenberger	TOP 2000 S	4.6
	Longlife	4.6
	Climalife	4.6
S-pan	TOP 2000 S	4.55
	Longlife	4.55
	Climalife	4.55
Sigma	TOP 2000 S	4.25
	Longlife	4.25
	Easylife	3.2
Planum	Longlife	5.2

Dimensions on delivery are as follows:

length x width

- 420 mm x 332 mm (Sigma, Planum, S-pan)
- 420 mm x 340 mm (Finkenberger)

Profile depth:

Finkenberger 26 +/- 1 mm, Planum 0 mm,

S-Pfanne 35 +/- 1 mm,

Sigma und Sigma Easylife 36 +/-1 mm

Coverage width: 300 mm (as per DIN EN 490/491/)

Depending on the order, packaging is carried out individually. The concrete roof tiles can be provided in standard palletization or as crane goods for transport.

The composition of the product is listed in the following table:

Component	Value	Unit
Sand	72.20	m.-%
Cement (CEM II)	19.35	m.-%
Water	7.82	m.-%
Pigment	0.13	m.-%
Coating	0.50	m.-%

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a declaration of performance taking into consideration EN 490:2011+A1:2017 (Concrete roofing tiles and fittings for roof covering and wall cladding - Product specifications) and the CE-marking.

For the application and use the respective national provisions apply.

2 Product

2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

Concrete roof tiles are used as roofing material for any roof architecture. The minimum roof pitch without adjustments is 22°, roof battens are used as the substructure.

2.3 REFERENCE SERVICE LIFE

RSL PRODUCT

According to BBSR Table 2026 / No. 363.213.25, roof tiles achieve a service life of over 50 years. There is no evidence of factors affecting aging when used in accordance with the rules of the art. Roof tiles come with a 30-year warranty.

USED RSL (YR) IN THIS LCA CALCULATION:

50

RSL PARTS

No deviation regarding the RSL for one of the raw materials/components is applicable.

2.4 TECHNICAL DATA

Name	Value	Unit
Dimensional deviation in accordance with DIN EN 197-1	4	mm
Coverage width	300	mm
Water impermeability	fulfilled	-
Mechanical resistance (load-bearing capacity) (profiled/ smooth roof tiles)	2200/1500	N/mm2
Durability (resistance to frost/dew)	fulfilled	-
Weight	3.2 - 5.2	kg/pce.
Requirements	9.7	pce./ m2
Gross density	2150	kg/m3
Dimensions: width x length	332 x 420 / 340 x 402	mm
Batten spacing	314 – 345	mm

The product's performance values correspond with the Declaration of Performance in terms of its essential properties in accordance with the current EN 490 standard.

Exceptional influences: Fire

The roof tiles described here comply with building material class A2, s1-d0 according to DIN 13501, i.e., they are non-combustible. In the event of a fire, no toxic gases or fumes are emitted; as a hard roofing material, they are resistant to flying sparks and radiant heat.

Fire protection

Designation	Value
Building material class	A2
Burning Drip	d0
Smoke emission	s1

Water: No water-polluting substances are leached out.

Mechanical damage: Not relevant.

2.5 SUBSTANCES OF VERY HIGH CONCERN

1) The product / At least one partial product contains substances from the ECHA list of candidates of Substances of Very High Concern (SVHC) (07.01.2019) exceeding 0.1% by mass: no

2) The product / At least one partial product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass in at least one partial product: no

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): no

2.6 DESCRIPTION PRODUCTION PROCESS

The production phase begins with the delivery of the various raw materials. The moist sand is poured by truck from a nearby gravel plant into a feed hopper and reaches storage

2 Product

silos via covered conveyor belts. The cement is delivered in silo trucks and is blown into two cement silos with fine dust extraction. The colours are delivered by tanker or in containers. The tanker goods are stored in silo tanks. The colouring is fed into the production process via pipelines with the help of pumps. The well water is fed to the liquid scale via pumps.

Sand, cement, colouring and water are fed to a fully-automatic weighing system. The materials are weighed according to a recipe that must be followed exactly and then added to the intensive mixer one after the other. The mixer is discharged into a concrete supply hopper suspended below the mixer platform. The fresh concrete reaches the roof tile box (shaping machine) via discharge belts.

The shaping machine works according to the extrusion process with a production speed of up to 150 roof tiles per minute, which corresponds to 700 kg of fresh concrete processing per minute.

Aluminium pallets are fed to the shaping machine via transport devices (conveyor belts, chains, belt conveyors). These aluminium pallets are wetted with mould oil via a roller system.

The wetted aluminium pallets pass through the roof tile box and are filled with fresh concrete from above. In the box, the upper contour of the roof tile is formed under strong pressure with the help of a spiked shaft, roller and shaping mouthpiece.

The profiled fresh concrete leaves the shaping machine as a continuous strand and is cut to the length of the roof tile with a knife controlled by compressed air.

For surface finishing, the wet roof tile is fed into the paint booth and coated with a water based plastic dispersion.

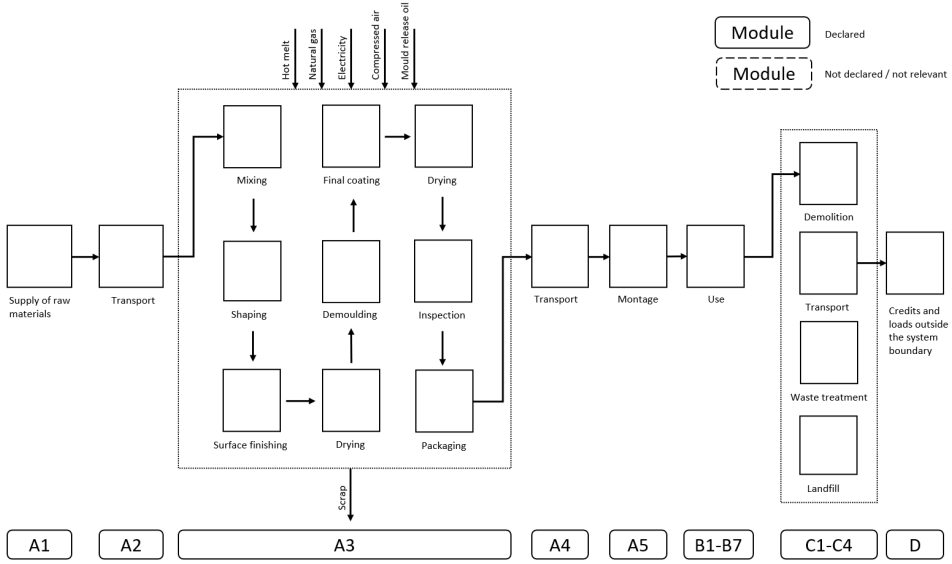
After this coating, the roof tiles are transported to the elevator via several automatic conveyor and collecting belts. There, the roof tiles are transported to the setting chamber by a group of vehicles. At a temperature of up to 65 °C and a humidity of approx. 95%, the roof tiles set and reach their strength for further processing after approx. 6 hours. The drying chamber is closed with a gate. The moisture deviation is minimal.

The roof tiles are automatically stacked from the chambers into a lowering system and then return to the production process via transport routes. The set roof tiles with the aluminium pallets are separated in a demoulding machine. The aluminium pallets are returned to the shaping machine, while the roof tile is given its final coating (water-based plastic dispersion) by another paint booth.

To dry the coating before packaging, a tunnel dryer is run through for additional drying acceleration.

The final inspection station is immediately after the surface drying and the controlled, finished product is fed to the automatic packaging plant. The concrete roof tiles are stacked in rows of 30 or 34 and shrink-wrapped with in flat film (PE film). These shipping units are grouped into 6 packages on a Euro pallet and bound with a plastic strap (PET). Alternatively, the roof tiles can also be provided as crane goods.

The production of roof tiles is energy-efficient throughout and utilizes sensible recycling processes. An active energy management system in accordance with ISO 50001 is operated at all production sites. Negative impacts on the environment and health are not expected provided standard safety measures are followed.



2.7 CONSTRUCTION DESCRIPTION

The roof tiles are transported to the roof level with the help of an inclined lift or by hand. For this calculation, it is assumed that roof tiles are transported to roof level by an inclined lift 50% of the time and by hand the remaining 50%. The roof tiles are then attached to the roof substructure by hand. Individual roof surfaces require the adjustment of individual roof tiles on site using appropriate cutting or separating equipment. The respective equipment for this must comply with the applicable specifications and be used as designated. When laying, the laying instructions of the respective product article, which are provided by Nelskamp Dachziegelwerke GmbH, must be observed.

3 Calculation rules

3.1 FUNCTIONAL UNIT

Ton

According to the PCR, one ton of concrete roof tiles is selected as the declared unit.
Weight per unit area of Finkenberger: 42 kg/m²
Weight per unit area of S-pan: 44 kg/m²
Weight per unit area of Sigma: 41 kg/m²
Weight per unit area of Planum: 50 kg/m²

Reference unit: ton (ton)

3.2 CONVERSION FACTORS

Description	Value	Unit
Reference unit	1	ton
Weight per reference unit	1000.000	kg
Conversion factor to 1 kg	0.001000	ton

3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to grave EPD. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

The modules of the EN 15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Construction - Installation process	Module C2 = Transport
Module B1 = Use	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the product system boundaries
Module B4 = Replacement	

3.4 REPRESENTATIVENESS

This EPD is representative of NELSKAMP Concrete Roof tiles, a product of Dachziegelwerke Nelskamp GmbH. The results of this EPD are representative of the European Union.

3.5 CUT-OFF CRITERIA

For each unit process, the cut-off criteria of 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process are complied with. The total neglected input flows do not exceed the limit of 5% of energy use and mass.

3 Calculation rules

Product stage (A1-A3)
All input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. production waste) are considered in this LCA.

Construction process stage (A4-A5)
All input flows (e.g. transportation to the construction site, additional raw material use for construction, installation energy use, etc.) and output flows (e.g. construction waste, packaging waste, etc.) are considered in this LCA.

Use stage (B1-B7)
All (known) input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. emissions to soil, air and water, construction waste, packaging waste, end-of-life waste, etc.) related to the building fabric are considered in this LCA.

End of life stage (C1-C4)
All input flows (e.g. energy use for demolition or disassembly, transport to waste processing, etc.) and output flows (e.g. end-of-life waste processing of the product, etc.) are considered in this LCA.

Benefits and loads beyond the system boundary (Module D)
All benefits and loads beyond the system boundary resulting from reusable products, recyclable materials and/or useful energy carriers leaving the product system are considered in this LCA.

The following processes are excluded:

- Manufacturing of equipment used in production, buildings or any other capital asset
- Water and electricity consumption for the building
- Transportation of personnel to the plant
- Transportation of personnel within the plant
- Research and development activities
- Long-term emissions

3.6 ALLOCATION

The energy consumption is calculated based on the total consumption at the Gartrop production site in 2025 (for all products manufactured) and are converted into the amount used solely for the production of the declared product. The amount of energy is given per ton of product manufactured.

No allocation is performed with regard to the use of secondary materials or fuels, co-products, plant-specific production processes or multi-input systems.

The polluter pays principle applies to the use of waste as a substitute for primary fuels or materials. Double counting is avoided.

3.7 DATA COLLECTION & REFERENCE PERIOD

All process-specific data are collected for the reference year 2025 (01.01.2025 - 31.12.2025).

3.8 ESTIMATES AND ASSUMPTIONS

For all raw materials used (raw materials, operating materials, packaging), the transportation distance is recorded. A payload factor of 50% is used for all truck transports (suppliers, disposal transports and internal transports), which corresponds to a full delivery and an empty return journey.

For Module A4 (transport from the production site to the construction site), a transport distance of 236 km by truck (50% payload) is estimated based on the distance between the production site and the geographic center of Germany.

It is assumed that 20% of the time roof tiles are produced with red pigment, and 80% of the time with black pigment. The calculation covers both red and black roof tiles. The results per impact category differ by no more than 10% when using only red or only black pigments.

Excluded are the manufacturing of capital equipment, construction undertakings, and infrastructure development, along with the maintenance and operation of capital equipment. Additionally, activities related to personnel, as well as energy and water consumption associated with company management and sales, are also excluded.

The scenarios included are currently in use and are representative of one of the most likely scenarios alternatives.

3 Calculation rules

3.9 DATA QUALITY

The data are based on the annual average. Generic datasets from the ecoinvent database V3.9.1 are used for the secondary data, which refers to reference year 2022. This database is regularly maintained and meets the requirements of EN 15804+A2 (background data not older than 10 years). All consistent datasets contained in the ecoinvent database are documented and can be viewed in the online ecoinvent documentation. In the operating data survey all relevant process-specific data could be collected. The quality of the data can be thus considered as good.

The primary data are collected and provided by **Dachziegelwerke Nelskamp GmbH** and most of the datasets selected in the LCA for raw materials refer to **Europe** as the geographical reference, representing the average European production. The quality of the data used for this EPD can be divided into three categories (time-related coverage, geographical coverage and technology coverage) according to the criteria of the UN Global Environmental Guideline on LCA database development (as described in Annex E of EN 15804 (Table E.1)). There is no use of any poor or very poor category data. There is no fair category data that contributes to > 30% of any core indicators declared.

Aspect	Data quality assessment
Time-related coverage	The primary data represent the current situation of the date of study (2024) or as close as possible (<5 years). The secondary data are updated within last 10 years.
Geographical coverage	Most of the datasets selected for the LCA refer to Europe as the geographical reference, representing the average European production.
Technology coverage	The data are representative of the technology used in production processes.
Completeness	Specific data are benchmarked with literature data. Simple validation checks (e.g. mass or energy balances) are performed.
Representativeness	The data fulfill the defined time-related, geographical, and technological scope.
Precision	The data used are as representative as possible. The data are derived from credible sources, and references are provided.
Reproducibility	Information about the method and data (reference source) are provided.
Sources of the data	The data are derived from credible sources, and references are provided.

The quality level of time representativeness can be considered “good”, the quality level of geographical representativeness can be considered “good” and the technical representativeness can also be considered “good”. Therefore, the overall data quality for this EPD can be described as “good”.

3.10 POWER MIX

The use of renewable electricity is included in the calculation of the environmental impacts. The calculation is based on the purchased electricity mix, referring to the market-based approach. The share of renewable electricity with guarantees of origin accounts for 30% of the total electricity consumption. The remaining purchased electricity is modeled based on the German residual electricity mix. The GWP-total of the electricity is calculated at 0.565 kg CO2 eq./kWh.

4 Scenarios and additional technical information

4.1 TRANSPORT TO CONSTRUCTION SITE (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD.

	Value and unit
Vehicle type used for transport	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Distance	236 km
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4.2 ASSEMBLY (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

FLOWS ENTERING THE SYSTEM

For flows entering the system at A5 the following scenario is assumed for module A5.

	Value	Unit
Energy consumption for installation/assembly		
(ei3.9.1) Electricity (EU) - low voltage (max 1kV)	0.0299	kWh

FLOWS LEAVING THE SYSTEM

The following output flows leaving the system at module A5 are assumed.

Description	Value	Unit
Output materials as result of loss during construction	3	%
Output materials as result of waste processing of materials used for installation/assembly at the building site	0.000	kg
Output materials as result of waste processing of used packaging	1.430	kg

4.3 USE STAGE (B1)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water.

4 Scenarios and additional technical information

4.4 MAINTENANCE (B2)

For maintenance no input or output flows are modelled.

4.5 REPAIR (B3)

Repairs are not applicable within the functional unit and to achieve the reference service life.

4.6 OPERATIONAL ENERGY USE (B6)

Description	Service cycle (yr)	Number of cycles (n)	Amount per cycle	Total Amount	Unit

4.7 OPERATIONAL WATER USE (B7)

Description	Service cycle (yr)	Number of cycles (n)	Amount per cycle	Total Amount	Unit

4.8 DE-CONSTRUCTION, DEMOLITION (C1)

The following information describes the scenario for demolition at end of life.

Description	Amount	Unit
(ei3.9.1) Electricity (EU) - low voltage (max 1kV)	0.030	kWh

4.9 TRANSPORT END-OF-LIFE (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing.

Waste Scenario	Transport conveyance	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
(ei3.9.1) concrete (i.a. elements, brickwork, reinforced concrete) (NMD ID 9)	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	50

4 Scenarios and additional technical information

The transport conveyance(s) used in the scenario(s) for transport during end of life has the following characteristics.

	Value and unit
Vehicle type used for transport	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4.10 END OF LIFE (C3, C4)

The scenario(s) assumed for end of life of the product are given in the following tables. First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts.

Waste Scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
(ei3.9.1) concrete (i.a. elements, brickwork, reinforced concrete) (NMD ID 9)	NL	0	1	0	99	0

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
(ei3.9.1) concrete (i.a. elements, brickwork, reinforced concrete) (NMD ID 9)	0.000	10.000	0.000	990.000	0.000
Total	**0.000**	**10.000**	**0.000**	**990.000**	**0.000**

4.11 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The presented Benefits and loads beyond the system boundary in this EPD are based on the following calculated Net output flows in kilograms and Energy recovery displayed in MJ Lower Heating Value.

Waste Scenario	Net output flow [kg]	Energy recovery [MJ]
(ei3.9.1) concrete (i.a. elements, brickwork, reinforced concrete) (NMD ID 9)	990.000	0.000
Total	**990.000**	**0.000**

5 Results

For the impact assessment long-term emissions (>100 years) are not considered. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

5.1 ENVIRONMENTAL IMPACT INDICATORS PER TON

CORE ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	1.62E+2	6.17E+0	1.40E+1	1.82E+2	3.52E+1	1.02E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.08E-2	7.52E+0	1.47E+0	6.08E-2	-6.76E+0
GWP-f	kg CO_2 eq.	1.62E+2	6.13E+0	1.39E+1	1.82E+2	3.51E+1	1.02E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.08E-2	7.50E+0	1.47E+0	6.08E-2	-6.75E+0
GWP-b	kg CO_2 eq.	1.02E-1	1.61E-2	1.74E-2	1.36E-1	1.14E-2	6.97E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.89E-5	2.44E-3	1.34E-3	2.65E-5	-8.72E-3
GWP-luluc	kg CO_2 eq.	4.30E-2	2.19E-2	6.29E-2	1.28E-1	1.25E-1	8.89E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.69E-5	2.67E-2	3.32E-4	3.67E-5	-5.35E-3
ODP	kg CFC 11 eq.	1.12E-6	1.06E-7	2.90E-7	1.52E-6	6.24E-7	1.62E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.05E-10	1.33E-7	3.31E-8	1.76E-9	-1.69E-7
AP	mol H+ eq.	6.07E-1	2.87E-2	3.65E-2	6.72E-1	1.68E-1	2.83E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.16E-5	3.59E-2	9.29E-3	4.58E-4	-3.17E-2
EP-fw	kg P eq.	2.94E-3	5.96E-5	7.97E-4	3.80E-3	3.49E-4	1.40E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.06E-6	7.46E-5	2.91E-5	5.93E-7	-1.52E-4
EP-m	kg N eq.	1.21E-1	1.09E-2	7.78E-3	1.40E-1	6.38E-2	7.14E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.73E-6	1.36E-2	3.94E-3	1.75E-4	-9.58E-3
EP-T	mol N eq.	1.38E+0	1.16E-1	8.54E-2	1.58E+0	6.81E-1	7.91E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.01E-5	1.45E-1	4.31E-2	1.88E-3	-1.10E-1
POCP		4.24E-1	3.97E-2	3.78E-2	5.01E-1	2.32E-1	2.55E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.89E-5	4.97E-2	1.28E-2	6.56E-4	-3.45E-2

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

5 Results

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	kg NMVOC eq.																		
ADP-mm	kg Sb-eq.	3.01E-4	1.88E-5	3.61E-5	3.56E-4	1.10E-4	1.68E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.28E-7	2.35E-5	5.96E-6	8.44E-8	-2.22E-5
ADP-f	MJ	1.04E+3	8.58E+1	2.49E+2	1.38E+3	5.02E+2	6.39E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.43E-1	1.07E+2	2.01E+1	1.51E+0	-9.29E+1
WDP	m3 world eq.	5.98E+1	4.51E-1	2.17E+0	6.24E+1	2.74E+0	2.17E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.75E-3	5.86E-1	1.11E-1	6.69E-2	-6.16E+1

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	disease incidence	4.67E-6	4.83E-7	2.96E-7	5.45E-6	3.46E-6	3.14E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.96E-10	7.40E-7	2.25E-7	1.00E-8	-5.68E-7
IR	kBq U235 eq.	2.14E+0	3.35E-2	2.76E-1	2.45E+0	1.96E-1	9.44E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.17E-3	4.19E-2	2.30E-2	4.00E-4	-1.24E-1
ETP-fw	CTUe	4.38E+2	6.52E+1	3.37E+1	5.37E+2	3.71E+2	6.89E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.09E-2	7.92E+1	6.77E+0	7.11E-1	-2.11E+1
HTP-c	CTUh	3.76E-8	3.17E-9	3.83E-9	4.46E-8	1.86E-8	2.68E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.02E-12	3.97E-9	4.67E-10	2.59E-11	-3.71E-9
HTP-nc	CTUh	1.21E-6	8.96E-8	8.25E-8	1.38E-6	4.04E-7	6.37E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.99E-10	8.62E-8	9.39E-9	3.24E-10	-4.67E-8

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality index (SQP)

5 Results

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
SQP	Pt	8.74E+2	6.77E+1	3.64E+1	9.78E+2	3.97E+2	4.54E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.76E-2	8.47E+1	2.71E+0	3.01E+0	-6.77E+1

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality index (SQP)

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – 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.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

5 Results

5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

PARAMETERS DESCRIBING RESOURCE USE

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	7.30E+1	1.21E+0	1.09E+1	8.52E+1	7.10E+0	3.27E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.32E-2	1.52E+0	1.68E+0	1.28E-2	-4.17E+0
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	7.30E+1	1.21E+0	1.09E+1	8.52E+1	7.10E+0	3.27E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.32E-2	1.52E+0	1.68E+0	1.28E-2	-4.17E+0
PENRE	MJ	9.90E+2	9.13E+1	1.81E+2	1.26E+3	5.03E+2	6.06E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.43E-1	1.08E+2	2.01E+1	1.51E+0	-9.08E+1
PENRM	MJ	5.08E+1	0.00E+0	6.78E+1	1.19E+2	0.00E+0	3.56E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-2.10E+0
PENRT	MJ	1.04E+3	9.13E+1	2.49E+2	1.38E+3	5.03E+2	6.41E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.43E-1	1.08E+2	2.01E+1	1.51E+0	-9.29E+1
SM	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m^3	1.59E+0	1.36E-2	7.99E-2	1.68E+0	1.21E-1	6.07E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.92E-4	2.59E-2	5.56E-3	1.61E-3	-1.44E+0

PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | **PERM**=Use of renewable primary energy resources used as raw materials | **PERT**=Total use of renewable primary energy resources | **PENRE**=Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | **PENRM**=Use of non-renewable primary energy resources used as raw materials | **PENRT**=Total use of non-renewable primary energy resources | **SM**=Use of secondary material | **RSF**=Use of renewable secondary fuels | **NRSF**=Use of non-renewable secondary fuels | **FW**=Net use of fresh water

OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	Kg	3.55E-3	5.47E-4	4.91E-4	4.59E-3	3.20E-3	2.71E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.28E-7	6.85E-4	1.04E-4	8.02E-6	-3.85E-4
NHWD	Kg	1.35E+1	5.67E+0	1.32E+0	2.05E+1	3.32E+1	3.71E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.74E-4	7.10E+0	3.02E+0	1.00E+1	-6.48E-1
RWD	Kg	1.65E-3	1.96E-5	2.59E-4	1.93E-3	1.15E-4	7.23E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.74E-6	2.46E-5	1.94E-5	2.24E-7	-7.98E-5

HWD=Hazardous waste disposed | **NHWD**=Non-hazardous waste disposed | **RWD**=Radioactive waste disposed

5 Results

ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	1.27E+1	1.27E+1	0.00E+0	3.02E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.90E+2	0.00E+0	0.00E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	1.99E+0	1.99E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.65E+1
EEE	MJ	0.00E+0	0.00E+0	1.15E+0	1.15E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.61E+0

CRU=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy, Thermic | **EEE**=Exported Energy, Electric

5 Results

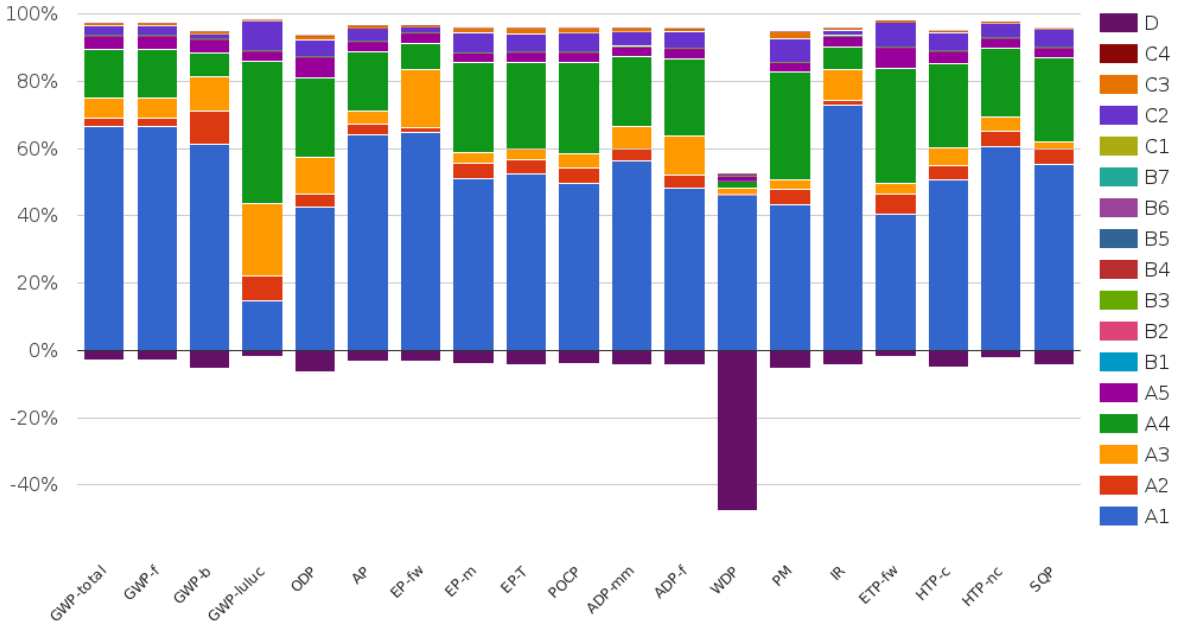
5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER TON

BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per ton:

Biogenic carbon content	Amount	Unit
Biogenic carbon content in the product	0	kg C
Biogenic carbon content in accompanying packaging	0	kg C

6 Interpretation of results



The largest contributor to the environmental impact is Module A1, primarily due to the raw materials used for cement, followed by sand and coating. Module A4 also has a notable impact due to the transport of one ton of product from the production site to the final construction site. Among the raw materials (module A1), cement results in the largest environmental impact, accounting for 78.6% of the GWP-total.

7 References

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EN 15804+A2
EN 15804:2012+A2:2019/AC:2021, Sustainability of Buildings - Environmental Product Declarations - Framework Development Rules by Product Category

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Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 4.0 (18.12.2025)

PCR B
Institut Bauen und Umwelt e.V. - Part B: Requirements on the EPD for Concrete roofing tiles - v11 (2024-08-01)

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R<THINK characterization method
ecoinvent 3.9.1: EN 15804+A2 indicators (EF 3.1)

EN 490:2011+A1:2017
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BBSR
BBSR, NBB 2025, Nutzungsdauern_von_Bauteilen Table 2026/ No. 363.213.25 (13.03.2026)

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