

Environmental Product Declaration

According to ISO 14025 and EN 15804+A2



Clay roof tiles Korec




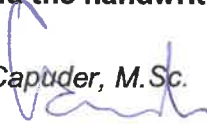

EPD number
EPD owner

EPD-25/0010
Goriške opekarne d.o.o, Merljaki 7
5292 Renče, Slovenia

EPD Program operator
Issue date
Valid until

ZAG EPD
12. 06. 2025
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www.zag.si

General information	Average EPD for Clay roof tiles Korec (Red clay tile, Colored clay tile, Clay tile with nose, Alpe jadrans tile, special elements)						
Program holder: Slovenian National Building And Civil Engineering Institute - ZAG Dimičeva ulica 12 1000 Ljubljana Slovenia http://www.zag.si	Owner of the Environmental Product Declaration: Goriške opekarne d.o.o Merljaki 7, 5292 Renče, Slovenia https://www.goriske.com/products/clay-roof-tiles-korec						
Number of the Environmental Product Declaration: EPD-25/0010	Declared unit: 1 ton of Clay roof tiles Korec						
This Environmental Product Declaration is based on the Product Category Rules (PCR): PCR for Building-Related Products and Services – Part A: Calculation rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019 version 1.4, and Part B: Requirements on the EPD for Bricks.	Scope: Cradle to grave (modules A1-A3, A4, A5, B1-B7, C1-C4, D)						
Issue date: 12.06.2025 Valid until: 12.06.2030	Verification: <table border="1" data-bbox="943 1283 1481 1554"> <tr> <td colspan="2">The CEN standard SIST EN 15804 serves as the core Product Category Rule (PCR)</td> </tr> <tr> <td colspan="2">Independent verification of the EPD according to EN ISO 14025</td> </tr> <tr> <td><input type="checkbox"/> external</td> <td><input checked="" type="checkbox"/> internal</td> </tr> </table>	The CEN standard SIST EN 15804 serves as the core Product Category Rule (PCR)		Independent verification of the EPD according to EN ISO 14025		<input type="checkbox"/> external	<input checked="" type="checkbox"/> internal
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Production plant: Goriške opekarne d.o.o Merljaki 7 5292 Renče Slovenia	Title and the handwritten signature of verifier: <i>Anja Lešek, mag. inž. ok. gr.</i>  Slovenian National Building And Civil Engineering Institute – ZAG						
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1 Product

1.1 Product description

Clay roof tiles Korec is a roofing material with a centuries-old tradition. It is suitable for various architectural styles, from family houses to large commercial buildings.

The products included under the Clay roof tiles Korec are listed in Table 1.

1.2 Technical Data

Clay roof tiles Korec comply with the requirements of SIST EN 1304:2014/A101:2014. They meet Category 1 requirements for water impermeability according to Test Method 2. The tiles are classified as Class A1 for fire resistance, meaning they are non-combustible, and achieve a Class B roof rating for external fire performance. They conform to the standard's requirements for flexural strength and dimensional accuracy. Additionally, the product contains no hazardous substances.

1.3 Application

The Clay roof tiles Korec is used for covering the roofs of residential, commercial, and industrial buildings. It is a traditional roof covering made of ceramic, providing protection for the structure against weather conditions such as rain, snow, wind, and UV radiation. In addition to its functional protective role, the tile also serves an aesthetic purpose by contributing to the architectural appearance of the building. Due to its durability and long lifespan, it is suitable for use in both new constructions and the renovation of existing roofs.

1.4 Delivery status

Korec clay roof tiles are packed on pallets, with 312 pieces per pallet. The final packaging is done in such a way that two pallets, stacked

one on top of the other, are wrapped together in foil. The roof tile pallets are stored in an open-air warehouse next to the tile factory. The products are labeled and declared.

1.5 Base materials






The basic material for the production of Clay roof tiles Korec are:

- Clay 99,8 %
- Colored engobes 0,015%
- Silica sand 0,11%

1.6 Manufacturing process

Raw materials are extracted year-round at the Okroglica clay pit, 7,8 km from the Goriške opekarne complex. The material is transported by truck to the Renče depot, where it is stored in specific composites based on the type of product. This ensures a steady supply of quality raw materials throughout the year. The raw material is then processed into the appropriate mix, crushed to the required size, and stored in an aging silo. During the shaping phase, the mix is further processed using homogenizers and a vacuum extruder, then cut and formed into green products. Clay shrinkage is considered during drying and firing. Products are dried in chamber dryers and fired in a tunnel kiln, after which high-quality items are prepared for market sale. The flow diagram is seen in Figure 1.

Table 1: Product Clay roof tiles Korec

Commercial Product Name	Available Dimensions (thickness/width/length in mm)	Picture	Description
Red clay tile	Korec: length 450 mm, width 180 mm. Short Korec: length 340 mm, width 180 mm. Ridge tile: length 450 mm, width 220 mm.		The Red clay tile creates a wavy roof surface with softened edges. During construction, smooth tiles, tiles with lines, or embossed tiles in natural brick color can be used, or they can be combined with other colored tiles.
Colored clay tiles	Colored Korec: length 450 mm, width 180 mm. Short Colored Korec: length 340 mm, width 180 mm. Colored Ridge Tile: length 450 mm, width 220 mm.		Colored or engobed clay tiles have the same properties as red tiles, with the difference that their upper surface is coated with an engobe—a clay-based colorant applied as a water-based suspension or powder before firing. The engobe consists of a metallic pigment and a flux, which melts and bonds with the clay body during the sintering process in the kiln, ensuring strong adhesion and long-lasting color. The engobe creates a semi-matte glaze on the tile surface, giving the tiles a more natural appearance.
Clay tile with nose	Korec with lug: length 450 mm, width 180 mm.		The Clay tile with nose enhances the roofing system by improving the stability of tiles on battened, ventilated roofs. It is installed as the concavely placed lower tile, or as the Alpe Jadran tile, by hooking it onto a longitudinal batten and, if necessary, additionally fastening it with nails. Once secured in this way, the lower tiles are highly stable and cannot slip. The upper, convexly placed tiles are also reinforced using hooks or screws. The Clay tile with nose is used exclusively as a lower tile. Roofs that utilize lugged tiles offer higher quality, better ventilation, increased stability, and require minimal maintenance.
Alpe jadran tile	Alpe Jadran tile: length 450 mm, width (wide part) 180 mm. Wide Alpe Jadran tile: length 450 mm, width 195 mm. Short Alpe Jadran tile: length 340 mm, width 180 mm.		The Alpe Jadran tile is brick-colored and features a smooth surface with linear grooves. Its trapezoidal shape gives the roof a pronounced textured appearance. It is installed on the roof substrate in the same manner as Korec tiles. The Alpe Jadran tile can be used as the lower (concavely placed) element in combination with various Korec tiles. This combination does not alter the visual appearance of the roof but significantly enhances its stability and walkability.
Special elements			The special clay elements enable a qualitative execution of finishing roofing works. These details enhance the aesthetic appearance of the roof and contribute to its functionality.

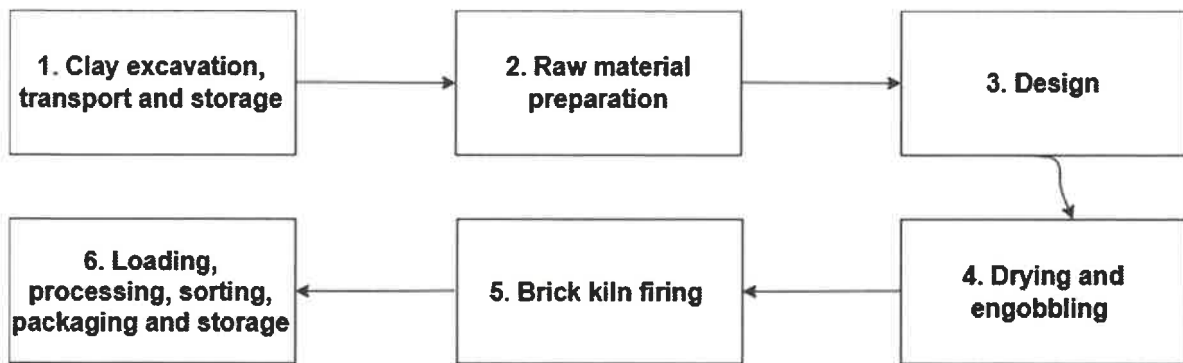


Figure 1: Flow diagram of the production process

1.7 Environment and health during manufacturing

Workers handle raw materials, operate machinery, and monitor quality while ensuring proper ventilation to minimize dust exposure. Safety measures, such as protective gear and ergonomic workstations, are enforced to prevent injuries and long-term health risks. Training on occupational safety helps employees stay aware of hazards and best practices in tile manufacturing.

1.8 Product processing/Installation

The installation of Clay roof tiles Korec requires a roofing hook or PU foam.

1.9 Packaging

Clay roof tiles Korec are packed on wooden pallets and wrapped with resistant foil. The products are tied with plastic straps.

1.10 Reference service life

The reference service life is the same as the RSL for the building to which the Clay roof tiles Korec are installed at and equals 50 years.

1.11 Reclaimed materials

The main raw material used in the production of Korec roof tiles is clay. Clay accounts for 99.8% of the final product, of which 33.2% is recovered clay. The recovered material content in the product is 33.2%.

1.12 Further information

Further information is available on the website <https://www.goriske.com/products/clay-roof-tiles-korec>.

2 LCA: Calculation rules

2.1 Declared unit

1 tone of Clay roof tiles Korec

2.2 System boundary

The system boundary was defined according to the standard EN 15804:2012+A2:2019. The system boundaries determine the unit processes that are included in the LCA analysis.

This LCA study is based on the Cradle to Grave(modules A1-A3, A4, A5, C1-C4, B1-B7 and D). This means, that in the LCA of Clay roof tiles Korec, the following life cycle stages have been assessed: (i) Product stage, which includes raw material supply (A1), transport to the manufacturer (A2) and production (A3); (ii) Construction process stage, which includes transport from the factory gate to the building site (A4) and installation (A5); Use stage, which includes the use of the installed product (B1), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5), operational energy use (B6) and operational water use (B7); (iii) End of life stage, which includes de-construction/demolition (C1), transport to waste processing (C2), waste processing for reuse, recovery and/or recycling (C3) and disposal (C4); and (iv) Benefits and loads beyond the system boundary, that includes recycling, reusing, and recovery (D). The schematic representation of system boundaries can be seen in Figure 2.

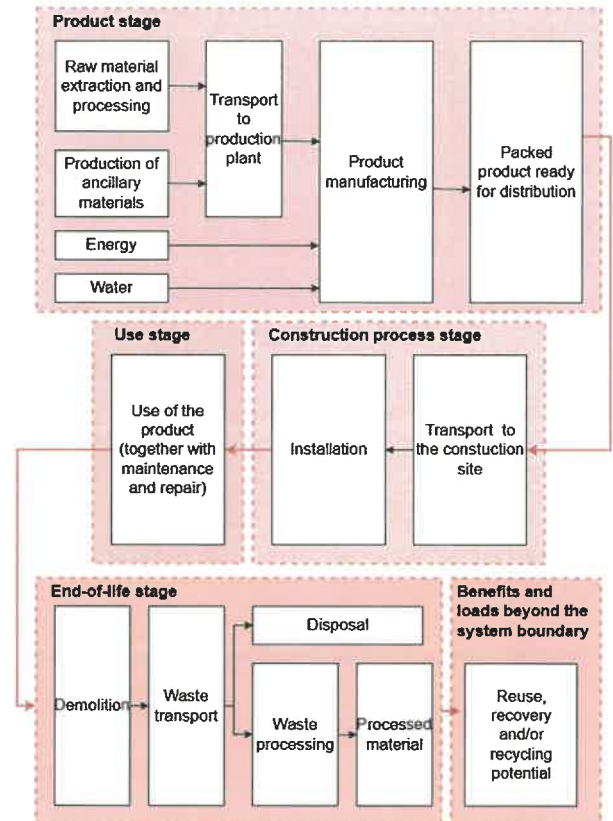


Figure 2: Schematic representation of the system boundaries.

2.3 Cut-off rules

The cut-off rules are defined in EN 15804:2012+A2:2019, with the following procedure being followed for the exclusion of inputs and outputs in this LCA study:

- all inputs and outputs to the studied system have been included in the calculation, for which data are available;
- in case of insufficient input data or data gaps for a unit process, the cut-off criteria has been 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows per module has been a maximum of 5% of energy usage and mass.

Excluded input materials are radiators for heating and sand. Excluded due to a negligible mass fraction relative to other materials.

2.4 Data quality

The quality of the data used for calculations within the LCA analysis corresponds to the requirements of EN 15804:2012+A2:2019:

- generic data have been checked for plausibility;
- data sets are complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs;
- data is as current as possible. Data sets used for calculations are valid for the current year and represent a reference year within 10 years for generic data and 5 years for producer specific data;
- the reference year refers to the year which the overall inventory best represents, considering the age/representativeness of the various specific and background data included, i.e. not automatically the year of modelling, calculation or publication year. Validity refers to the date to which the inventory is still judged sufficiently valid with the documented technological and geographical representativeness;
- all datasets are based on 1 year averaged data;
- the time period over which inputs to and outputs from the system has been accounted for is 100 years from the year for which the data set is deemed representative.

The time representativeness of all data is very good, the technical representativeness ranges from very good to good and the geographical representativeness is good. This is in accordance with EN 15804+A2, Annex E, table E.1.

2.5 Background data

The LCA analysis of Clay roof tiles Korec has been conducted with the LCA for Experts version 10.9.0.20. modeling software. All processes have been modelled on the inventory data given in the MLC database. For electricity, a location-based approach has been used, in acc. to EN 15941.

2.6 Period under review

Product data are based on average production information collected for the year 2024.

2.7 Allocation

In this specific LCA analysis, allocation was used.

In the process of roof tile production, specifically after firing and drying, a certain amount of product remains, which is then sold on the market.

2.8 Comparability

Comparison of the environmental performance of construction products using the EPD information has to be based on the product's use in and its impacts on the building. Comparisons are possible in the sub-building level if the conditions, listed in EN 15804:2012+A2:2019 are met.

3 LCA: Scenarios and additional technical information

3.1 Information about biogenic carbon content

Biogenic carbon is present in the product and packing materials. Values are presented in Table 1.

Table 2: Biogenic carbon content

Name	Value	Unit
Biogenic Carbon Content in product	0,55	kg C
Biogenic Carbon Content in accompanying packaging	2,28	kg C

1 kg biogenic carbon is equivalent to 44/12 kg of CO₂

3.2 Technical information

The following technical information is the basis for the declared modules or can be used for the development of specific scenarios in the context of a building assessment.

3.2.1 Transport to the building site (A4)

Transport from the factory gate to the building site is included in the module A4 and is set to the average transport distance from the factory to the installation site. In this case, the distance is set to 100 km.

3.2.2 Installation into the building (A5)

Module A5 includes a roofing hook or PU foam, which is required for the installation. We used a scenario where 50% are installed with roofing hook and in other 50% with PU foam.

Module A5 includes waste processing of the waste from product packaging, during the construction process up to the end-of-waste state which includes incineration burdens of palettes following the usual practice from

countries the product is exported to – incineration for heat recovery in a waste-to-energy (WtE) plants. Plastic packaging is going to be recycled. In module A5, we consider just the preprocessing of plastic.

3.2.3 Use stage (B1-B7)

No relevant environmental impacts are generated in the use stage. Use stage has a value of zero.

3.2.4 End of life (C1-C4)

The end-of-life scenario predicts a 90% recycling of the Clay roof tiles Korec. 10% goes to the landfill.

The deconstruction (module C1) of the Clay roof tiles Korec is performed mechanically. Module C2 covers the transportation of the dismantled panels to the local recycling site and equals 15 km. Module C3 includes the necessary pre-processing steps to prepare the product for recycling. Module C4 covers the disposal of the Korec roofing tiles in a landfill.

3.2.5 Reuse, recovery and recycling potential (D) relevant scenario information

Module D includes the reuse, recovery, and/or recycling potentials, expressed as net impacts and benefits. This includes recycling of the Clay roof tiles Korec.

Module D also includes the potentials arising from the recycling of packaging waste generated during the installation phase (modules A4-A5).

4 LCA: Results

Table 2: Selected phases of the LCA

SYSTEM BOUNDARY																	
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE								END-OF-LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Production	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential	D
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
☒	☒	☒	☒	☒	MNA	MNA	MNA	MNA	MNA	MNA	MNA	☒	☒	☒	☒		☒
The modules of the product lifecycle, which are included in EPD are marked by "X", modules not included are marked with a "MNA" = module not assessed, "MND" = module not declared, "MNR" = module not relevant																	

4.1 Core environmental impact indicators

According to the standard EN 15804+A2, the environmental impacts are presented with thirteen Core environmental impact indicators (Table 3).

Table 3: Abbreviations and units of Core environmental impact indicators

Core environmental impact indicators	Abbreviation	Unit
Global warming potential - total	GWP-total	kg CO ₂ eq.
Global warming potential - fossil fuels	GWP-fossil	kg CO ₂ eq.
Global warming potential - biogenic	GWP-biogenic	kg CO ₂ eq.
Global warming potential - land use and land use change	GWP-luluc	kg CO ₂ eq.
Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11 eq.
Acidification potential, accumulated exceedance	AP	mol H ⁺ eq.
Eutrophication potential, fraction of nutrients reaching freshwater end	EP-freshwater	kg PO ₄ eq.
Eutrophication potential, fraction of nutrients reaching marine end comp.	EP-marine	kg N eq.
Eutrophication potential, accumulated exceedance	EP-terrestrial	mol N eq.
Formation potential of tropospheric ozone	POCP	kg NMVOC eq.
Abiotic depletion potential for non-fossil resources	ADP-minerals & metals	kg Sb eq.
Abiotic depletion for fossil resources potential	ADP-fossil	MJ, net c. value
Water (user)m deprivation potential, deprivation-weighted water cons.	WDP	m ³ world eq. d.

The Core environmental impact indicators for Clay roof tiles Korec are shown in Table 4.

Table 4: Core environmental impact indicators for Clay roof tiles Korec (FU: 1 ton)

Indicator	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT A-C
GWP-total	[kg CO ₂ eq.]	2,35E+02	9,25E+00	2,79E+01	0,00E+00	6,45E-01	1,85E+00	2,52E+00	1,50E+00	-4,24E+00	2,78E+02
GWP-fossil	[kg CO ₂ eq.]	2,43E+02	9,78E+00	1,91E+01	0,00E+00	6,50E-01	1,96E+00	2,54E+00	1,50E+00	-5,02E+00	2,78E+02
GWP-biogenic	[kg CO ₂ eq.]	-8,19E+00	-7,02E-01	8,85E+00	0,00E+00	-1,55E-02	-1,40E-01	-5,21E-02	-1,03E-02	7,75E-01	-2,62E-01
GWP-luluc	[kg CO ₂ eq.]	8,59E-02	1,72E-01	6,35E-03	0,00E+00	1,05E-02	3,44E-02	3,80E-02	8,98E-03	-7,90E-03	3,56E-01
ODP	[kg CFC 11 eq.]	2,64E-10	1,51E-12	1,36E-10	0,00E+00	9,19E-14	3,02E-13	7,85E-12	4,04E-12	-3,20E-11	4,14E-10
AP	[mol H ⁺ eq.]	1,74E-01	1,33E-02	4,18E-02	0,00E+00	3,22E-03	2,66E-03	1,23E-02	1,06E-02	-2,26E-02	2,58E-01
EP-freshwater	[kg PO ₄ eq.]	9,81E-05	4,37E-05	3,58E-05	0,00E+00	2,66E-06	8,75E-06	7,10E-06	3,40E-06	-4,10E-05	2,00E-04
EP-marine	[kg N eq.]	6,39E-02	4,91E-03	1,14E-02	0,00E+00	1,52E-03	9,83E-04	5,69E-03	2,74E-03	-1,24E-02	9,11E-02
EP-terrestrial	[mol N eq.]	7,03E-01	5,71E-02	1,22E-01	0,00E+00	1,68E-02	1,14E-02	6,30E-02	3,01E-02	-9,10E-02	1,00E+00
POCP	[kg NMVOC eq.]	1,94E-01	1,36E-02	3,93E-02	0,00E+00	4,30E-03	2,72E-03	1,57E-02	8,37E-03	-1,38E-02	2,78E-01
ADP-minerals&metals	[kg Sb eq.]	1,16E-05	8,92E-07	1,71E-06	0,00E+00	5,44E-08	1,78E-07	2,80E-06	9,70E-08	-7,63E-07	1,73E-05
ADP-fossil	[MJ]	3,98E+03	1,35E+02	2,67E+02	0,00E+00	8,22E+00	2,70E+01	4,57E+01	1,97E+01	-7,53E+01	4,48E+03
WDP	[m ³ world eq. deprived]	1,54E+01	1,59E-01	1,83E+00	0,00E+00	9,66E-03	3,17E-02	4,24E-01	1,71E-01	-5,69E-01	1,80E+01

4.2 Parameters describing resource use

The results of the Parameters describing resource use are in accordance with the standard EN 15804+A2, shown with ten indicators (Table 5). Parameters include the use of renewable and non-renewable energy, the use of renewable and non-renewable material resources, and the use of water.

Table 5: Abbreviations and units of Parameters describing resource use

Parameters describing resource use	Abbreviation	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	PERM	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value
Use of non-renewable primary energy sources used as raw materials	PENRM	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value
Use of secondary materials	SM	kg
Use of renewable secondary fuels	RSF	MJ, net calorific value
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value
Net use fresh water	FW	m ³

The indicators of the Parameters describing resource use for Clay roof tiles Korec are shown in Table 6.

Table 6: Parameters describing resource use for Clay roof tiles Korec (FU: 1 ton)

Indicator	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT A-C
PERE	[MJ]	3,26E+02	1,16E+01	6,99E+01	0,00E+00	7,08E-01	2,32E+00	6,38E+00	3,44E+00	-4,77E+01	4,21E+02
PERM	[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	0,00E+00	0,00E+00
PERT	[MJ]	3,26E+02	1,16E+01	6,99E+01	0,00E+00	7,08E-01	2,32E+00	6,38E+00	3,44E+00	-4,77E+01	4,21E+02
PENRE	[MJ]	3,98E+03	1,35E+02	2,67E+02	0,00E+00	8,22E+00	2,70E+01	4,57E+01	1,97E+01	-7,53E+01	4,48E+03
PENRM	[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	0,00E+00	0,00E+00
PENRT	[MJ]	3,98E+03	1,35E+02	2,67E+02	0,00E+00	8,22E+00	2,70E+01	4,57E+01	1,97E+01	-7,53E+01	4,48E+03
SM	[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	0,00E+00	0,00E+00
RSF	[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	0,00E+00	0,00E+00
NRSF	[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	0,00E+00	0,00E+00
FW	[m ³]	4,98E-01	1,30E-02	7,31E-02	0,00E+00	7,89E-04	2,59E-03	1,33E-02	5,23E-03	-2,94E-02	6,06E-01

4.3 Environmental information describing waste categories and output flows

According to the standard EN 15804+A2, the results for Environmental information describing waste categories are presented with three indicators, and the results of the output flows from the system are based on four indicators (Table 7).

Table 7: *Abbreviations and units of Environmental information describing waste categories and output flows*

Environmental information describing waste categories	Abbreviation	Units
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Environmental information describing outout flows	Abbreviation	Units
Components for re-use	CRU	kg
Material for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ on the energy carrier

Indicators for Environmental information describing waste categories and output flows for Clay roof tiles Korec Korec roofing tiles are shown in Table 8.

Table 8: Environmental information describing waste categories and output flows for Clay roof tiles Korec (FU: 1 ton)

Indicator	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT A-C
HWD	kg	2,76E-07	5,17E-09	1,57E-07	0,00E+00	3,15E-10	1,03E-09	9,67E-09	4,92E-09	-3,23E-08	4,54E-07
NHWD	kg	2,06E+00	2,20E-02	3,57E-01	0,00E+00	1,34E-03	4,41E-03	1,36E-02	1,00E+02	-3,77E+01	1,03E+02
RWD	kg	8,43E-02	2,46E-04	7,52E-03	0,00E+00	1,50E-05	4,92E-05	3,57E-04	2,07E-04	-4,62E-03	9,27E-02
CRU	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	0,00E+00	0,00E+00
MFR	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	9,00E+02	0,00E+00
MER	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	5,45E+00	0,00E+00
EE	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	9,54E+01	0,00E+00

4.4 Additional environmental impact indicators

According to the standard EN 15804+A2, the results for Additional environmental impact indicators are presented with six indicators (Table 9).

Table 9: *Abbreviations and units of Additional environmental impact indicators*

Additional environmental impact indicators	Abbreviation	Unit
Potential incidence of disease due to PM emissions	PM	disease incidence
Potential human exposure efficiency relative to U235	IRP	kBq U235 eq.
Potential comparative toxic unit for ecosystems	ETP-fw	CTUe
Potential comparative toxic unit for humans-cancerogenic	HTP-c	CTUh
Potential comparative toxic unit for humans-non-cancerogenic	HTP-nc	CTUh
Potential soil quality index	SQP	-

Additional environmental impact indicators for Clay roof tiles Korec are shown in Table 10.

Table 10: Additional environmental impact indicators for Clay roof tiles Korec (FU: 1ton)

Indicator	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT A-C
PM	[disease incidence]	2,55E-06	1,26E-07	5,42E-07	0,00E+00	3,84E-08	2,51E-08	2,41E-07	1,33E-07	-6,38E-07	3,66E-06
IRP ¹	[kBq U235 eq.]	5,80E+00	3,57E-02	9,11E-01	0,00E+00	2,17E-03	7,13E-03	3,76E-02	2,40E-02	-8,42E-01	6,82E+00
ETP-fw	[CTUe]	2,33E+02	1,00E+02	8,62E+01	0,00E+00	6,10E+00	2,00E+01	3,53E+01	1,14E+01	-3,32E+02	4,92E+02
HTP-c	[CTUh]	3,37E-08	2,02E-09	1,64E-08	0,00E+00	1,23E-10	4,04E-10	7,67E-10	2,69E-10	-2,65E-09	5,37E-08
HTP-nc	[CTUh]	1,15E-06	9,08E-08	1,83E-07	0,00E+00	5,54E-09	1,82E-08	2,69E-08	1,04E-08	-2,70E-07	1,49E-06
SQP	[-]	1,65E+03	6,64E+01	4,85E+01	0,00E+00	4,04E+00	1,33E+01	1,95E+01	5,44E+00	-8,34E+01	1,80E+03

Disclaimer 1 (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 – for the indicators ADPE, ADPF, WDP, ETP-fw, HTP-c, HTP-nc, SQP
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 experience with the indicator.

5 Interpretation of results

The results of the LCA analysis for the Core environmental indicators show that the majority of environmental impacts are contributed by the product phase (modules A1–A3). This phase accounts for 83% of the total impact in terms of global warming potential (GWP-total), 59% in terms of ozone depletion potential (ODP), 62% in terms of acidification potential (AP), between 41% and 46% in terms of eutrophication (freshwater, marine water, and soil), 67% in terms of photochemical ozone creation potential (POCP), 64% in terms of abiotic depletion of minerals and metals (ADP-minerals & metals), 87% in terms of abiotic depletion of fossil resources (ADP-fossil), and 83% in terms of water depletion potential (WDP).

Module A4 (transport of the roofing material from the factory to the installation site) has the highest impact on the environmental indicator EP-freshwater, contributing 19% of the total impact. Module A5, which includes installation of the roofing, materials required for installation, and waste handling, has the highest impact on the ODP indicator (31%), and AP with 21%

No relevant environmental impacts are generated in use stage (module B1-B7).

The end-of-life stage (modules C1–C4) has the lowest contribution to the core indicators. Within this stage, module C3 (pre-processing) shows the most notable impact on ADP-minerals & metals, contributing 15%.

Potential environmental benefits were calculated for module D, which represents benefits and loads occurring beyond the system boundaries. These benefits are

associated with the recycling of roofing material and plastic waste, as well as the energy recovery from pallet incineration.

The LCA results for raw material use show that the majority of resources are consumed during the production phase (modules A1–A3), while other life cycle stages have a smaller impact on resource use.

The LCA results for waste generation indicate that the largest quantity of hazardous waste (HWD) is produced during the production (modules A1–A3) and installation (module A4) stages. In contrast, the highest amounts of non-hazardous waste (NHWD) and radioactive waste (RWD) are generated during the production phase (modules A1–A3). Regarding output flows, the benefits and burdens are linked to the system boundary-exceeding module (i.e. module D).

For additional environmental indicators, the LCA analysis showed that the highest impacts stem from the production phase (modules A1–A3). For indicators such as freshwater ecotoxicity (ETP-fw) and human toxicity – cancer effects (HTP-c), the installation phase (modules A4–A5) also has a visible contribution in addition to the production phase.

6 References

1. LCA for Experts with MLC database
2. EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
3. EN ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework (EN ISO 14040:2006)
4. EN ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines (EN ISO 14044:2006)
5. EN ISO 14025:2010 Environmental labels and declarations - Type III environmental
6. Product Category Rules (PCR) Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019, version 1.4
7. Product Category Rules (PCR) Part B: Requirements on the EPD for Bricks (published: 01.08.2024)
8. Report No. 1085/24-520-1, Analiza življenjskega cikla strešne kritine Korec (2025)
9. Report on verification of the ZAG EPD Environmental Product Declaration EPD-25/0010 for Clay roof tiles Korec by Goriške opekarne d.o.o. (2025)

The data specified in the EPD are calculated on the basis of the data provided by the manufacturer. In the event that the manufacturer's information is incorrect, calculations do not apply.