ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Bundesverband der Deutschen Ziegelindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BDZ-20210268-IBG4-EN
Issue date	15/11/2021
Valid to	14/05/2027

Roofing tiles (including accessories)

Bundesverband der Deutschen Ziegelindustrie e.V.

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com



1. General Information

Bundesverband der Deutschen Ziegelindustrie e.V.

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-BDZ-20210268-IBG4-EN

This declaration is based on the product category rules:

Roof tiles, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

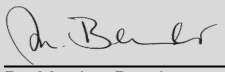
15/11/2021

Valid to

14/05/2027



Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)



Dr. Martina Bender
(Managing Director Institut Bauen und Umwelt e.V.)

Roofing tiles (including accessories)

Owner of the declaration

Bundesverband der Deutschen Ziegelindustrie e.V.
Reinhardtstraße 12-16
10117 Berlin
Germany

Declared product / declared unit

1
m² roofing tiles (including accessories)

Scope:

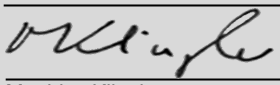
Application of this document
is restricted to roofing tiles manufactured by member companies of the Bundesverband der Deutschen Ziegelindustrie e.V. For this Declaration,

data from 2020 was made
available by 8 member companies and a total of 20 production locations. These
members represent around 85% of the manufacturers of roofing tiles united in
the federal association. Depending on their respective production quantities,
the production volume of these companies accounts for approx. 85% of the German
market.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally



Matthias Klingler,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Clay roofing tiles, including ceramic accessories, of the members of the Bundesverband der Deutschen Ziegelindustrie e. V. are modelled. This involves flat tiles, shaped tiles and accessories (also suitable for facades).
The various products are only distinguished in terms of shape and colour (engobe, glaze). The relevant composition, i.e. clay and loam content, is largely uniform.
(EU) Directive No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance taking consideration of the DIN EN 1304:2013-08 – Clay roofing tiles and fittings – Product definitions and specifications, and CE marking. Use is governed by the respective national provisions; in Germany: the rules of the German roofing trade and information supplied by the manufacturer.
Please select one of the following options and delete the header of the selected [alternative]:

[Alternative 1a: Product according to the CPR based on a hEN]:

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 xyz:date, title and the CE-marking.

For the application and use the respective national provisions apply.

[Alternative 1b: Products according to the CPR based on an ETA]:

For the placing of the product on the market in the European Union/European Free Trade Association /EU/EFTA) (with the exception of Switzerland) the Regulation (EU) No. 305/2011 (CPR) applies. The product needs a declaration of performance taking into consideration ETA no. xyz:date, title and the CE-marking.

For the application and use the respective national provisions apply.

[Alternative 2a: Product not harmonised in accordance with the CPR but in accordance with other provisions for harmonisation of the EU]:

For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

- *Directive no. xyz: date, title*
- *Regulation no. xyz: date, title*
- and the harmonised standards based on these provisions:
- *EN xyz: date, title*

The CE-marking takes into account the proof of conformity with the respective harmonized standards based on the legal provisions above.

For the application and use the respective national provisions apply.

[Alternative 2b: Product harmonized as well in accordance with the CPR as with other provisions for harmonisation of the EU]:

For the placing of the product on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the Regulation (EU) No. 305/2011/ (CPR) and the following other provisions for harmonisation apply:

- *Directive (EU) xyz: date, title*
- *Regulation (EU) no. xyz: date, title*

The product needs a declaration of performance in accordance with the CPR taking into consideration /EN xyz: date/, title or /ETA no. xyz/:date, title respectively and the CE-marking.

The CE-marking for the product takes into account the Declaration of Performance in accordance with the CPR and the proof of conformity with the following harmonised standards or based on the other provisions for harmonisation:

- *EN xyz: date, title*
- *Source, date, title*

For the application and use the respective national provisions apply.

[Alternative 3: Product for which no legal provisions for harmonisation of the EU exist]:

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

2.2 Application

Clay roofing tiles are used for covering pitched roofs or for cladding facades.

2.3 Technical Data

Name	Value	representative product	Unit
Dimensional deviation Coverage width as per DIN EN 1024	<2	<2	%
Coverage length acc. to DIN EN 1024	110-540	390	mm
Coverage width acc. to DIN EN 1024	150-360	250	mm
Water impermeability acc. to DIN EN 539-1	≤0.8	≤0.8	-
Flexural tensile strength acc. to DIN EN 538	≥ 0.6	≥ 1.2	kN
Durability (resistance to frost acc. to DIN EN 539-2, performance level 1 – 150 FTW)	fulfilled	fulfilled	-
Weight acc. to DIN EN 539-2	1-10	4	kg/unit
Space requirements	5-50	10	pces./m2
Dimensions: width x length acc. to DIN EN 1024	depending on the roof tile model	300x450	mm
Gross density	2000 - 2410	app. 2020	kg/m³

The performance values of the product correspond to the Declaration of Performance with regard to its essential characteristics according to *DIN EN 1304:2013-08 – Clay roofing tiles and fittings – Product definitions and specifications* (not a component of CE marking).

2.4 Delivery status

The technical data on flat tiles is provided in 2.1; the accessory tiles may deviate from this due to their individual function. The
tiles are supplied on wooden pallets.

2.5 Base materials/Ancillary materials

Roofing tiles are manufactured from natural raw materials. The main components of the ceramic mass are loam and clay. Their contents fluctuate depending on their ceramic properties.

Name	Value	Unit
clay	75 – 85	%
loam	15 – 25	%
sand	0 – 5	%
aggregates	0 – 0,5	%
Engobes/Glazes	0 – 0,8	%

Clay and loam

Clay and loam are naturally occurring sedimentary materials with varying levels of clay mineral content and plastic deformation characteristics depending on the respective water content. They are excavated directly from near-surface deposits under observation of statutory specifications and approvals.

Water

The water content essentially involves pit moisture, water from factory wells or drinking water.

Engobes and glazes

Glazes and engobes primarily comprise special clays, premelted glazes and pigments for providing colour. The coating is inextricably bonded to the ceramic shards through firing.

Water is added to the raw materials for processing, which escapes as water vapour in the further production steps. All components are fired at approx.
1000–1200 °C and thus combined to form long-lasting roof tiles.
The product / At least one partial product contains substances from the ECHA list of candidates of Substances of Very High Concern (SVHC) (20.12.2018) exceeding 0.1% by mass: no
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% by mass in at least one partial product: no

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.

The main constituents of the product or its components shall be indicated as mass percentages to enable the user of the EPD to understand the composition of the product in delivery status. This information should support safety and efficiency during installation, use, and disposal of the product.

When substances from the “Candidate List of Substances of Very High Concern for Authorisation” (SVHC) are part of the formulation with a mass percentage of > 0,1 of the mass of the construction product, i.e. when they were added to the formulation on purpose, then the substances shall be declared including CAS-number.

If the construction product is a substance or mixture under the chemical law (*REACH*), the concentration limit value refers to the entire product; if it is an article, the partial product or component applies as a unit of reference.

The Candidate list can be found on the ECHA website address: echa.europa.eu/de/home

This declaration is mandatory for all EPDs and must be formulated as follows:

1) “This product/article/at least one partial article contains substances listed in the candidate list (date: dd.mm.yyyy) exceeding 0.1 percentage by mass: yes/no”.

[if yes: List of respective SVHC and their CAS-number]

[If yes:] - Information on the concentration and/or concentration range (comparable information on hazardous properties and if relevant, information on the partial article in the case of articles)

If the construction product is a substance or mixture under the chemical law (REACH), the safety data sheet shall be made available in the EPD, e.g. by a link. In addition, the

concentrations of the hazardous substance as well as its hazardous properties have to be stated in the EPD.

Carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A and 1B must also be declared including CAS-number if a European harmonised classification is available as well as information on treatment with biocides. For IBU-EPDs statements 2) and 3) are mandatory.
This statement on other CMR substances which are not listed as SVHC and on biocides must be formulated as follows:

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

[If yes:] – List the concentration and/or concentration ranges (comparable to the information on a safety data sheet), provide information on hazardous properties and if relevant information on the partial article in the case of articles.

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): yes/no”

[If yes:] - List the biocides referred to above.
The active substance and the product type (in-can preservative, film preservative, wood protection, etc. according to the Ordinance on Biocide Products (see also 1.4) must be indicated.

Ancillary materials and additives remaining on the product must also be declared.
If additives such as fire retardants, softeners or biocides are used, their functional chemical group must be indicated.

Statements like “…free of ….” and/or “…does not contain…” may not be used.

2.6 Manufacture

Pit operation
The main components (loam and clay) are extracted in opencast mines. After the topsoil has been removed and, if necessary, archaeological sites have been processed, extraction is usually carried out with excavators. Depending on the road conditions, transport entails the use of suitable trucks. Conveyor belts can be used for short distances. When the pits are exhausted, they are recultivated in accordance with nature conservation guidelines and, if necessary, returned to their previous use.

Processing raw materials
The individual raw material components are sampled and analysed in the laboratory for their ceramic properties and their mineralogical and chemical compositions. In the processing stage, the components are combined into the operating mass according to their ceramic properties, homogenised and stored.

Forming
The operating mass is pressed in extrusion presses under vacuum to form lumps, which are then pressed in turret or rotary table presses by means of plaster moulds to form roof tiles. Plain tiles are only extruded.
Various parameters such as press vacuum, roof tile properties (moisture, plasticity and weight) are checked regularly. Excess operating mass and faulty pressings are returned in full to the mass circuit.

Drying
Drying serves as preparation of the plastic roofing tile for the subsequent firing process and takes place over 1–2 days at approx. 60–120 °C, depending on the model. Due to its shrinkage behaviour, the ceramic material reacts very sensitively and must therefore be dried under defined conditions. Various drying parameters and the residual moisture are constantly monitored. Dried roof tiles that have been sorted out (dry quarry) are returned to the production mass in the raw material preparation department.

Colouring
Engobes or glazes are applied to the dried roofing tiles as required. The density of the engobes/glazes and the application thickness are checked regularly. Any residues and the washing water are processed and returned to the raw material cycle.

Firing
The tiles are fired in tunnel kilns and bogie hearth furnaces at approx. 1000–1200 °C using natural gas. The firing time incl. the heating and cooling phase is approx. 1–2 days. The firing process gives the roof tiles their ceramic properties, which make them durable and long-lasting.

Water-repellent finish
In order to reduce the water absorption capacity, some roof tiles are hydrophobised on the surface in an immersion bath before being packed.

Quality control
The requisite ceramic quality properties according to *EN 1304* and the product dimensions to be adhered to are regularly controlled internally in the factory's own production control and additionally monitored externally at least once a year.

2.7 Environment and health during manufacturing

Safety experts are appointed for occupational health and safety and company doctors are available in the factories with regular consultation hours.

If necessary, the flue gas from the fire is purified in flue gas purification plants. The emission values are monitored regularly and fall below the limits permitted under the Federal Immission Control Act (*BImSchG*).
Noise and dust emissions are also controlled and the limits are strictly observed. Waste generated during the production of roofing tiles is collected separately, recycled or disposed of properly according to the waste codes. The energy input for roofing tile production is kept as low as possible and the specific energy requirement is constantly improved.

Energy management systems according to *ISO 50001* or alternative systems according to *SpaEfv for SMEs* are operated at all production sites.

2.8 Product processing/Installation

Cutting, drilling and grinding of ceramic building materials such as roofing tiles releases dust that may contain respirable quartz components. Wet cutting equipment or equipment with dust extraction should be used to avoid the release of dust. For protection, a suitable dust mask should be worn as personal protective equipment in addition to gloves, safety goggles and ear protection. When laying the roofing tiles, the professional rules of the roofing trade and the manufacturer's instructions must be observed.

2.9 Packaging

The roofing tiles are bundled into small handy packs and stacked on wooden pallets. Cardboard, wood veneer strips, polyethylene (PE) or polypropylene (PP) strapping tape and, if necessary, PE shrink film are used as packaging material. The

palletised roofing tiles are stored on the factory premises until commissioning and loading. The wooden pallets can be returned and are then reused.. All other packaging materials can be recycled and disposed of via the usual recycling systems.

2.10 Condition of use

Roofing tiles are regarded as being very durable and resilient. Material composition is not altered during use.

2.11 Environment and health during use

There are no known impacts on the environment or health when roofing tiles are used as intended.

2.12 Reference service life

The reference service life when the roofing tiles are installed in accordance with the professional rules of the German roofing trade and the manufacturer's specifications is 150 years. Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire

Roofing tiles are regarded as non-flammable and are categorised as fire class A1 in accordance with *EN 13501-1*.

Fire protection

Name	Value
Building material class	A1
Burning droplets	d0
Smoke gas development	s1

Water

Roofing tiles are not regarded as being hazardous for water.

Mechanical destruction

No negative environmental impacts are to be anticipated in the event of mechanical destruction of clay roofing tiles.

2.14 Re-use phase

In undamaged form, the dismantled clay roofing tiles can be reused in accordance with their original purpose.

Broken, dismantled, single-variety tiles can be ground up and used as aggregate for the production of building materials, in gardening and landscaping, for tennis courts or as filling material for civil engineering and road construction and can also be used to a limited extent in brick and roof tile production.

2.15 Disposal

Roofing tiles can be disposed of after use as construction waste (non-hazardous waste) according to waste code AVV 17 01 02 (bricks and roof tiles).

2.16 Further information

Further information is available at www.ziegel.de.

3. LCA: Calculation rules

3.1 Declared Unit

This Declaration refers to the manufacture of one square metre roofing tiles (40 kg/m²].

Declared unit

Name	Value	Unit
Declared unit	1	m^2
conversion factor to 1 kg	0,025	-
conversion factor to 1 t	25	-

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

3.2 System boundary

Type of EPD: cradle to plant gate – with options. The Life Cycle Assessment takes into account the extraction of raw materials, the transport of raw materials and actual product manufacturing, including packaging materials (Modules A1–A3). Transport to the construction site (Module A4) and treatment of the packaging materials in the waste incineration plants following installation of the product (Module A5) are also part of the system boundaries. At the end of its useful life, the product is deconstructed by hand (Module C1). After transport of the dismantled product (Module C2), about 6% of the roofing tiles are to be disposed of in an inert waste landfill (Module C4), 94% can be recycled. Credits incurred by recycling firing waste are declared in Module D. Credits for electricity and thermal energy following thermal utilisation of packaging within Module A5 are also considered in Module D.

3.3 Estimates and assumptions

Data sets are not available for all raw materials or preliminary products in the *GaBi 9* database. For some substances, the processes were estimated with preliminary products similar in production and environmental impact. Assumptions are made regarding the collated production-related emissions. For companies that are not subject to monitoring by the competent authorities for selected parameters and thus cannot provide measured values, an estimate is made based on the information provided by the other companies.

3.4 Cut-off criteria

All data from the operating data survey is taken into consideration, i.e. all starting materials used according to the formula, auxiliary materials as well as the thermal and electrical energy used.
Accordingly, material and energy flows accounting for a share < 1% are also considered. All data provided is integrated in the LCA model. Transport costs are included for all basic materials, the shipping of products (A4) and in the end-of-life scenario (C2). The wear factor of the wooden pallet as well as the machinery, equipment and infrastructure required in production are neglected.

It can be assumed that the processes ignored would each have contributed less than 5% to the impact categories under review.

3.5 Background data

The GaBi 9 software system for comprehensive analysis developed by thinkstep AG was used for modelling the roofing tile manufacturing process. The consistent data sets contained in the GaBi 9 database are documented in the online GaBi documentation. The basic data in the GaBi data base was applied for energy, transport and consumables. The Life Cycle

Assessment was modelled for Germany as a reference area. This means that apart from the production processes, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers are used. The general electricity mix and a customer-specific electricity mix (from the year 2020), thermal energy from natural gas, heating oil and biomass for Germany with the reference year 2016 are taken into account. Emissions from the firing process are recorded as primary data on the basis of measurements taken by members of the Bundesverband der Deutschen Ziegelindustrie e.V.

3.6 Data quality

Data for the production year 2020 is used to model the product stage of the roof tiles. All other background data sets of relevance were taken from the *GaBi 9* software database. The database was last updated

in 2020. Data is collected on the products examined by the research agency of the Bundesverband der Deutschen Ziegelindustrie e.V. in the actual plants. The deviations in the environmental impacts in the course of the averaging carried out for the raw materials used and media consumption of the participating plants are small. The majority of data for upstream chains originates from industrial sources and was collected under consistent time- and method-based constraints. Importance is attached to a high degree of completeness when collating material and energy flows of environmental relevance. The data quality can therefore be referred as being good.

3.7 Period under review

2020 is the period under review. The data represents an annual average over 12 months.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

3.9 Allocation

Production data from 20 plants was made available for manufacturing the products under review. The requisite raw materials were allocated to the respective products in line with their recipes.

Allocation of the product-specific applications entailed allocating fuels and packaging materials by volume produced while electricity and diesel requirements as well as indirectly allocable raw materials were allocated by mass.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Aus der GaBi 9- Datenbank 2020, Servicepack 40,
stammen die Hintergrunddaten.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The total mass of biogenic carbonaceous materials and associated packaging is less than 5% of the total mass of the product. The mass of the packaging containing biogenic carbon is 0.089 kg.
The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	0.22	l/100km
Transport distance	300	km
Capacity utilisation (including empty runs)	85	%

Construction installation process (A5)

Name	Value	Unit
Output substances following waste treatment on site	0.132	kg

In case a **reference service life** according to applicable ISO standards is declared then the assumptions and in-use conditions underlying the determined RSL shall be declared. In addition, it shall be stated that the RSL applies to the reference conditions only.

The same holds for a service life declared by the manufacturer. Corresponding information related to in-use conditions needs not be provided if a service life taken from the list of service life by *BNB* is declared.

Reference service life

Name	Value	Unit
Reference service life acc. to manufacturer	150	a

Reuse, recovery and recycling potential (D), relevant scenario details

Scenario D: Credits as a result of the recycling of building rubble processing
At the end of life of the roofing tiles, a material credit of one-third each is applied for perlite, pumice and lava within the framework of this recycling scenario.
This scenario was chosen because the aforementioned raw materials are most frequently substituted in practice in the course of broken roof tiles as a primary raw material.
Scenario D/1: Credits resulting from the recycling of packaging materials (from Module A5) are shown in Module D/1.

5. LCA: Results

The following is a presentation of the environmental impacts for 1 m² of roofing tiles, produced by the members of the Bundesverband der Deutschen Ziegelindustrie e.V.
The following tables depict the results of the indicators concerning impact estimates, use of resources as well as the waste and other output flows with reference to the declared unit.

Important:
EP freshwater: This indicator was developed in accordance with the characterisation model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml)), calculated as 'kg P equiv.'.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² roofing tiles (including accessories)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
GWP-total	kg CO_2 eq	1.23E+01	7.87E-01	2.61E-01	0	6.56E-02	1E-01	4.1E-02	-6.06E+00	-1.58E-01
GWP-fossil	kg CO_2 eq	1.24E+01	7.83E-01	1.38E-01	0	6.53E-02	9.98E-02	3.8E-02	-6.04E+00	-1.57E-01
GWP-biogenic	kg CO_2 eq	-1.08E-01	3.15E-04	1.23E-01	0	2.62E-05	1.91E-04	3.01E-03	-1.29E-02	-6.87E-04
GWP-luluc	kg CO_2 eq	8.03E-03	3.28E-03	4.52E-06	0	2.73E-04	3.68E-04	1.09E-04	-2.1E-03	-2.18E-04
ODP	kg CFC11 eq	1.06E-12	1.92E-16	4.97E-17	0	1.6E-17	4.25E-16	1.42E-16	-9.48E-15	-2.61E-15
AP	mol H^+ eq	1.28E-02	7.27E-04	5.45E-05	0	6.06E-05	9.38E-04	2.72E-04	-9.35E-03	-1.78E-04
EP-freshwater	kg P eq	1.71E-05	1.7E-06	8.42E-09	0	1.42E-07	2.39E-07	6.54E-08	-3.28E-06	-3.56E-07
EP-marine	kg N eq	4.59E-03	2.26E-04	1.66E-05	0	1.88E-05	4.62E-04	7E-05	-3.78E-03	-5.75E-05
EP-terrestrial	mol N eq	4.94E-02	2.74E-03	2.51E-04	0	2.29E-04	5.08E-03	7.7E-04	-4.17E-02	-6.12E-04
POCP	kg NMVOC eq	1.3E-02	5.98E-04	4.43E-05	0	4.98E-05	1.34E-03	2.12E-04	-1.1E-02	-1.53E-04
ADPE	kg Sb eq	1.79E-06	6.5E-08	7.18E-10	0	5.42E-09	1.1E-07	3.42E-09	-3.17E-07	-3.62E-08
ADPF	MJ	1.96E+02	1.04E+01	5.95E-02	0	8.67E-01	1.88E+00	4.98E-01	-7.96E+01	-2.23E+00
WDP	m^3 world eq deprived	4.32E-01	3.37E-03	2.8E-02	0	2.81E-04	1.69E-02	3.96E-03	-5.01E-02	-1.93E-03

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² roofing tiles (including accessories)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
PERE	MJ	3.56E+01	6.05E-01	1.41E+00	0	5.05E-02	1.58E-01	6.53E-02	-2.47E+00	-6.12E-01
PERM	MJ	1.4E+00	0	-1.4E+00	0	0	0	0	0	0
PERT	MJ	3.7E+01	6.05E-01	1.26E-02	0	5.05E-02	1.58E-01	6.53E-02	-2.47E+00	-6.12E-01
PENRE	MJ	1.96E+02	1.04E+01	5.95E-02	0	8.67E-01	1.88E+00	4.98E-01	-7.96E+01	-2.23E+00
PENRM	MJ	8.8E-01	0	-8.8E-01	0	0	0	0	0	0
PENRT	MJ	1.97E+02	1.04E+01	-8.2E-01	0	8.67E-01	1.88E+00	4.98E-01	-7.96E+01	-2.23E+00
SM	kg	3.2E-01	0	0	0	0	0	0	3.75E+01	0
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	2.16E-02	5.42E-04	6.58E-04	0	4.52E-05	4.93E-04	1.25E-04	-1.77E-03	-3.34E-04

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 = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² roofing tiles (including accessories)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
HWD	kg	3.36E-07	3.89E-07	7.88E-11	0	3.24E-08	3.96E-08	7.59E-09	-1.56E-07	-1.2E-09

NHWD	kg	1.11E-01	1.83E-03	3.19E-03	0	1.52E-04	5.67E-04	2.5E+00	-2.22E-02	-1.1E-03
RWD	kg	3.05E-03	1.09E-05	2.33E-06	0	9.12E-07	1.51E-05	5.58E-06	-3.47E-04	-8.88E-05
CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	4E+01	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	4.48E-01	0	0	0	0	0	0
EET	MJ	0	0	8.86E-01	0	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m² roofing tiles (including accessories)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
PM	Disease incidence	ND	ND	ND	ND	ND	ND	ND	ND	ND
IR	kBq U235 eq	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETP-fw	CTUe	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-c	CTUh	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-nc	CTUh	ND	ND	ND	ND	ND	ND	ND	ND	ND
SQP	SQP	ND	ND	ND	ND	ND	ND	ND	ND	ND

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

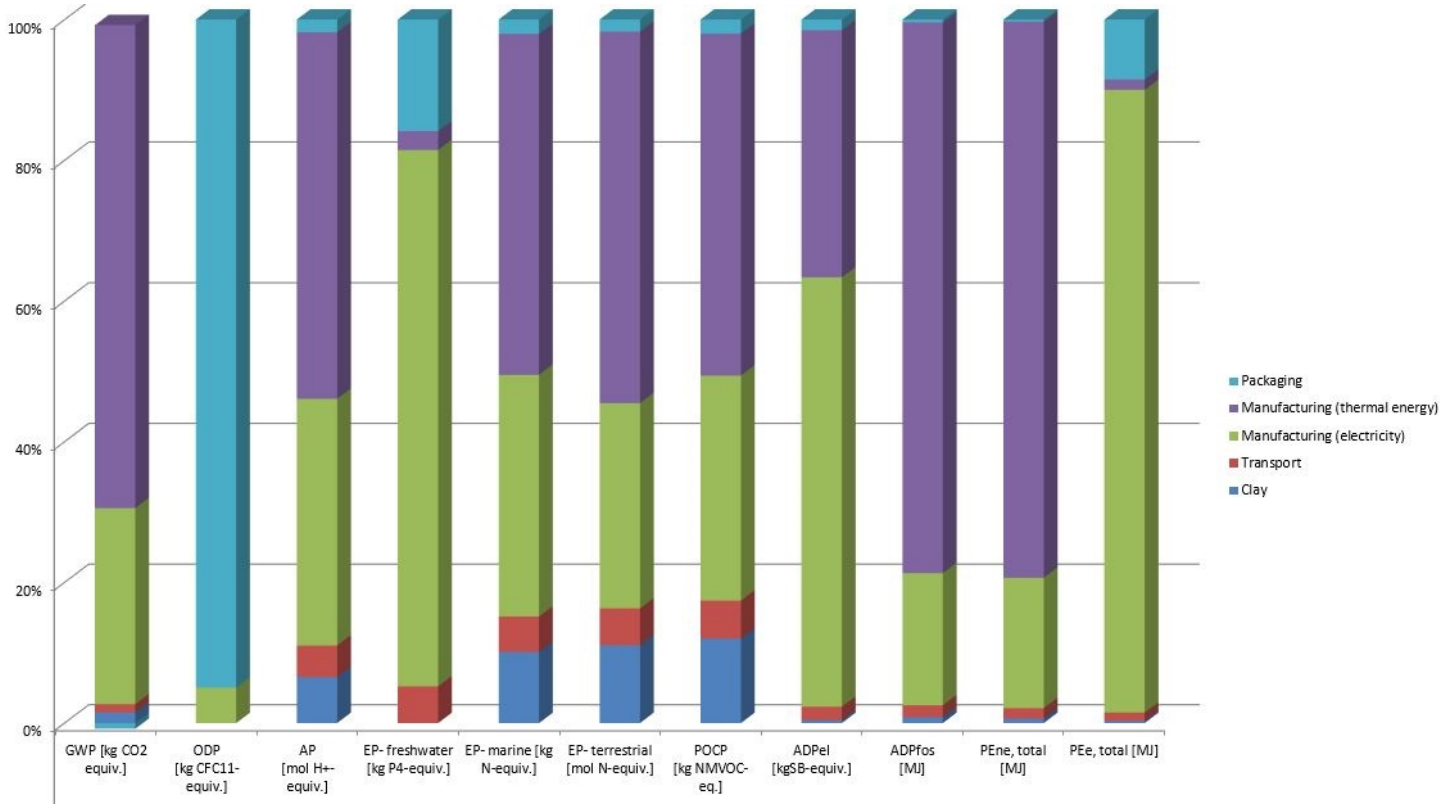
The results of the impact assessment represent relative data/potentials that do not represent any information on specific environmental impacts (endpoint); no limit value transgressions or risk analyses can be derived from them.

The following are the restriction notes for the declaration of core and additional environmental impact indicators:

Restriction note 2: ILCD classification = ILCD type 3, indicator: ADP – Minerals and metals, ADP – fossil, WDP (Water Deprivation Potential),

Restriction note 2: The results of this environmental impact indicator must be used with caution, as the uncertainties in these results are high or there is only limited experience with the indicator.

6. LCA: Interpretation



The evaluation of the Life Cycle Assessment results of the roofing tiles shows that the environmental impacts in all environmental categories are dominated by energy consumption during the manufacturing process (electricity and thermal energy from natural gas) in the factory.

Packaging and transport only play a subordinate role.

The majority of waste is incurred by the upstream chains of the raw materials, whereby largely non-hazardous waste is incurred. Radioactive waste is incurred within the framework of production of electrical energy.

The deviation of the impact assessment results from the declared average value is low.

The data quality for the modelling of the roofing tiles of the Bundesverband der Deutschen Ziegelindustrie e.V. can be rated as good.
For the basic and auxiliary materials used, corresponding consistent data sets are available in the GaBi 9 database. For a few substances, the processes were estimated with preliminary products similar in production and environmental impact.

A standardisation of the results for life cycle inventory and impact assessment is not carried out, as this could lead to misleading statements.

7. Requisite evidence

7.1. Leaching
The tests for leaching of inorganic components are carried out according to NEN 7345 at the Keramisch-Technologisches Baustofflaboratorium Hamburg e. V. All eluate values are well below the permissible limits of BRL 1510 according to the Dutch Building Materials Decree. For many elements, the measured values are below the detection limit. 7.1 Leaching The test procedure and test result must be indicated.

8. References

EN 1304
DIN EN 1304:2013-08, Clay roofing tiles and fittings – Product definitions and specifications

EN 13501-1
DIN EN 13501-1:2019-05, Classification of building products and types by fire performance – Part 1: Classification with the results of tests on reaction to fire of construction products

EN 15804
EN 15804:2012+A1:2017, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

ISO 14025
DIN EN ISO 14025:2011-10, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 50001
DIN EN ISO 50001:2018-12, Environmental management systems – Requirements with guidance for use

AVV
List of Wastes Directive (AVV), dated 10 December 2001 (Federal Law Gazette I p. 3379), last amended by Article 2, § 22 of the law dated 24 February 2012 (Federal Law Gazette I, p. 212)

BRL 52230
BRL 52230: Ceramic products, Evaluation guideline for environmental aspects of ceramic finished products, 22.04.2015

BImSchG
Act protecting against harmful environmental impact caused by air pollution, noise, shocks and similar processes (Federal Immission Control Act), 17 May 2013

IBU 2021
General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021, www.ibu- epd.com

NEN 7375
NEN 7375:2004:01--01 nl, Leaching characteristics – Determination of the leaching of inorganic components from moulded or monolithic materials with a diffusion test – Solid earthy and stony materials

REACH
(EC) Directive No. 1907/2006, EU Chemicals Ordinance, which came into force on 1 June 2007. REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals.

SpaEfv
EnSpAusglESysV:2013-07-31; Regulation on energy efficiency improvement schemes in connection with energy and electricity tax relief in special cases (Peak Compensation Efficiency Scheme Ordinance – SpaEfV)

(EU) Directive No. 305/2011
EUV 305/2011:2011-03-09; BauPVO:2011-03-09; CPR 2011-03-09, Directive of the European Parliament and Council dated 9 March 2011 establishing harmonised conditions for marketing construction products and replacing Council Guideline 89/106/EEC

(EU) Directive No. 528/2012
EUV 528/2012:2012-05-22, Regulation of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

(EU) Directive No. 305/2011
(EU) Directive No. 305/2011 of the European Parliament and Council dated 9 March 2011 establishing harmonised conditions for marketing construction products and replacing Council Guideline 89/106/EEC; Construction Products Regulation (CPR)

GaBi 9
GaBi 9 data set documentation for the software system and databases, LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2021 (http://documentation.gabi-software.com)

IBU 2021
General instructions for the EPD range of Institut Bauen und Umwelt e.V. (IBU), version
2.0, Berlin: Institut Bauen und Umwelt e.V., 2021, www.ibu epd.com

PCR, Part A
Product Category Rules for building-related products and services, Part A: Calculation rules for the Life Cycle Assessment and requirements on the Background Report. Berlin: Institut Bauen und Umwelt e.V. (pub.), version 2.0,

08.01.2021

PCR: Roofing tiles
Product Category Rules for building-related products and services, Part B: Requirements on the Environmental Product Declaration for roofing tiles; Berlin: Institut Bauen und Umwelt e.V. (pub.), version 1.6, 30.11.2017

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

LCEE - Life Cycle Engineering Experts GmbH
Birkenweg 24
64295 Darmstadt
Germany

+49 6151 1309860
t.mielecke@lcee.de
www.lcee.de

Owner of the Declaration

Bundesverband der Deutschen Ziegelindustrie e.V.
Reinhardtstraße 12-16
10117 Berlin
Germany

+49 30 5200 999-0
INFO@ZIEGEL.DE
www.ziegel.de