ENVIRONMENTAL PRODUCT DECLARATION

after *ISO 14025* and *EN15804+A2*

declaration holder	Federal Association of the German Brick and Tile Industry eV
editor	Institute Building and Environment eV (IBU)
program holder	Institut Bauen und Umwelt eV (IBU)
declaration number	EPD-BDZ-20210066-ICG1-DE
date of issue	04.08.2021
Date of Expiry	08/03/2026

bricks (unfilled)

Federal Association of the German Brick Industry eV

1. General Information

Federal Association of the German Brick Industry eV

program holder

IBU – Institute Building and Environment eV
Panoramastr. 1
10178 Berlin
Germany

declaration number

EPD-BDZ-20210066-ICG1-DE

This declaration is based on the product category rules:

Brick, 11.2017
(PCR tested and approved by the independent Advisory Council (SVR))

date of issue

04.08.2021

Date of Expiry

08/03/2026

Graduate engineer Hans Peters
(Chairman of the Institute Building and Environment eV)

dr Alexander Roeder
(Managing Director Institute Building and Environment eV)

bricks (unfilled)

holder of the declaration

Federal Association of the German Brick Industry eV
Reinhardtstraße 12-16
10117 Berlin
Germany

Declared product/declared unit

1 m³ brick (unfilled)

Scope:

The application of this document is restricted to bricks manufactured by member companies of the Federal Association of the German Brick and Tile Industry eV in Germany. For this declaration, data from 2019 was provided by 20 member companies. These members represent 90% of the members in the federal association
merged manufacturers of bricks. The production volume of these companies - based on production volume - is around 90% of the German market.

The owner of the declaration is liable for the information and evidence on which it is based; liability of the IBU with regard to manufacturer information, life cycle assessment data and evidence is excluded.

The EPD was created according to the specifications of the *EN15804+A2* created. In the following, the norm is simplified as *EN15804* designated.

verification

The European standard *EN15804* serves as core PCR
Independent verification of the declaration and Entries referred to *ISO 14025:2010*
☐ internal ☒ external

dr Eva Schmincke,
Independent verifier

2. product

2.1 Company Description The Federal Association of the German Brick Industry eV is an association of companies that produce bricks. For this EPD, the data from the plants that produce hollow bricks (unfilled) are evaluated.

2.2 Product Description/Product Definition Bricks are building products made of fired clay. A distinction is made between vertical perforated bricks and molded parts for load-bearing and non-load-bearing masonry and wall panels (brick elements as assembly parts) for the exterior and interior walls of buildings. Bricks for protected and unprotected masonry are covered in this EPD, see also the

Bulk density range from 550–2000 kg/m³. In the case of highly thermally insulating bricks, porosity agents are added during production. Masonry bricks can also be filled with various insulating materials. These bricks are dealt with in a separate EPD. The life cycle assessment results in this EPD are based on an average of all German plants, which is calculated as a weighted average based on the share of the individual production sites in the

total annual production. A brick with a bulk density of 575 kg/m³ was selected as a representative product.

For placing the product on the market in the EU/ EFTA (with the exception of Switzerland), the *Regulation (EU) No.305/2011(CPR).* The product requires a declaration of performance at consideration of*DIN EN 771-1:2015-11, Specifications for bricks - Part 1: Bricks* and the CE marking.

The respective national regulations apply to the use, in Germany the
- DIN 20000-401,
- Sample list of technical building regulations *MVVTB,*
- General technical approval from the German Institute for Building Technology of the respective manufacturer,

- General type approval from the German Institute for Structural Engineering of the respective manufacturer,
- External and in-house monitoring of the products with general building authority approval from the respective manufacturer.

2.3 Application
Depending on the construction of the walls, bricks of various shapes are used for solid components such as basement walls, exterior walls, load-bearing and non-load-bearing interior walls.

2.4 Specifications

Relevant structural data

Bezeichnung	Werte für repräsentatives Produkt	Werte für Gesamtprodukt-portfolio	Einheit
Druckfestigkeit nach DIN EN 772	4 - 12	4 - 28	N/mm²
Rohdichte nach DIN EN 772	575	550 - 2000	kg/m³
Wärmeleitfähigkeit nach DIN EN 1745	0,075 - 0,12	0,075 - 0,96	W/(mK)
Ausgleichsfeuchte bei 23 °C, 80 % nach DIN EN 4108-4	0,5	0,5 - 1,5	M.-%
Wasserdampfdiffusionswiderstandszahl nach DIN 4108-4	5/10	5/10	-

performance values of the product accordingly

- *DIN 20000-401*
- *pattern list*the technical building regulations*MVV TB*
- General building authority approval from the German Institute for Building Technology of the respective manufacturer
- General type approval from the German Institute for Structural Engineering of the respective manufacturer
- External and in-house monitoring of the products with general building authority approval or the general type approval of the respective manufacturer

2.5 Delivery condition

geometric data
Bricks are available in different formats and sizes depending on the application. The respective dimensions are regulated in the following standards:
- DIN EN 772-16
- DIN 105-100
-DIN 4159
-DIN 4160
- DIN 1053-4
- DIN 20000-401
- and according to approval notices or general type approvals from the German Institute for Building Technology of the respective manufacturer

2.6 Raw Materials/Excipients Masonry bricks consist of the basic materials clay/ loam (around 96%) and mineral additives (around 4%).

Clay/Clay:
Natural soils of different, natural mineralogical composition (aluminum oxide Al_2O_3, silicon dioxide SiO_2, ferric oxide Fe_2O_3). The raw materials are mined near the surface in selected deposits.

Other natural clay components: Clays/loams contain geologically deposited natural components in fluctuating proportions, such as e.g. B. coloring iron oxides. Therefore, depending on the clay, yellowish to dark red firing colors can occur. Furthermore, clays/ loams can contain lime and dolomite.

Sand:
Is added as a leaning agent to compensate for the natural fluctuations in the mineralogical composition of the raw clay in the case of very rich (fine-grain) clays.

Auxiliaries: porosity agents:
Additional porosity is required in the production of highly thermally insulating bricks. This porosity is achieved through the addition of polystyrene beads and/or fine cellulose fibers such as e.g. B. untreated sawdust or paper fibers. Suppliers are sawmills and the paper industry.

SVHC:
The product contains substances on the ECHA list (*REACH*) Substances of Very High Concern (SVHC) (date: February 1, 2021) that are eligible for authorization above 0.1% by mass:**no.**

CMR substances:
The product contains other CMR substances of category 1A or 1B, which are not on the candidate list, above 0.1% by mass in at least one partial article:**no.**

Biocides:
Biocidal products have been added to this construction product or it has been treated with biocidal products (this is treated goods within the meaning of the Biocidal Products Regulation (EU) No. 528/2012):**no.**

2.7 Manufacturing
After the clay has been mined in open-pit mining, it is transported to interim storage on the factory premises. The mechanical processing of the clay, such as crushing and mixing, takes place in pan mills and rolling mills. The above raw materials are crushed in certain optimized proportions

(prepared), mixed and moistened. Storage in the swamp house follows. The porosity agents are added before or after storage in the sump house. After passing through the fine rolling mill and adding more water, the blanks are shaped by extrusion with appropriate dies and a downstream cutter.

The material shaped in this way goes into the dryer, which is essentially operated with the waste heat from the tunnel kiln. The drying time varies depending on the format and bulk density and is usually 24 hours. The dried blanks are then fired at around 1000 °C in a tunnel kiln for a maximum of 24 hours. The combustion of the porosity substances causes fine porosity. To produce flat bricks, the bricks are ground flat. The bricks are stacked, sealed in recyclable polyethylene (PE) foil or strapped with polyester or steel straps. The energy requirements for brick production mainly relate to the firing process and drying. The electrical energy is mainly consumed in processing.

2.8 Environment and health during manufacture

Health protection during production:
The regulations of the professional associations apply, special measures to protect the health of employees do not have to be taken.

Environmental protection during production:

water/soil:
Water and soil are not polluted. The process is waste-free. The mixing water used is released again during the drying process in the form of steam. The waste heat from the tunnel kiln is used to dry the

Brick blanks used (energy network).

Air:
The emissions from the combustion process are below the limit values of the *TA air*. Environmental protection measures are aimed at the lowest possible energy consumption and low-emission exhaust air. If necessary, emissions are reduced by post-combustion of the smoldering gases, the operation of limestone packed bed filters and the choice of fuels that contribute to CO2 reduction (e.g. natural gas). Furthermore, the fire control was improved

computer-aided optimization.

Noise:
Due to noise protection measures, the measured values (workplace and outdoor space) are far below the required values.

2.9 Product Processing/Installation

Processing recommendations:
The bricks are connected to each other and to other standardized building materials with mortar (normal, light, medium or thin-bed mortar) or Dryfix plane brick adhesive. When selecting the mortar, care must be taken to ensure that it has the described health and safety properties
Environmental compatibility of the bricks not disadvantageous influence (see the manufacturer's recommendation available from the manufacturer).

Occupational safety/environmental protection:
The weight of the individual tiles is below the 25 kg recommended by the building trade association. Infill bricks can be moved by hand and get their heavy weight from being filled with concrete. When laying the bricks, occupational health and safety measures are observed in accordance with the regulations of the trade association and the manufacturer's recommendations. Wet processes are generally prescribed for cutting and cutting work. A dust mask (P3/FFP 3) must be worn for dry cutting work.

rest material:
Masonry leftovers on the construction site are to be collected separately. Sorted brick residues can be taken back from the manufacturing plants and used as raw material or in various ways (for details, see 2.15).

2.10 Packaging
The polyethylene films are recyclable. Unsoiled PE foils (care must be taken to sort them) and reusable wooden pallets are taken back by the building materials trade (reusable pallets against reimbursement in the deposit system) and returned to the brickworks, which forward the PE foils via a contractual agreement

waste disposal companies to these.

2.11 Condition of Use

Ingredients:
As listed under 2.6 "Basic materials", bricks mainly consist of clay, loam and sand. The brick ingredients are bound as solid substances when in use (ceramic bond). The air-filled pores of the fine porosity result in a significantly higher thermal insulation property compared to the non-porous clay bricks.

Durability in use: Wall bricks no longer change after leaving the tunnel kiln. When used as intended, they are resistant indefinitely. Wall bricks are vermin resistant,

Rot-resistant, fouling-resistant, acid- and alkali-resistant.

2.12 Environment and health during use

Bricks do not emit any substances that are harmful to the environment or health. The natural ionizing radiation of the bricks is extremely low and harmless to health.

2.13 Reference Use Period
The reference service life is 150 years when installed in accordance with the rules of technology (PCR document of the European
Brick Industry Association: *TBE PCR document*).

Buildings constructed with bricks can operate for the same amount of time.

2.14 Extraordinary Impacts

fire
In the event of fire, no view-obstructing and toxic gases and vapors can develop. The products mentioned meet the requirements of
Building material class A1 according to *DIN 4102-4* (and or *EN 13501-2*) "non-flammable"

Fire protection

designation	value
building material class	A1
Burning dripping	-
smoke development	-

water
Under the influence of water (e.g. flooding), no water-polluting ingredients can be washed out due to the firm, ceramic bond.

mechanical destruction
There are no known risks to the environment or living organisms from unforeseen mechanical destruction.

2.15 Post-Use Phase

Reuse and further use:
Single-variety bricks from dismantling can be taken back by the brick manufacturers and reused in ground form as a leaning agent in production. This has been practiced for production breaks for decades. Possibilities of further use exist as an aggregate for crushed brick concrete, as filling or bulk material in road construction and civil engineering, material for the backfilling of pits and quarries, in the construction of noise protection walls as well as tennis flour and tennis sand.

2.16 Disposal
Leftover bricks, broken bricks and bricks from demolition on the construction site can be disposed of without any problems if the above-mentioned recycling options are not practicable and do not represent any exceptional burden on the environment. Due to the chemically neutral, inert and immobile behavior of the bricks, they can go to landfills according to landfill class I
Landfill Ordinance stored or used in pits and quarries according to Z1.1. The waste key number is after *GCU* 17 01 02, bricks.

2.17 More information Further information can be found at www.ziegel.de

3. LCA: Calculation Rules

3.1 Declared Unit
The declaration refers to one cubic meter of brick with a bulk density of 575 kg/m3
(Mean value of the gross density class 600 kg/m3). The life cycle assessment results in this EPD are based on an average of all German plants, which is calculated as a weighted average based on the share of the individual production sites in the
total annual production.

Declared unit

designation	value	unit
Declared unit	1	m3
bulk density	575	kg/m3
Conversion factor to 1 kg	575	-
Conversion factor to 1 t	1,739	

3.2 System Boundary
Type of EPD: cradle to factory gate - with options. The life cycle assessment takes into account the extraction of raw materials, the transport of raw materials and the actual
Product manufacture including the packaging materials (modules A1-A3). The transport to the construction site (module A4) and the treatment of packaging materials in waste incineration plants after installation of the product (module A5) are also part of the system boundaries. After the useful life has expired, the product is dismantled (module C1). After transporting the dismantled product (module C2), around 6% of the bricks are to be landfilled on an inert material landfill (module C4), 94% can be reused. Credits resulting from the recycling of broken bricks are declared in Module D. Credits for electricity and thermal energy as a result of the thermal utilization of the
Packaging within Module A5 is also considered in Module D.

3.3 Estimates and Assumptions
Not for all raw materials or preliminary products are in the *GaBi 9*-Database records before. For some substances, the processes with preliminary products that are similar in terms of production and environmental impact were estimated. It was e.g. For example, the raw material clay is substituted with the data set clay. Assumptions are made regarding the collected production-related emissions. For companies that are not subject to monitoring by the responsible authorities and are therefore unable to provide any measured values, an estimate is made based on the information provided by the other companies. CO_2-Emissions from sawdust and biogenic additives are mapped on the input side with a data set and on the output side the previously stored CO_2 give up completely.

3.4 Truncation Rules
All data from the operational data collection is taken into account, ie all starting materials and auxiliary materials used according to the recipe, as well as the thermal and electrical energy. This means that material and energy flows with a share of < 1% are also taken into account. All data provided will be converted into the
Integrated life cycle assessment model. Transport expenses are included for all basic materials, shipping the products (A4) and in the end-of-life scenario (C2). The wear factor of the wooden pallet as well as the machines, systems and infrastructure required in production are neglected.
It can be assumed that the neglected processes would each have contributed less than 5% to the impact categories considered.

3.5 Background Data

The software system developed by thinkstep is used for holistic accounting to model the bricks*GaBi 9* deployed. The consistent data sets contained in the GaBi database are documented online in the GaBi documentation. The basic data of the GaBi database are used for energy, transport and auxiliary materials. The life cycle assessment is created for the reference area of Germany. This means that in addition to the production processes, the preliminary stages relevant for Germany, such as electricity or

Energy supply, are used. The electricity mix and electricity from hydropower, 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 based on measurements by members of the Federal Association of the German Brick and Tile Industry.

3.6 Data Quality

Data for the production year 2019 is used to model the product stage of the bricks. All other relevant background data sets are in the software's database *GaBi 9* removed. The database was last updated in 2020. The data for the products examined is recorded directly in the factories by the member companies of the Federal Association of the German Brick and Tile Industry. The majority of the data for the upstream chains comes from industrial sources, which were collected under consistent temporal and methodical boundary conditions. A high level of completeness in the recording of environmentally relevant material and energy flows is important. The data quality is thus considered good too

describe.

3.7 Observation Period

The period under consideration is 2019. The data represent an annual average over 12 months.

3.8 Allocation

A wide variety of materials, e.g. B. sawdust used. The sawdust represents a by-product in the sawing process

economic allocation applied to separate the effects of sawdust from those of lumber. In the case of sawdust and biogenic additives, the carbon content is taken into account via the corresponding absorption of CO2. These materials burn during the

manufacturing process. The resulting CO2 emissions are calculated according to the theoretical complete conversion of carbon into carbon dioxide.

A wide variety of secondary materials are used in the manufacture of the bricks, such as e.g. B. Sludge from paper recycling, paper fiber waste, secondary polystyrene and filter cake. In the model, these materials are introduced into the system without any loads.

The production process does not provide any by-products. In this respect, no allocation is integrated in the life cycle assessment model used. Scraps from production can be reused in production, but also find application in
various areas (road construction, tennis courts, etc.). The broken bricks used internally remain within A1–A3 (closed loop).

3.9 Comparability

In principle, a comparison or evaluation of EPD data is only possible if all data sets to be compared are *EN15804*were created and the building context or the product-specific performance characteristics are taken into account.

From the*GaBi 9*-Database 2019, service pack 39, the background data comes from. .

4. LCA: Scenarios and other technical information

Characteristic product properties
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 0.00031 kg.

Transport to construction site (A4)

designation	value	unit
liters of fuel	1:16	l/100 km
transportation distance	109	km
Utilization (including empty runs)	85	%
Bulk density of the transported products	550-2000	kg/m^3

Installation in the building (A5)

designation	value	unit
Output substances as a result of	0.6	kg
Waste treatment on site		
loss of material	please refer declarations below	

Environmental impacts from installation losses are not included in the LCA results, as these depend on the construction project and therefore vary. In order to calculate the additional environmental burdens caused by the production and disposal of the installation losses, the LCA results can be calculated for a specific installation loss (e.g. installation loss 3%, multiplication of the LCA results by 1.03). If the user of the EPD does not have any specific information for the installation losses, a share of 3% can be expected (*TBE PCR document*).

Reference useful life

designation	value	unit
Service life (according to BBSR)	50	a

Service life according to the manufacturer	150	a

The reference service life is 150 years when installed in accordance with the rules of technology.

End of Life (C1-C4)

designation	value	unit
Collected as mixed construction waste	575	kg
For recycling	539.35	kg
For landfill	35.65	kg

The basic materials clay/loam contain lime and dolomite, which are decomposed during the burning process and CO_2free (which is taken into account in A1 to A3). A large part of the resulting calcium and magnesium oxides is bound in silicates. However, a small proportion is present as free alkali metal or alkaline earth metal oxides in fired shards. These free oxides recarbonate with the help of CO_2

from the air. This process begins after leaving the oven. At the latest, the treatment in the dismantling phase leads to a complete recarbonation of the free alkali and
Alkaline earth oxides, which result in an average of 2 M% CO_2report per kg of fired bricks from credit in module C3 (*recarbonation)*

Reuse, recovery and recycling potential (D), relevant scenario information See information in Chapter 3
Scenario D: Credits as a result of the recycling of construction waste processing
Scenario D1: Credits resulting from the recycling of the packaging materials (from module A5) are shown in module D1.

5. LCA: results

The following tables show the results of the indicators of the impact assessment, the use of resources as well as waste and other output flows related to one cubic meter of brick. To convert the results to one ton of bricks, the results can be calculated using the specific density (575 kg/m3) of the brick and multiplied by 1,000. Environmental impacts from installation losses are not included in the LCA results, as these depend on the construction project and therefore vary. To calculate the additional environmental impacts of producing and disposing of the installation losses, the LCA results can be calculated for a specific installation loss (e.g. installation loss 3%, multiplying the LCA results by 1.03).

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

STATEMENT OF SYSTEM BOUNDARIES (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

production stage			stage of erection of building		usage stage							disposal stage				credits and loads except for system boundary
raw material supply	transport	manufacturing	Transport from manufacturer to place of use	Assembly	use/application	maintenance	repair	replacement	renovation	use of energy for that operating the building	use of water for that operating the building	dismantling/demolition	transport	waste treatment	elimination	reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ brick (575 kg/m³)

core indicator	unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
GWP total	[kg CO_2-Eq.]	1.13E+2	4.15E+0	8.24E-1	3.52E-1	9.42E-1	- 1.01E+1	5.00E-1	- 1.46E+0	- 1.06E+0
GWP fossil	[kg CO_2-Eq.]	1.13E+2	4.13E+0	8.30E-1	3.66E-1	9.38E-1	1.44E+0	5.41E-1	- 1.45E+0	- 1.05E+0
GWP biogenic	[kg CO_2-Eq.]	1.80E-1	1.66E-3	- 3.90E-3	- 1.56E-2	3.77E-4	- 1.15E+1	- 4.29E-2	- 9.09E-3	- 4.39E-3
GWP-luluc	[kg CO_2-Eq.]	5:18E-2	1.73E-2	- 1.32E-3	1.47E-3	3.92E-3	5:29E-3	1.56E-3	- 4.84E-3	- 1.35E-3
ODP	[kg CFC11 eq.]	4:91E-13	1.01E-15	- 1.59E-14	8:61E-17	2.30E-16	6:11E-15	2.03E-15	- 2.07E-14	- 1.61E-14
AP	[mol H^+-Eq.]	9:24E-2	3.83E-3	- 8.66E-4	1.73E-3	8:71E-4	1.35E-2	3.88E-3	- 4.61E-3	- 1.16E-3
EP freshwater	[kg PO_4-Eq.]	9:27E-5	8.99E-6	- 2.17E-6	7.64E-7	2.04E-6	3.43E-6	9:32E-7	- 4.41E-6	- 2.20E-6
EP marine	[kg N-eq.]	2.69E-2	1:19E-3	- 3.29E-4	8:16E-4	2.71E-4	6.64E-3	9.99E-4	- 1.75E-3	- 3.75E-4
EP terrestrial	[mol N-Eq.]	3.41E-1	1.45E-2	- 2.65E-3	9.04E-3	3:29E-3	7.30E-2	1.10E-2	- 1.92E-2	- 4.00E-3
POCP	[kg NMVOC eq.]	7.65E-2	3.15E-3	- 8.81E-4	2.28E-3	7:17E-4	1.93E-2	3.02E-3	- 4.14E-3	- 1.01E-3
ADPE	[kg Sb eq.]	9.90E-6	3.43E-7	- 2.25E-7	2.92E-8	7.79E-8	1.58E-6	4.88E-8	- 3.14E-7	- 2.28E-7
ADPF	[MJ]	1.15E+3	5.48E+1	- 1.49E+1	4.66E+0	1.25E+1	2.71E+1	6.90E+0	- 1.91E+1	- 1.51E+1
WDP	[m^3 world eq. withdrawn]	2.37E+0	1.78E-2	1.61E-1	1.51E-3	4.04E-3	2.42E-1	5.65E-2	- 3.55E-2	- 1.20E-2

Legend	GWP = Global Warming Potential; ODP = Stratospheric Ozone Depletion Potential; AP = acidification potential of soil and Water; EP = Eutrophication Potential; POCP = tropospheric ozone formation potential; ADPE = Potential for Depletion of Abiotic Resources - Non-Fossil Resources (ADP - Substances); ADPF = Abiotic Resource Depletion Potential – Fossil fuels (ADP – fossil fuels); WDP = Water Withdrawal Potential (User)

RESULTS OF THE LCA – INDICATORS TO DESCRIBE THE USE OF RESOURCES according to EN 15804+A2: 1 m³ brick (575 kg/m³)

indicator	unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
PERE	[MJ]	2.15E+2	3.19E+0	5.59E-2	2.71E-1	7.25E-1	2.28E+0	1.70E+0	- 5.45E+0	- 3.78E+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
PERT	[MJ]	2.15E+2	3.19E+0	5.59E-2	2.71E-1	7.25E-1	2.28E+0	1.70E+0	- 5.45E+0	- 3.78E+0
PENRE	[MJ]	1.18E+3	5.48E+1	2.92E-1	4.66E+0	1.25E+1	2.71E+1	1.29E+1	- 1.91E+1	- 1.51E+1
PENRM	[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
PENT	[MJ]	1.18E+3	5.48E+1	2.92E-1	4.66E+0	1.25E+1	2.71E+1	1.29E+1	- 1.91E+1	- 1.51E+1
SM	[kg]	1.42E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.39E+2	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
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
fw	[m^3]	1.71E-1	2.86E-3	4.05E-3	2.43E-4	6.50E-4	7.09E-3	3.26E-3	3.54E-3	2.06E-3

Legend	PERE = renewable primary energy as an energy source; PERM = renewable primary energy for material use; PERT = Total Renewable Primary Energy; PENRE = non-renewable primary energy as an energy source; PENRM = non-renewable primary energy for material use; PENRT = Total non-renewable primary energy; SM = use of secondary materials; RSF = Renewables secondary fuels; NRSF = Non-Renewable Recoverable Fuels; FW = net use of freshwater resources

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOW according to EN 15804+A2: 1 m³ brick (575 kg/m³)

indicator	unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
HWD	[kg]	1.47E-6	2.05E-6	2.28E-10	1.74E-7	4.66E-7	5.70E-7	1.08E-7	- 3.60E-7	- 7.95E-9
NHWD	[kg]	1.71E+0	9.62E-3	7.61E-3	8:18E-4	2:19E-3	8:15E-3	3.57E+1	- 1.12E+1	- 7.12E-3
RWD	[kg]	1.71E-2	5.77E-5	8:10E-6	4.91E-6	1:31E-5	2:17E-4	7.96E-5	- 7.12E-4	- 5.48E-4
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
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.39E+2	0.00E+0	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
EEE	[MJ]	0.00E+0	0.00E+0	3.42E+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	7.88E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Legend	HWD = Hazardous Waste to Landfill; NHWD = Discarded Non-Hazardous Waste; RWD = Discarded Radioactive Waste; CRU = Components for Reuse; MFR = materials for recycling; MER = materials for energy recovery; EEE = Exported energy - electric; EET = Energy Exported - Thermal

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ brick (575 kg/m³)

indicator	unit	A1-A3	A4	A5	C1	C2	C3	C4	D	D/1
p.m	[disease all]	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	[-]	ND	ND	ND	ND	ND	ND	ND	ND	ND

Legend	PM = Potential disease occurrence due to particulate matter emissions; IR = Potential effect from human exposure to U235; ETP-fw = Potential Comparative Toxicity Unit for ecosystems; HTP-c = potential comparative toxicity unit for humans (carcinogenicity); HTP-nc = Potential comparative toxicity unit for humans (non-carcinogenic effects); SQP = Potential Soil Quality Index

* GWP in module C3 includes -20 kg CO_2-eq./t by carbonation.

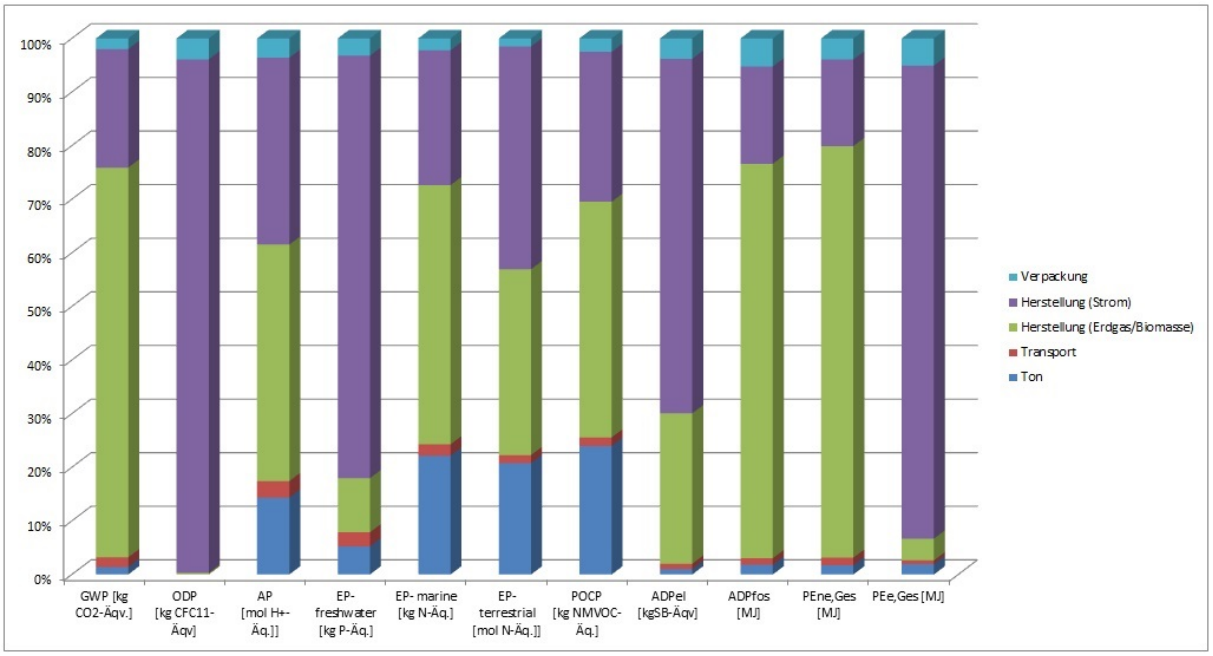
The results of the impact assessment represent relative information/potentials that do not depict any information on specific environmental impacts (endpoint); no exceeding of limit values or risk analyzes can be derived from this.

Below are the restrictions on the declaration of core and additional environmental impact indicators:

Limitation Note 2:
ILCD classification = ILCD type 3, indicator: ADP minerals and metals), ADP-fossil, WDP, en: Water Deprivation Potential

Disclaimer 2 — The results of this environmental impact indicator must be used with caution because the uncertainties surrounding these results are high or because there is limited experience with the indicator.

6.LCA: Interpretation



The evaluation of the life cycle assessment results of the unfilled bricks shows that the environmental impacts in all environmental categories, especially from
Energy consumption during the manufacturing process (electricity and thermal energy) in the factory and the associated emissions as a result of the burning process are dominated.
The process-related emissions are largely due to the raw materials. Accordingly, the nature of the clays used also plays a not inconsiderable role. Packaging and transport only play a very minor role.

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

The data quality for the modeling of the unfilled bricks of the Federal Association of the German Brick Industry eV can be rated as good. Corresponding consistent data records are available in the GaBi database for the raw materials and auxiliary materials used. For a few substances, the processes involved in the production and

Environmental impact of similar preliminary products estimated.

7.proof

The investigations and evaluations show that the natural radioactivity of bricks allows unrestricted use of this building material from a radiological point of view. Masonry bricks do not contribute to a relevant increase in the radon concentration in rooms, their contribution to the inhalation dose is im

Compared to the proportion of radon in the ground, it is negligible. (Info sheet: Natural radionuclides in building materials)

8th.References

DIN 105-100
DIN 105-100:2012-01, Technical regulations for bricks.

EN 771-1
DIN EN 771-1:2015-11, specification for bricks; Part 1. Bricks.

EN 772-1

DIN EN 772-1:2016-05, Test methods for bricks
- Part 1: Determination of compressive strength.

DIN EN 772-13
DIN EN 772-13:2000-09, Test methods for bricks - Part 13: Determination of the net and gross dry bulk density of bricks (except natural stones).

EN 772-16

EN 772-16:2011-07, Test methods for bricks.

DIN 1053-4
DIN 1053-4:2018-05, masonry; prefabricated parts.

EN 1745
DIN EN 1745:2020-10, Masonry and masonry products - Methods for determining thermal insulation properties.

DIN 4102-4
DIN 4102-4:2016-05, Technical regulations on fire behavior of building materials and components; Compilation and application of classified building materials, components and special components.

DIN 4108-4
DIN 4108-4:2020-11, thermal insulation and energy saving in buildings; heat and moisture protection ratings.

DIN 4159
DIN 4159:2014-05, Bricks for brick ceilings and cast panels, statically involved.

DIN 4160
DIN 4160:2000-04: Bricks for ceilings, statically not involved.

EN 13501-2
DIN EN 13501-2:2016-12, Fire classification of construction products and building elements - Part 2: Classification using results from fire resistance tests, with the exception of ventilation systems.

DIN 20000-401
DIN 20000-401:2017-01, Use of construction products in buildings - Part 401: Rules for the use of bricks according to DIN EN 771-1:2015-11.

GCU
Waste List Ordinance of December 10, 2001 (Federal Law Gazette I p. 3379), which was last amended by Article 5 Paragraph 22 of the law of February 24, 2012 (Federal Law Gazette I p. 212).

Info sheet: Natural radionuclides in building materials
Federal Office for Radiation Protection, 2012.

TA air
First general administrative regulation for the Federal Immission Control Act (Technical Instructions for Air Pollution Control - TA Luft) of July 24, 2002.

TBE PCR document
Product Category Rules for Environmental Product Declarations for Construction Clay Products, Tiles and Bricks Europe, 2014).

PCR Part A
Product category rules for building-related products and services. Part A: Calculation rules for the life cycle assessment and requirements for the background report. Berlin: Institut Bauen und Umwelt eV (ed.), version 1.8, 04.07.2019.

PCR: brick
Product category rules for building-related products and services. Part B: Requirements for the environmental product declaration for bricks. Berlin: Institut Bauen und Umwelt eV (ed.), version 1.6, 30.11.2017.

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

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

EN15804
EN 15804:2012+A2:2019, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

Regulation (EU) No.305/2011
Regulation (EU) No. 305/2011 of the European Parliament and of the Council of March 9, 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC;
Construction Products Regulation (CPR).

Regulation (EG) No. 1907/2006 /REACH/ EU Chemicals Regulation that came into effect on June 1, 2007. REACH stands for Registration, Evaluation, Authorization and Restriction of Chemicals.

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

Chemical Restriction.

Hazardous Substances Ordinance
Hazardous Substances Ordinance of November 26, 2010 (BGBI. 1 p. 1643, 1644), which was last amended by Article 2 of the Ordinance of July 15, 2013 (BGBI. 1 p. 2514).

MVV TB
Sample Administrative Regulation Technical Building Regulations (MVV TB), Edition 2019/1.

recarbonation
Gravimetric determination of the carbon dioxide bound to the free lime, stoichiometric calculation of the reacted calcium oxide, comparison with the dissolved CaO in the brick, Institut für Ziegelforschung Essen eV, January 17th, 2014.

editor
Institute Building and Environment eV
Panoramastr.1
10178 Berlin
Germany

phone + 49 (0)30 3087748-0
fax + 49 (0)30 3087748-29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

program holder
Institute Building and Environment eV
Panoramastr.1
10178 Berlin
Germany

phone + 49 (0)30 3087748-0
fax + 49 (0)30 3087748-29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Creator of the life cycle assessment
LCEE - Life Cycle Engineering Experts GmbH
Birkenweg 24
64295 Darmstadt
Germany

phone + 49 6151 1309860
fax -
Mail t.mielecke@lcee.de
Web **www.lcee.de**

holder of the declaration
Federal Association of the
German Brick Industry eV
Reinhardtstrasse 12-16
10117 Berlin
Germany

phone + 49 30 5200 999-0
fax + 49 30 5200 999-28
Mail INFO@ZIEGEL.DE
Web **www.ziegel.de**