ENVIRONMENTAL PRODUCT DECLARATION

after *ISO 14025* and *EN 15804 + 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)
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Masonry brick (unfilled)

Federal Association of the German Brick Industry eV

1. General Information

Federal Association of the German Brick Industry eV

Program holder

IBU - Institute for Building and Environment
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10178 Berlin
Germany

Declaration number

EPD-BDZ-20210066-ICG1-DE

This declaration is based on the product category rules:

Bricks, 11.2017
(PCR tested and approved by the Independent Expert Council (SVR))

date of issue

08/04/2021

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Masonry brick (unfilled)

Owner 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)

Area of validity:

The application of this document is restricted to masonry bricks made by Member company 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 those in the federal association affiliated manufacturer of masonry bricks. The production volume of these companies is - in terms of production volume - around 90% of the German market.

The owner of the declaration is liable for the information and evidence on which it is based; the IBU accepts no liability for manufacturer information, life cycle assessment data and evidence.

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

verification

The European standard *EN 15804* serves as the core PCR

Independent verification of the declaration and Entries referred to *ISO 14025: 2010*

☐ internally ☒ external

Dr. Eva Schmincke,
Independent verifier

2. product

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

2.2 Product description / product definition Bricks are building products made from baked clay. A distinction is made between vertically perforated bricks and molded parts for load-bearing and non-load-bearing masonry and wall panels (brick elements as assembly parts) for outer and inner walls of buildings. Bricks for protected and unprotected masonry are dealt with in this EPD, see also the

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

Annual production took place. A brick with a gross 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 under consideration of *DIN EN 771-1: 2015-11, Specifications for masonry blocks - Part 1: Masonry 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 *MVV TB,*
- General building inspection approval of the German Institute for Structural Engineering of the respective manufacturer,
- General type approval of the German Institute for Structural Engineering of the respective manufacturer,
- External and in-house monitoring of the products with general building inspectorate 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 Technical data

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*
- *Sample list* the technical building regulations *MVV TB*
- General building approval from the German Institute for Structural Engineering of the respective manufacturer
- General type approval from the German Institute for Structural Engineering of the respective manufacturer
- External and internal 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 Structural Engineering of the respective manufacturer

2.6 Basic materials / auxiliary materials
Bricks consist of the basic materials clay / loam (around 96%) and mineral aggregates (around 4%).

Clay / loam:
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 extracted close to the surface in selected deposits.

Other natural clay components: Clays / loams contain natural components that have been deposited due to geological history in fluctuating proportions, such as B. coloring iron oxides. Therefore, depending on the occurrence of clay, yellowish to dark red firing colors can arise. Furthermore, clays 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 very rich (fine-grained) clays.

Auxiliary materials: Porosity agent:
Additional porosity is required when manufacturing highly insulating bricks. This porosity is achieved by adding polystyrene beads and / or fine cellulose fibers, such as e.g. B. untreated sawdust or paper fibers achieved. Suppliers are sawmills and the paper industry.

SVHC:
The product contains substances on the ECHA list (*REACH*) of substances of very high concern (SVHC) eligible for authorization (date: 02/01/2021) above 0.1% by mass: **no.**

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

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

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

(processed), mixed and moistened. This is followed by storage in the swamp house. 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 mouthpieces and a downstream cutter.

The material formed in this way goes into the dryer, which is mainly 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 in a tunnel kiln at approx. 1000 ° C 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, shrink-wrapped in recyclable polyethylene (PE) film or strapped with polyester or steel straps. The energy demand for brick production mainly relates to the firing process and drying. The electrical energy is mainly used in processing.

2.8 Environment and health during manufacture

Health protection during production:
The rules of the employers' liability insurance association apply; special measures to protect the health of employees are not to be taken.

Environmental protection in manufacturing:

Water / soil:
There is no pollution of water and soil. The process runs without wastewater. The mixing water used is released again in the form of water vapor during the drying process. 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 *TA Luft*. Environmental protection measures are geared towards the lowest possible energy consumption and low-pollutant exhaust air. If necessary, emissions are reduced through post-combustion of the carbonization gases, the operation of lime-bed filters and the choice of fuels that contribute to the reduction of CO2 (e.g. natural gas). Furthermore, the fire control was improved by

computer-aided optimization.

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

2.9 Product processing / installation

Processing recommendations:
The connection of the bricks with each other and with other standardized building materials is done with mortar (normal, light, medium or thin-bed mortar) or Dryfix flat brick adhesive. When choosing the mortar, care should be taken that it has the properties of health and health described
Environmental compatibility of the masonry bricks is not disadvantageous influence (see the manufacturer recommendation available from the manufacturer).

Occupational safety / environmental protection:
The weights of the individual bricks are below the recommendations of the building trade association of 25 kg. Filling bricks can be moved by hand and are given their heavy weight by filling them with concrete. When laying the bricks, occupational safety measures in accordance with the regulations of the employers' liability insurance association and the manufacturer's recommendations are observed. Wet processes are usually prescribed for cutting and separating work. A dust mask (P3 / FFP 3) must be worn for dry cutting work.

Residual material:
Remnants of brickwork on the construction site must be collected separately. Unmixed brick remains can be taken back by the manufacturing plants and used as raw material or used in various ways (for details see 2.15).

2.10 packaging
The polyethylene films are recyclable. Non-soiled PE foils (it is important to ensure that they are sorted according to type) and reusable wooden pallets are taken back via the building materials specialist trade (reusable pallets against reimbursement in the deposit system) and returned by them to the brickworks, who pass on the PE foils via a contractual agreement
Waste management companies to this.

2.11 State of use

Ingredients:
As listed under 2.6 "Basic materials", masonry bricks consist mainly of clay, loam and sand. The brick constituents 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.

Resistance in use: Bricks do not change after leaving the tunnel kiln. When used as intended, they have unlimited resistance. Bricks are resistant to vermin,

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 masonry bricks is extremely low and harmless to health.

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

Buildings made with masonry bricks can be operated for just as long.

2.14 Extraordinary Effects

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

Fire protection

description	value
Building material class	A1
Burning drips	-
Flue gas development	-

water
Under the influence of water (e.g. floods), 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 to living organisms from unforeseen mechanical destruction.

2.15 re-use phase

Reuse and further use:

Bricks from dismantling of the same type can be taken back by brick manufacturers and reused in ground form as a lean agent in production. This has been practiced for production discontinuities for decades. It can be used as an aggregate for brick chippings, as filler or filler material in road construction and civil engineering, material for backfilling pits and quarries, in the construction of noise barriers and as tennis flour and tennis sand.

2.16 Disposal
Remnants of bricks, broken bricks and bricks from demolition on the construction site can be disposed of without any problems if the above recycling options are not practical and do not pose any extraordinary pollution to the environment. Due to the chemically neutral, inert and immobile behavior of the masonry bricks, they can be landfilled according to landfill class I
Landfill Ordinance can be stored or used in pits and quarries according to Z1.1. The waste key number is after*AVV* 17 01 02, brick.

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

3. LCA: calculation rules

3.1 Declared unit
The declaration relates to one cubic meter of brick with a bulk density of 575 kg / m3
(Average of the raw density class 600 kg / m3). The basis of the life cycle assessment results in this EPD is an averaging of all German plants, which is calculated as a weighted average based on the proportion of the individual production sites in the
Annual production took place.

Declared unit

description	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 the factory gate - with options. The life cycle assessment takes into account the extraction of raw materials, the transport of raw materials and the actual transport
Product manufacture including packaging materials (modules A1 – A3). The transport to the construction site (module A4) as well as the treatment of the packaging materials in waste incineration plants after the installation of the product (module A5) are also part of the system boundaries. After the end of its useful life, the product is dismantled (module C1). After the dismantled product has been transported (module C2), around 6% of the bricks are to be deposited in an inert material landfill (module C4), 94% can be recycled. 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 taken into account in module D.

3.3 Estimates and Assumptions
Not all raw materials or intermediate products are in the *GaBi 9*-Database records above. For some substances, the processes were estimated with intermediate products that were similar in terms of production and environmental impact. It was z. B. the raw material clay has been substituted with the data record clay.
Assumptions are made with regard to the collected production-related emissions. For companies that are not subject to monitoring by the responsible authorities and therefore cannot 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 submit completely.

3.4 Cut-off rules
All data from the operational data collection are taken into account, ie all raw materials and auxiliary materials used according to the recipe, as well as thermal and electrical energy. This means that material and energy flows with a share of <1% are also taken into account. All given data will be saved in the
Integrated life cycle assessment model. Transport expenses are included for all basic materials, the dispatch of 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

To model the bricks, the software system developed by thinkstep is used for holistic accounting *GaBi 9* used. 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 drawn up for the reference area Germany. This means that in addition to the production processes, the preliminary stages relevant for Germany, such as electricity or

Energy carrier provision, 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 on the basis of measurements by the 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*taken. The database was last updated in 2020. The data for the products examined is recorded by the member companies of the Federal Association of the German Brick and Tile Industry eV directly in the factories. The majority of the data for the upstream chains comes from industrial sources that were collected under consistent temporal and methodological boundary conditions. Great importance is attached to the completeness of the recording of environmentally relevant material and energy flows. The data quality is thus as good too

describe.

3.7 Observation Period

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

3.8 Allocation

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

economic allocation applied to separate the effects of sawdust from those of sawn timber. In the case of sawdust and biogenic additives, the carbon content is taken into account through 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 B. sludge from paper recycling, paper fiber waste, secondary styrofoam and filter cake. In the model, these materials are brought into the system without any load.

The production process does not provide any by-products. In this respect, no allocation is integrated in the applied life cycle assessment model. Scrap from production can be reused in production, but is also used in
various areas (road construction, tennis sand, etc.). The broken bricks that are 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 based on *EN 15804* have been created and the building context or the product-specific performance characteristics are taken into account.

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

4th LCA: scenarios and further 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, which contains biogenic carbon, is 0.00031 kg.

Transport to construction site (A4)

description	value	unit
Liters of fuel	1.16	l / 100 km
Transport distance	109	km
Utilization (including empty trips)	85	%
Gross density of the transported products	550-2000	kg / m ^ 3

Installation in the building (A5)

description	value	unit
Output substances as a result of	0.6	kg
Waste treatment on the construction site		
Loss of material	please refer declarations below	

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

Reference useful life

description	value	unit
Lifetime (according to BBSR)	50	a

Lifetime according to the manufacturer	150	a

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

End of Life (C1-C4)

description	value	unit
Collected as mixed construction waste	575	kg
For recycling	539.35	kg
For dumping	35.65	kg

The raw materials clay / loam contain lime and dolomite, these are decomposed during the firing process and CO is generated$_2$ free (which is taken into account in A1 to A3). A large part of the calcium and magnesium oxides that are formed is bound silicate. However, a small proportion is present as free alkali or alkaline earth oxides in burnt cullet. 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_2 show per kg fired bricks from the 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 building rubble processing
Scenario D1: credits resulting from the recycling of 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 masonry brick. To convert the results to one tonne of masonry bricks, you can use the specific density (575 kg / m3) of the brick can be divided and multiplied by 1,000. Environmental impacts due to installation losses are not included in the LCA results, as these depend on the construction project and thus vary. To calculate the additional environmental impact 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).

Important NOTE:
EP-freshwater: This indicator was developed 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.".

INDICATION OF THE SYSTEM LIMITS (X = INCLUDED IN THE LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Production stage			Stage of Establishment of Structure		Stage of use							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	substitute	renovation	Use of energy for the Operating the Building	Use of water for the 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 masonry bricks (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	- 1.455 + 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	- 1.155 + 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_{4th}-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]	1.155 + 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 = depletion potential of the stratospheric ozone layer; AP = acidification potential of soil and Water; EP = Eutrophication Potential; POCP = formation potential for tropospheric ozone; ADPE = potential for scarcity of abiotic resources - not fossil resources (ADP - substances); ADPF = potential for scarcity of abiotic resources - fossil Fuels (ADP - fossil fuels); WDP = water withdrawal potential (user)

RESULTS OF THE LCA - INDICATORS DESCRIBING THE USE OF RESOURCES according to EN 15804 + A2: 1 m³ masonry bricks (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
PENRT	[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 = Renewable Secondary fuels; NRSF = non-renewable secondary fuels; FW = net use of freshwater resources

RESULTS OF THE LCA - WASTE CATEGORIES AND OUTPUT FLOWS 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 = disposed of non-hazardous waste; RWD = Disposed Radioactive Waste; CRU = components for reuse; MFR = materials for recycling; MER = substances for energy recovery; EEE = exported Energy - electric; EET = Exported Energy - Thermal

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

indicator	unit	A1-A3	A4	A5	C1	C2	C3	C4	D.	D / 1
PM	[Disease f cases]	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 occurrence of diseases due to particulate matter emissions; IR = potential effect of human exposure to U235; ETP-fw = Potential Comparative Toxicity Unit for Ecosystems; HTP-c = potential comparative toxicity unit for humans (carcinogenic effect); HTP-nc = potential comparative toxicity unit for humans (non-carcinogenic effect); SQP = Potential Soil Quality Index

* GWP in module C3 contains -20 kg CO_2-Eq. / T due to carbonation.

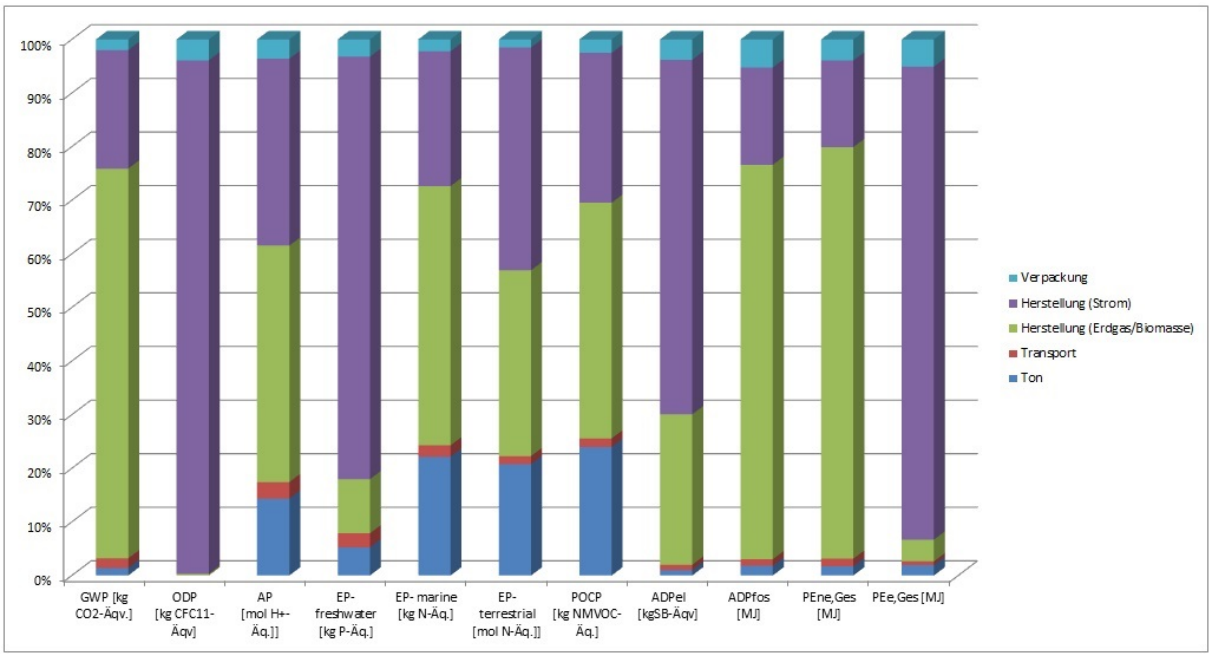
The results of the impact assessment represent relative information / potentials that do not represent any information on specific environmental impacts (endpoint); No exceeding of limit values or risk analyzes can be derived from this.

The following 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

Limitation note 2 - The results of this environmental impact indicator must be used with caution because the uncertainties in these results are high or because there is only limited experience with the indicator.

6th 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 plant and the associated emissions as a result of the burning process are dominated.
The process-related emissions are largely due to raw materials. Accordingly, the nature of the clays used also plays a not insignificant role. Packaging and transport only play a very subordinate role.

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

The data quality for the modeling of the unfilled bricks of the Federal Association of the German Brick and Tile Industry eV can be rated as good. Corresponding consistent data sets are available in the GaBi database for the basic and auxiliary materials used. For a few substances the processes were included in the manufacture and
Estimated environmental impact of similar preliminary products.

7th proof

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

Vanishingly small compared to the proportion of radon in the ground. (Info sheet: Natural radionuclides in building materials)

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Restriction of chemicals.

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