ENVIRONMENTAL PRODUCT DECLARATION

according to ISO 14025 and EN 15804+A1

Declaration holder	Federal Association of the German Brick Industry e.V.
Editor	Institute Building and Environment e.V. (IBU)
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Facing bricks, pavers and brick slips
Federal Association of the German Brick Industry e.V.

Institut Bauen und Umwelt e.V.

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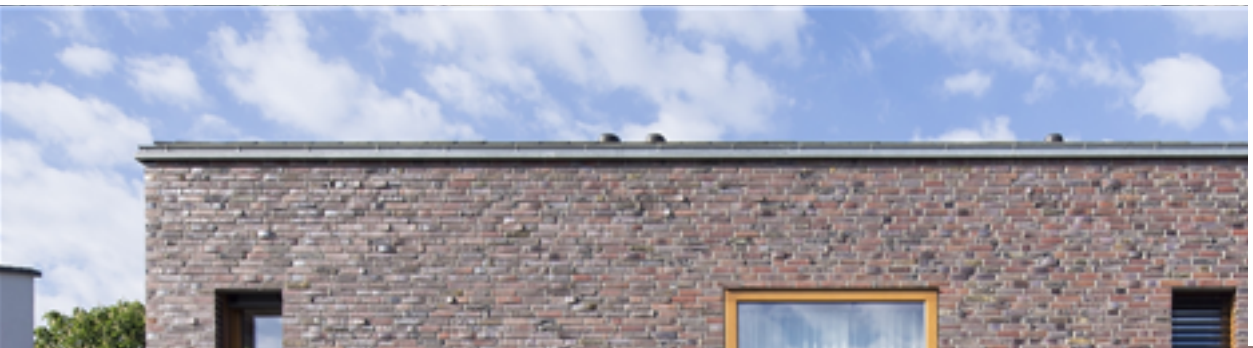

1. General Information

Federal Association of the German Brick Industry e.V.

Facing bricks, pavers and brick slips

Program Holder
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10178 Berlin
Germany

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Federal Association of the German Brick and Tile Industry e.V. Reinhardtstraße 12-16
10117 Berlin

Declaration Number
EPD-ZWM-20210148-ICG1-DE

Declared product/declared unit
1 ton of facing bricks, pavers and brick slips

This declaration is based on the product category rules:
Brick, 01.2016
(PCR tested and approved by the independent Advisory Council (SVR)

Scope:
This document refers to facing bricks, pavers and brick slips from "Bauen mit Backstein Zweischalige Wand Marketing e.V." For this declaration, data from 2014 was provided by 12 member companies. The companies involved represent 90% of the member companies of the manufacturers of facing bricks, paving bricks and brick slips associated in the double-shell wall. The production volume of these companies is around 95% of the German market in terms of production volume.

This EPD is an extension of the EPD EPD-ZWM-20160126-ICG1-DE without recalculation.
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 EN 15804+A1. In the following, the standard is simply referred to as EN 15804.

Date of issue
09/16/2021

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Verification

The European standard EN 15804 serves as the core PCR

Independent verification of declaration and information according to ISO 14025:2010

☐ intern ☒ extern

Graduate engineer Hans Peters
(Chairman of the Institute Building and Environment e.V.)

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(Managing Director Institute Building and Environment e.V

Dr Stefan Diederichs,
Independent Verifier

2. Product

2.1 Product Description/Product Definition

Facing bricks, paving bricks and brick slips belong to the group of coarse ceramic fired clay building materials.
Based on the mass-related annual production, the shares of the individual companies in the total production were determined and used to calculate the weighted average values.
In this EPD, the life cycle assessment results for facing bricks, pavers and brick slips are presented for one tonne [t]..

For placing the product on the market EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011(CPR) applies. The products require a declaration of performance taking into account DIN EN 771-1: 2011 for facing bricks, DIN EN 1344: 2015 for pavers and DIN EN 14411: 2016 for brick slips and the CE marking.

2.2 Application

Facing bricks are used as exposed masonry in double-leaf wall constructions in outdoor areas that are not protected from the weather, or as exposed masonry indoors.

Paving bricks are used for pavement coverings in traffic and path construction as well as for interior coverings. Straps are glued to wall constructions as exterior or interior wall cladding.

2.3 Technical specifications

Structural data

Designation	Value	Unit
Compressive strength according to /DIN EN 772-1/ (only for facing bricks)	>= 4	N/mm²
Raw density according to /DIN EN 772-13/ (only for facing bricks)	900 - 2500	kg/m³
Water vapor diffusion resistance number according to /DIN EN 1745/ or /DIN 4108-4/ (only for facing bricks)	50/100	-
Freeze-thaw resistance according to /DIN 52252-1/, /DIN V 52252-3/ or /DIN 52252-2/ (for facing bricks and brick slips), according to /DIN EN 1344/ (for pavers), according to /DIN EN ISO 10545-12/ (for slips)	Fulfills	-
Abrasion resistance according to /DIN EN 1344/ (only for clay pavers)	<=450 mm3	-
Water absorption according to /DIN EN 772-21/ (for facing bricks and brick slips), according to /DIN EN ISO 10545-3/ (for brick slips)	no restrictions nk for VMZ	M.-%
Flexural strength flat/upright according to /DIN EN 1344/ (only for pavers)	>=80 N/mm	-
Active soluble salts according to /DIN EN 772-5/ (only for facing bricks)	S2-S3	-

The respective national regulations apply to their use.
- Masonry bricks according to /DIN EN 771-1/ the application rules of /DIN 20 000-401: 2017/
- Paving bricks according to /DIN EN 1344/ the technical delivery conditions - paving
- Straps the general building authority approval of the German Institute for Building Technology of the respective manufacturer or according to /DIN 18515-1: 2017/

2.4 Delivery Condition

Facing bricks, paving bricks and brick slips are available in different formats and sizes depending on the application. Specification of the respective dimensions and the permissible tolerances are regulated in the following standards:

- /DIN EN 771-1/ in connection with /DIN 20000-401/ 20000-401/
- /DIN EN 1344/
- /DIN EN 14411/

2.5 Raw materials/excipients

Facing bricks, pavers and brick slips consist of the basic materials clay/loam (around 85%) and sand (around 8%).
Clay/loam: natural soils of different natural mineralogical composition
(Alumina Al2O3, Silicon Oxide SiO2,
Iron(III) oxide (Fe2O3). The mining of raw materials Occurs 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, different firing colors can arise. Furthermore, clays/loams can contain lime and dolomite. Sand and broken bricks are 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-grained) clays. Manganese and iron oxide are used to achieve specific color tones.

Glazes and engobes are also used to achieve specific color tones.
The product/article/at least one partial article contains substances from the ECHA list of substances of very high concern (SVHC) (date dd.mm.yyyy) that are eligible for authorization above 0.1 mass %: no." The product/article/at least one partial article contains other CMR substances of category 1A or 1B that are not on the candidate list, more than 0.1% by mass in at least one partial article: no.

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):

2.6 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-mentioned raw materials are crushed in certain optimized proportions (prepared), mixed and moistened. It is stored in the swamp house.

After adding more water, the blanks are shaped by pressing with appropriate dies and a downstream cutter. Water-struck platen presses, hand molding or form baking systems are also used. The formed material 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 can be 48 hours, for example. The dried blanks are then fired in the tunnel kiln at 900-1250 °C within approx. 24-48 hours. The bricks are stacked and sealed in recyclable PE foil. Brick slips are mainly packed in boxes. The energy requirements for brick production mainly relate to the firing process and drying. The electrical energy is mainly consumed in processing.

2.7 Environment and health during the manufacturing

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 in manufacturing
water/soil
Water and soil are not polluted. The process runs largely free of waste water. The mixing water used is

Drying process in the form of water vapor.
Air
The manufacturing process is subject to the requirements of /TA Luft/. If necessary, emissions are reduced by operating flue gas cleaning systems and by choosing fuels that contribute to CO2 reduction (e.g. natural gas). Furthermore, the firing control is improved by computer-assisted optimization. Noise
Due to noise protection measures, the measured values (workplace and outdoor space) are far below the required values.

2.8 Product Processing/Installation

The facing bricks are connected to one another using normal masonry mortar in accordance with /DIN EN 998-2/ in accordance with /DIN EN 1996-2/.
Paving bricks are used in either unbound or bound laying.
Brick slips are used either in accordance with /DIN 18515-1/ or in accordance with general building authority approvals from the German Institute for Building Technology.
Occupational safety/environmental protection
The weight of the individual bricks is below the 25 kg recommended by the building trade association. When walling/laying the bricks, occupational safety measures are observed in accordance with the regulations of the professional associations and in accordance with 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.
residual material
Any leftover bricks left on the construction site must be collected separately. Single-variety brick residues can be taken back by the manufacturers and used as raw materials or in various ways (for details, see 2.15 End-of-life phase).

2.9 Packaging

The polyethylene films, paper and cardboard are recyclable. Unsoiled PE foils (care must be taken to sort them) and reusable wooden pallets can be taken back to the building materials trade (reusable pallets against reimbursement in the deposit system) and returned to the brickworks. They then forward the PE films to the film manufacturers for recycling. In Germany, paper and cardboard as well as PE foils can also be disposed of through a contractual agreement with specialist disposal companies.

2.10 State of use

As listed under point 1 "Basic materials", bricks consist mainly of clay, loam and sand. The brick ingredients are bound as solid substances when in use (ceramic bond). Durability in condition of use
Bricks no longer change after leaving the kiln. When used as intended, they are unlimitedly durable, vermin-resistant, rot-resistant, fouling-resistant, acid- and alkali-resistant.

2.11 Environment and health during the use

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

2.12 Reference useful life

The reference service life is 150 years when installed in accordance with the rules of technology (PCR document of the European Brick and Tile Industry Association /TBE/). Association /TBE/).

2.13 Extraordinary Effects

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/ (and/or /DIN EN 13501-2/) "non-combustible".

Fire protection

Designation	Wert
Building material class	A1
Burning dripping	-
Smoke development	-

Water
Under the influence of water (e.g. driving rain), 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.

2.14 Post-use phase

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 with the production break for decades. Further possible uses exist as an aggregate for crushed brick concrete, as filling or bulk material in road construction and civil engineering, as a substrate in gardening and landscaping, material for backfilling pits and quarries, in the construction of noise protection walls, and as tennis flour and tennis sand.

2.15 Disposal

Leftover bricks, broken bricks and bricks from demolition on the construction site can be disposed of without any problems if the recycling options described above are not practicable and do not represent an exceptional burden on the environment. Due to the chemically neutral, inert and immobile behavior of the bricks, they can go to landfills of landfill class I according to the Landfill Ordinance or used in pits and quarries according to Z 1.1. The waste key number is AVV 17 01 02 bricks
/Waste List Ordinance/.

2.16 Weitere Informationen

Weitere Informationen befinden sich unter www.backstein.com

3. LCA: Calculation Rules

3.1 Declared unit

The declaration refers to 1 ton of facing bricks, pavers or brick slips. The life cycle assessment results in this EPD are based on an average of the participating 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
Bulk Density	900 - 2500	kg/m³
Conversion factor to 1 kg	0,001	-
Declared unit	1	t

For IBU core EPDs (where Chapter 3.6 is not declared): For average EPDs, the robustness of the life cycle assessment values must be assessed, e.g. B. with regard to the variability of the production process, the geographical representativeness and the influence of the background data and preliminary products in comparison to the environmental impacts caused by the actual production.

3.2 System boundary

Type of EPD: cradle to grave.
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 study.
At the end of its useful life, the product is dismantled (module C1) and transported for recycling or disposal (C2).
Two end-of-life scenarios are declared in this EPD:

- EoL scenario 1 refers to recycling as aggregate in the construction industry (C3).
- EoL scenario 2 describes disposal on a building rubble landfill (C4).

Both scenarios are declared for 1 t of bricks (100%).
Credits resulting from the recycling of clay bricks are declared in Module D. Credits for electricity and thermal energy as a result of thermal recycling of the packaging within Module A5 are also taken into account in Module D.
The usage stage (module B1-B5) is taken into account in this study. There are no environmental impacts in these modules.
Since modules B6 and B7 refer to the operation of the building and the use of the product is not related to the operational use of energy and water in the building, these modules are not relevant to the declared product and therefore have no environmental impact.

3.3 Estimates and Assumptions

Data gaps are filled in this study using a conservative approach. Plausible average values are used for this. There are gaps in the data for some emission values and the quantities used of recipe components.
Since the composition of the glaze and engobe is very different, a representative recipe is assumed for this

In the present study, corresponding data sets are available for all raw materials, packaging materials, energy supply and auxiliary processes used.

3.4 Clipping Rules

All data from the operating data surveys, i.e. all raw materials used according to the recipe, the thermal and electrical energy used, internal fuel consumption and electricity consumption, all direct production waste and all available emission measurements are taken into account in the balance.
Material and energy flows with a share of less than one percent are also taken into account and the cut-off limit of 5% according to PCR Part A is observed.

3.5 Background Data

The software system for holistic accounting /GaBi ts/ is used to model the life cycle. The background data comes from the GaBi ts databases.

3.6 Data Quality

The data quality for the modeling can be considered good. Corresponding data records are available in the GaBi database for all relevant preliminary products and auxiliary materials used. Both foreground and background data refer to current data or the years 2011-2016 with regard to the GaBi database. The estimate made for the recipe of the glaze and engobe is appropriate and has a marginal influence on the overall result.

3.7 Observation Period

The period under consideration is 2014.

3.8 Allocation

Small amounts of secondary material (approx. 3%) in the form of broken bricks are used in the manufacture of bricks. This enters the system effortlessly and unencumbered. The transport costs are taken into account. When the product is recycled after use, no credits are given for the secondary material content.
On the output side, small amounts (approx. 5%) of broken bricks occur in production.
About a third of the broken material can be ground up and reused. This internally recycled broken brick remains within A1-A3 (closed loop).

Some of the broken bricks are used as filling material in a wide range of applications (see 2.15).
He leaves the system boundary free of value and burdens.

3.9 Comparability

In principle, a comparison or evaluation of EPD data is only possible if everyone agrees

Comparative data sets were created according to EN 15804 and the building context or the product-specific performance characteristics are taken into account.

The background database used must be named

4. LCA: Scenarios and other technical information

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

Transport to construction site (A4)

Designation	Value	Unit
Liters of fuel	1,4	l/100km
Transportation Distance	290	km
Utilization (including empty runs)	85	%
Bulk density of the transported products	1000	kg/m³

Installation in the building (A5)

Designation	Value	Unit
Output substances as a result of waste treatment on site packaging materials	5.8	kg

Environmental impacts from installation losses are not included in the life cycle assessment results, as these depend on the construction project and therefore vary. For additional environmental loads arising from the production and disposal of the installation losses, the LCA results can be calculated for a specific installation loss (e.g. installation loss 3%, multiplying the LCA results for A1-A3 by 1.03).

Use (B1)
see information in chap.

Use (B1) see Chap. 2.12
see information in chap. 2.12

Designation	Value	Unit

Maintenance (B2)

Designation	Value	Unit
Water consumption	0	m³
Power consumption	0	kWh
Other energy carriers	0	MJ
Loss of material	-	kg

Facing bricks, pavers and brick slips do not require any maintenance during their service life.

Repair (B3)

Designation	Value	Unit
Power consumption	0	kWh
Other energy carriers	0	MJ

Facing bricks, pavers and brick slips do not require repairs during their service life.

Replacement (B4)/conversion/renewal (B5)

Designation	Value	Unit
Power consumption	0	kWh

Facing bricks, paving bricks and brick slips do not have to be replaced or rebuilt during their useful life

If a reference service life is declared according to the applicable ISO standards, the assumptions and conditions of use on which the determined RSL is based must be declared. It must also be stated that the declared RSL only applies under the reference terms of use mentioned. The same applies to a service life declared by the manufacturer.

Corresponding information on reference terms of use does not have to be declared for a period of use according to the BNB table.

Reference useful life

Designation	Value	Unit
Reference useful life	150	a
Service life (according to BBSR)	-	a
Service life according to the manufacturer	-	a
Service life according to the manufacturer	-	-
Parameters for the intended use (if specified by the manufacturer), including advice on appropriate use and instructions for use	-	-
The assumed quality of workmanship when performed according to the manufacturer's specifications	-	-
Outdoor conditions (for outdoor use), e.g. B. Effects of weather, pollutants, UV and wind exposure, building orientation, shading, temperature	-	-
Indoor conditions (for indoor use), e.g. B. Temperature, humidity, chemical exposure	-	-
Terms of Use, e.g. B. Frequency of use, mechanical stress	-	-
Inspection, maintenance, cleaning. e.g. B. required frequency, type and quality as well as replacement of components	-	-

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

Operational energy (B6) and water use (B7)

Designation	Wert	Einheit
Water consumption	0	m³
Power consumption	0	kWh

This module is not relevant for facing bricks.

Paving bricks and brick slips.

End of Life (C1-C4)

Designation	Value	Unit
Separately collected waste type	1000	kg
For recycling (100% scenario)	1000	kg
To landfill (100% scenario)	1000	kg

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

see information in chapter 3

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

Designation	Value	Unit

See information in Chapter 3.

5. LCA: results

EoL scenario 1 refers to material recycling as aggregate in the construction industry. The results for this scenario are declared in modules C2/1, C3/1, D/1.
EoL scenario 2 describes disposal at a rubble dump.
The results for this scenario are declared in modules C2/2, C4/2, D/2

STATEMENT OF SYSTEM BOUNDARIES (X = INCLUDED IN LCA; MND = MODULE 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	Substitute	Renovation	Energy use for running the building	Use of water to operate the building	dismantling/demolition	Transport	Waste treatment	Elimination	Potential for reuse, recovery or recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 t of facing bricks, pavers, brick slips

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
GWP	[kg CO_2-Äq.]	255.55	12.50	9.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	1.04	1.72	2.63	0.00	0.00	16.10	-6.12	-3.66
ODP	[kg CFC11-Äq.]	3.41E-9	4.65E-11	3.00E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.11E-12	2.17E-12	3.58E-12	2.73E-11	0.00E+0	0.00E+0	1.58E-10	-1.33E-9	-1.21E-9
AP	[kg SO_2-Äq.]	8.88E-1	4.55E-2	9.16E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.00E-3	2.42E-3	4.00E-3	1.82E-2	0.00E+0	0.00E+0	9.62E-2	-1.75E-2	-5.81E-3
EP	[kg $(PO_4)^{3-}$-Äq.]	5.78E-2	8.68E-3	1.91E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.90E-4	6.04E-4	9.98E-4	4.39E-3	0.00E+0	0.00E+0	1.31E-2	-2.99E-3	-5.88E-4
POCP	[kg Ethen-Äq.]	5.37E-2	-7.21E-3	6.48E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.35E-4	-7.61E-4	-1.26E-3	2.65E-3	0.00E+0	0.00E+0	9.25E-3	-1.97E-3	-6.17E-4
ADPE	[kg Sb-Äq.]	2.92E-4	1.05E-6	7.70E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.07E-8	7.92E-8	1.31E-7	4.68E-6	0.00E+0	0.00E+0	5.55E-6	-1.19E-6	-6.25E-7
ADPF	[MJ]	3697.99	168.00	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.31	14.20	23.50	49.90	0.00	0.00	209.00	-79.60	-50.30

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)

RESULTS OF THE LCA – INDICATORS TO DESCRIBE THE USE OF RESOURCES according to EN 15804+A1: 1 t of facing bricks, pavers, brick slips

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PERE	[MJ]	229.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.97	1.60	3.84	0.00	0.00	24.60	-14.40	-8.31
PERM	[MJ]	61.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	291.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.97	1.60	3.84	0.00	0.00	24.60	-14.40	-8.31
PENRE	[MJ]	3810.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.33	14.30	23.60	51.10	0.00	0.00	216.00	-95.20	-61.50
PENRM	[MJ]	27.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	3838.08	170.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.33	14.30	23.60	51.10	0.00	0.00	216.00	-95.20	-61.50
SM	[kg]	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	970.50
RSF	[MJ]	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00
NRSF	[MJ]	0.35	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	-0.01	-0.01
FW	[m^3]	0.32	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	-0.02	-0.01

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 Waste Fuels; NRSF = Non-Renewable Recoverable Fuels; FW = net use of freshwater resources

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 t of facing bricks, pavers, brick slips

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
HWD	[kg]	1.35E-4	2.04E-5	1.58E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.43E-7	1.84E-6	3.04E-6	3.65E-6	0.00E+0	0.00E+0	4.95E-6	-2.44E-5	-2.38E-8
NHWD	[kg]	13.81	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	1000.00	-40.50	-0.02
RWD	[kg]	5.55E-2	6.36E-4	1.16E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.93E-6	1.93E-5	3.19E-5	4.96E-4	0.00E+0	0.00E+0	2.99E-3	-6.20E-3	-4.48E-3
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1000.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

6. LCA: Interpretation

The life cycle of facing bricks, pavers and brick slips is dominated by the effects of the production stage (modules A1-A3). Within A1-A3, the consumption of thermal energy has a dominant share in most of the investigated impact categories (potential for abiotic depletion of fossil fuels ADPf, eutrophication potential EP, global warming potential GWP, formation potential for tropospheric ozone POCP) and the non-renewable primary energy consumption (PENRT). on the overall result. In addition, the pre-products in the eutrophication potential (EP) category have an important share, caused by the pre-chains of the clay and manganese oxide degradation and production processes. In the impact category Ozone Depletion Potential (ODP) and the energetically used renewable primary energy
(PERE) the effect of power generation is decisive.
The results within the acidification potential (AP) impact category are determined by the production-related sulfur dioxide emissions.
The provision of raw materials is the main driver in the impact category Potential for abiotic depletion of non-fossil resources (ADPe). This is mainly caused by the pigments.
The transport of the raw materials (A2) and the packaging of the product play a subordinate role. The only exception here is the photochemical oxidant formation potential, in which the transport results in a negative potential. This is methodologically justified, since the nitrogen oxides have a reducing effect in the POCP category.

This EPD reflects the environmental impact of an average facing brick, paver and brick slip. The following statements can be made with regard to the fluctuation range of the identified main parameters:
The energy consumption of the individual plants - in the form of electricity and thermal energy - is directly related to the production made, the data collection is plausible in this respect.
The production technology is comparable at all locations, as a result of which the declared average is representative of a facing brick, paver and slip of the association, despite strong deviations at individual, fewer locations (e.g. with regard to energy consumption).
The fluctuations in energy consumption range (with a few exceptions) from minus 40% to plus 60% of the average value and have a significant impact on the majority of the environmental impacts considered, i.e. ADPfossil, GWP, EP, POCP, ODP and PENRT.
In all plants, only natural gas is used for burning, so there are no differences in the environmental impact caused by the use of different energy sources. With regard to the primary products used, the range of fluctuation is small due to their homogeneity. The formulations are largely similar, but the different use of additives has a significant influence on the ADPelements category.

7. Proof

Studies and evaluations show that the natural radioactivity of facing bricks, paving bricks and brick slips allows unrestricted use of this building material from a radiological point of view. They do not contribute to a relevant increase in the radon concentration in rooms, their contribution to

The inhalation dose is negligible compared to the proportion of radon in the ground /Info sheet: Natural radionuclides in building materials/.

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