ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Bauen mit Backstein Zweischalige Wand Marketing e. V.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ZWM-20160126-ICG1-EN
Issue date	20.10.2016
Valid to	19.10.2021

Facing Bricks, Clay Pavers and Brick Slips

Bauen mit Backstein
Zweischalige Wand Marketing e. V.

Presented by the participating company:
ABC Klinkergruppe, D-49509 Recke, www.abc-klinker.de

Institut Bauen und Umwelt e.V.

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

1. General Information

Bauen mit Backstein
Zweischalige Wand Marketing e. V.

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-ZWM-20160126-ICG1-EN

This Declaration is based on the Product Category Rules:
Bricks, 01.2016
(PCR tested and approved by the SVR)

Issue date
20.10.2016

Valid to
19.10.2023

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

Facing bricks, clay pavers and brick slips

Owner of the Declaration
Bauen mit Backstein
Zweischalige Wand Marketing e. V.
Schaumburg-Lippe-Straße 4
53113 Bonn

Declared product / Declared unit
1 tonne facing bricks, clay pavers and brick slips

Scope:
This document refers to facing bricks, clay pavers and brick slips manufactured by "Bauen mit Backstein Zweischalige Wand Marketing e.V." 12 member companies supplied data from 2014 for this Declaration. The companies involved represent 90% of the member companies merged as manufacturers of facing bricks, clay pavers and brick slips in the Zweischalige Wand association. The production volume of these companies accounts for approx. 95% of the German market.The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Dr. Stefan Diederichs
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

Facing bricks, clay pavers and brick slips belong to the group of heavy-clay building materials.
Based on mass-related annual production, the shares contributed to overall production by the individual companies were identified and used to calculate the weighted average values.
This EPD presents the LCA results for one tonne [t] each of facing bricks, clay pavers and brick slips.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a Declaration of Performance taking into consideration /DIN EN 771-1:2011/ for facing bricks, /DIN EN 1344:2015/ for clay pavers and /DIN EN 14411:2012/ for brick slips and the CE-marking.

2.2 Application

Facing bricks are used as exposed brickwork in double wall constructions in exterior areas not protected from weathering or as exposed brickwork in indoor applications. Clay pavers are used for paving in road construction as well as for interior floorings. Brick slips are used as exterior or interior cladding on wall constructions.

2.3 Technical Data

Technical construction data

Name	Value	Unit
Compressive strength acc. to /EN 772-1/ (for facing bricks only)	>= 4	N/mm²
Gross density acc. to /EN 772-13/ (for facing bricks only)	900 - 2500	kg/m³
Water vapour diffusion resistance factor acc. to /DIN EN 1745/ or /DIN 4108-4/ (for facing bricks only)	50/100	-
Freeze-thaw resistance acc. to /DIN 52252-1/, /DIN V 52252-3/, /DIN 52252-2/ (for facing bricks and brick slips), acc. to /DIN EN 1344/ (for clay pavers), acc. to /DIN EN 10545-12/ (for brick slips)	fulfilled	-
Abrasion resistance acc. /DIN EN 1344/ (only clay pavers)	<=450 mm3	-
Water absorption acc. /EN 772-	no	M.-%

21/ (for facing bricks and brick slips), acc. to /EN 10545-3/ (for brick slips)	restriction for facing bricks	
Bend-breaking strain when flat/edgewise acc. /EN 1344/ (for clay pavers only)	>=80 N/mm	-
Active soluble salts acc. /EN 772-5/ (for facing bricks only)	S2-S3	-

Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /DIN EN 771-1:2011/ for facing bricks, /DIN EN 1344:2015/ for clay pavers and /DIN EN 14411:2012/ for brick slips.]

2.4 Delivery status

Facing bricks, clay pavers and brick slips are available in various shapes and sizes depending on the respective application. The respective dimensions and permissible tolerances are regulated in the following standards:

- /DIN EN 771-1/ combined with /DIN V 20000-401/
- /DIN EN 1344/
- /DIN EN 14411/

2.5 Base materials / Ancillary materials

Facing bricks, clay pavers and brick slips comprise the base materials of clay/loam (around 85%) and sand (around 8%). They do not contain any SVHCs (substances of very high concern) in accordance with Directive (EC) No. 1907/2006 /REACH/ and Directive (EC) No. 1272/2008/CLP Directive/.

Clay/Loam: natural earth of varying natural mineralogical composition (aluminium oxide Al2O3, silicon oxide SiO2, iron(III)oxide (Fe2O3). Materials are quarried close to the surface in selected natural mineral deposits.

Other natural clay components: Clay/Loam contains natural deposit components of varying percentages such as colouring ferrous oxide, for example. For this reason, various fired colours can arise depending on the clay involved. Clay/Loam can also contain lime and dolomite.

Sand and firing waste are added as shortening material for offsetting the natural fluctuations in the mineralogical composition of the raw clay for very plastic (fine-grain) clays.

Manganese oxide and iron oxide are used to achieve certain colours.

Glazes and engobes are also used in order to achieve certain colour shades.

2.6 Manufacture

After quarrying clay in surface mining, the clay is transported to the factory grounds for interim storage. Mechanical preparation of the clay such as crushing and mixing, for example, is performed in the edge runner with perforated bottom and the roller mills. The base materials referred to above are crushed (processed), mixed and moistened at certain optimised ratios. They are then stored in the souring house. After renewed watering, the green bricks are moulded by presses using the corresponding dies and cutter. Water-struck plate presses, hand-operated moulding or moulding plants are also used. The moulded material enters the dryer which is essentially powered by the waste heat of the tunnel kiln. Drying times vary depending on the format and gross density and can take 48 hours, for example. The dried green bricks are then fired at approx. 900 - 1250 °C in the tunnel kiln within approx. 24 - 48 hours. The bricks are stacked and shrink-wrapped in recyclable PE foil. Brick slips are largely packed in boxes. Energy requirements by brick production primarily concern the firing process and drying. Electrical energy is primarily required in processing.

2.7 Environment and health during manufacturing

Health and safety requirements during manufacturing

The applicable regulations of the professional liability associations apply; no special measures are to be taken to protect employee health.

Environmental protection during manufacturing

Water/Soil

Water and soil do not incur any environmental damage. The process is largely free of waste water. The mixing water used is released again as water vapour during the drying process.

Air

The manufacturing process is subject to the requirements of the /"TA Luft"/. If necessary, emissions are reduced by using flue gas cleaning plants and choosing fuels which contribute to reducing CO_2 (e.g. natural gas). Firing is also improved by computer-supported optimisation.

Noise

Measured values are far below the requisite values thanks to sound protection measures (workplace and outdoors).

2.8 Product processing/Installation

Facing bricks are connected using standard mortar for brickwork as per /DIN EN 998-2/ in accordance with /DIN EN 1996-2/.

Clay pavers are laid bonded or loosely.

Brick slips are used either in accordance with /DIN 18515-1/ or as per general technical approvals issued by the Deutsches Institut für Bautechnik.

Health and Safety / Environmental protection

The weights of individual bricks are below the recommendations of the professional liability associations of 25 kg. When walling up/laying bricks, industrial protection measures are adhered to in accordance with the rules of the professional liability associations and manufacturer recommendations. Cutting and separating work generally involves specified wet processes. Dust masks (P3/FFP 3) should be worn when dry-cutting.

Residual material

Brick residue incurred on the building site must be collected separately. Sorted brick residue can be taken back by the manufacturers and used as a raw material or otherwise (please refer to 2.15 Re-use phase for details).

2.9 Packaging

The polyethylene foil, paper and cardboard are recyclable. Non-contaminated PE foils (ensure single-variety collection) and reusable pallets made of wood can be taken back by the building trade (reusable pallets against deposit payments) and returned to the brickworks which redirect foils to the foil manufacturers for recycling. In Germany, paper and cardboard as well as PE foil can also be disposed of by means of a

contractual agreement with professional disposal companies.

2.10 Condition of use
As outlined in “Base materials”, bricks largely comprise clay, loam and sand. Brick contents are bound as solid materials in the condition of use (ceramic bond).
Resistance in condition of use
Bricks do not alter their condition after leaving the kiln. When used as designated, they display unlimited resistance to pests, rotting, growth, acids and lyes.

2.11 Environment and health during use
Bricks do not emit any materials which are harmful to health or the environment. Natural ionising radiation by bricks is extremely low and negligible in terms of health hazards.

2.12 Reference service life
When installed in accordance with the rules of technology, the Reference Service Life (RSL) is 150 years (PCR document issued by the European Brick and Tile Industry Association /TBE/).

2.13 Extraordinary effects

Fire
In the event of a fire, no toxic gases and vapours can arise which impair visibility. The products referred to comply with the requirements of building material class A1 in accordance with /DIN 4102/ (and/or /DIN EN 13501-2/) “not flammable”.

Brandschutz

Name	Value
Building material class	A1
Burning droplets	-
Smoke gas development	-

Water
When influenced by water (e.g. driving rain), no water-polluting components can be washed out thanks to the solid, ceramic bond.

Mechanical destruction
Unforeseen mechanical destruction is not associated with any risks for the environment or living organisms.

2.14 Re-use phase
Sorted bricks from de-constructed sites can be taken back by brick manufacturers and recycled in ground form as shortening material in production. This practice has been applied with broken product for decades. The possibilities of further use involve as aggregate for crushed brick concrete, as filling or bulk material in the area of road construction and civil engineering, as substrate in garden design and landscape gardening, as material for refilling mines and quarries, when building sound barriers and as tennis powder and tennis sand.

2.15 Disposal
Where these recycling options are not practical, brick residue, broken bricks and leftover bricks incurred on the building site are easy to dispose of and do not pose any extraordinary risks for the environment. Owing to the chemically neutral, inert and immobile nature of bricks, they can be stored in class I landfills in accordance with the Landfill Ordinance and/or used in mines and quarried in accordance with Z 1.1. The waste code is AVV 17 01 02 Bricks /List of Wastes Ordinance/.

2.16 Further information
Further information is available at www.backstein.com.

3. LCA: Calculation rules

3.1 Declared Unit
This Declaration refers to 1 tonne of facing bricks, clay pavers or brick slips.
The LCD results in this EPD are based on averages provided by the participating plants which are, in turn, weighted averages based on the percentage of total annual production accounted for by the individual production facilities.

Deklarierte Einheit

Name	Value	Unit
Gross density	900 - 2500	kg/m^3
Conversion factor to 1 kg	0.001	-
Declared unit	1	t

3.2 System boundary
EPD type: cradle to grave
The LCD takes consideration of the aquisition of raw materials, raw material transport and actual product manufacturing, including packaging materials (Modules A1-A3).
Transport to the construction site (Module A4) and treatment of the packaging materials in the waste incineration plants following installation of the product (Module A5) are also part of the study.

After expiry of the use phase, the product is de-constructed (Module C1) and transported for recycling or disposal (C2).

Two EoL scenarios are declared in this EPD:
- EoL scenario 1 refers to material utilisation as aggregate in the construction industry (C3).
- EoL scenario 2 outlines disposal at a building rubble landfill (C4).
Both scenarios are declared for 1 tonne bricks (100%). Credits incurred by recycling clay bricks are declared in Module D. Credits for electricity and thermal energy following thermal utilisation of packaging within Module A5 are also considered in Module D.
The use stage (Modules B1-B5) is taken consideration of in this study. These modules do not incur any negative environmental impacts.
As Modules B6 and B7 refer to operation of the building and use of the product does not have any connection with operational energy or water use in the building, these modules are not of relevance for the declared product and do not therefore have any environmental impact.

3.3 Estimates and assumptions
Data gaps in this study are filled by applying a conservative approach for which plausible average values are used. Data gaps arise in the case of some emission values and volumes of mixture components used.
As the composition of the glaze and engobe differ widely, a representative formula is assumed here. The corresponding data sets are available in this study for

all raw materials, packaging materials, provision of energy and auxiliary processes.

3.4 Cut-off criteria
All operating data, i.e. all of the starting materials used, thermal and electrical energy used, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis.
Material and energy flows accounting for less than one per cent are also taken into consideration and the cut-off limit of 5% is maintained in accordance with PCR, Part A.

3.5 Background data
The /GaBi ts/ software system for modelling the life cycle was applied for comprehensive analysis. The background data is taken from the GaBi ts data bases.

3.6 Data quality
The data quality can be regarded as good for modelling. The corresponding data sets are available in the GaBi data base for all of the relevant preliminary products and auxiliaries used. Both primary and background data refer to current data and/or the period 2011-2016 in terms of the GaBi data base. The estimate for the glaze and engobe formula is appropriate and has a marginal influence on the overall result.

3.7 Period under review
The period under review is 2014.

3.8 Allocation
In the manufacture of bricks, small volumes of secondary materials (approx. 3%) are used in the form of brick residue which enter the system without effort and unencumbered. Transportation is considered. No credits for secondary materials are allocated for recycling the product after use.
On the output side, low volumes of brick residue (approx. 5%) are incurred in production.
Approx. one-third of brick residue can be ground and re-used. This brick residue recycled internally remains within A1-A3 (*closed loop*).
Some of the brick residue is used as filling material in a wide variety of applications (please refer to 2.15).
It leaves the system boundary objectively and unencumbered.

3.9 Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account. The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

The following technical information forms the basis for the declared modules or can be used for developing specific scenarios within the context of a building assessment.

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	1.4	l/100km
Transport distance	290	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1000	kg/m³

Construction installation process (A5)

Name	Value	Unit
Output substances following waste treatment on site packaging material	5.8	kg

Environmental impact caused by installation losses is not included in the LCA results as they are dependent on the construction project and can vary.
The LCA results for a specific installation loss can be calculated for additional environmental impact caused by the manufacture and disposal of installation losses (e.g. installation loss of 3%, multiplication of the LCA results by 1.03 for A1-A3).

Use (B1)
Please refer to 2.12 Use.

Maintenance (B2)

Name	Value	Unit
Water consumption	0	m³
Electricity consumption	0	kWh
Other energy carriers	0	MJ
Material loss	-	kg

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

Repairs (B3)

Name	Value	Unit
Electricity consumption	0	kWh
Other energy carriers	0	MJ

Facing bricks, clay pavers and brick slips do not require any repairs during their service lives.

Replacement (B4) / Refurbishment / Renewal (B5)

Name	Value	Unit
Electricity consumption	0	kWh

Facing bricks, clay pavers and brick slips do not need to be replaced, refurbished or renewed during their service lives.

Reference Service Life

Name	Value	Unit
Reference service life	150	a

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

Operational energy (B6) and Water consumption (B7)

Name	Value	Unit
Water consumption	0	m³
Electricity consumption	0	kWh

This module is not of relevance for facing bricks, clay pavers and brick slips.

End of Life (C1-C4)

Name	Value	Unit
Collected separately waste type	1000	kg
Recycling (100% scenario)	1000	kg
Landfilling (100% scenario)	1000	kg

Re-use, recovery and recycling potential (D), relevant scenario information

Please refer to 3.

Empfohlene Qualität für zweischaliges Bauen mit Backstein

5. LCA: Results

EoL scenario 1 refers to material utilisation as aggregate in the construction industry. The results of this scenario are declared in Modules C2/1, C3/1, D/1. **EoL scenario 2** outlines disposal at a building rubble landfill. The results of this scenario are declared in Modules C2/2, C4/2, D/2.

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse- Recovery- Recycling- potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 tonne facing bricks, clay 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-Eq.]	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-Eq.]	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-Eq.]	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 $(PO_4)^{3-}$-Eq.]	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 ethene-Eq.]	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-Eq.]	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

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

RESULTS OF THE LCA - RESOURCE USE: 1 tonne facing bricks, clay 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	[m³]	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

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 tonne facing bricks, clay pavers, brick slips

Empfohlene Qualität für zweischaliges Bauen mit Backstein

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

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

6. LCA: Interpretation

The life cycle of facing bricks, clay pavers and brick slips is dominated by the effects of the production stage (Modules A1-A3).
Within A1-A3, the consumption of thermal energy in most of the impact categories analysed (Abiotic depletion potential for fossil resources ADPf, Eutrophication potential EP, Global warming potential GWP, Photochemical ozone creation potential (POCP) and Total non-renewable primary energy requirements (PENRT) account for a dominating share of the overall result. The preliminary products in the Eutrophication potential (EP) category also account for a key share, caused by the upstream chains associated with clay and manganese oxide depletion and/or the manufacturing processes. In the Ozone depletion potential (ODP) and Use of renewable energy resources as primary energy (PERE) impact categories, the effect of electricity generation is decisive.
The results within the Acidification potential (AP) impact category are determined by production-based sulphur dioxide emissions.
The extraction of raw materials is the main driver in the Abiotic depletion potential for non-fossil resources (ADPe) impact category. This is caused by the pigments in particular.
Transporting the raw materials (A2) and product packaging play a subordinate role. An exception is only represented here by the Photochemical ozone creation potential where transport gives rise to a negative potential. This is methodically justified as the nitric oxides have a reducing impact in the POCP category.
This EPD reflects the environmental impacts of an average facing brick, clay paver and brick slip. The following claims can be made regarding fluctuations by the recognised primary parameters:
Energy consumption by the individual plants – in the form of electricity and thermal energy – is directly associated with production; the data collated is therefore plausible.
Production technology is comparable at all locations with the result that, despite major deviations by a few individual locations (e.g. concerning energy consumption), the declared average is representative for an association facing brick, clay paver and brick slip.
The fluctuations in energy consumption range (with a few exceptions) from -40% to +60% of the average value and have a significant influence on most of the environmental impacts reviewed, i.e. ADPfossil, GWP, EP, POCP, ODP and PENRT.
Exclusively natural gas is used for firing in all plants. Accordingly, there are no differences in the environmental impacts necessitated by the use of various energy resources.
In terms of the preliminary products used, fluctuations are minor thanks to their degree of homogeneity. The formulae are largely similar but the varying use of additives has a significant influence on the ADPelements impact category.

7. Requisite evidence

Tests and evaluations indicate that the natural radioactivity of facing bricks, clay pavers and brick slips permits unrestricted usage of these construction materials from a radiological perspective. They do not contribute towards any relevant increase in radon concentrations indoors and their contribution to the inhalation dose is neglible in comparison to the percentage of radon in soil /Info sheet: Natural radionuclides in building materials/.

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