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Statement of Verification

BREG EN EPD No.: 000002 Issue 4

ECO EPD Ref. No. 000092

This is to verify that the

Environmental Product Declaration

provided by:

The Brick Development Association

BRE Global Verified EPD

is in accordance with the requirements of:

EN 15804:2012+A1:2013

and

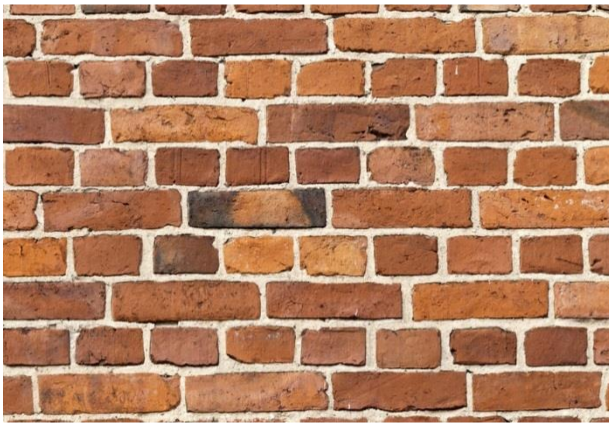
BRE Global Scheme Document SD207

This declaration is for:

UK Clay Brick

Company Address

The Building Centre
26 Store Street
London
WC1E 7BT



BRICK DEVELOPMENT ASSOCIATION

Signed for BRE Global Ltd	Laura Crition Operator	19 February 2019 Date of this Issue
27 February 201927 February 2019 Date of First Issue		18 February 2024 Expiry Date

BRE Global Verified EPD

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ECO PLATFORM EPD EN 15804 VERIFIED

Environmental Product Declaration

EPD Number: 000002

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013
Commissioner of LCA study	**LCA consultant/Tool**
Brick Development Association (BDA) Ltd 26 Store Street Fitzrovia London WC1E 7BT United Kingdom	Fei Zhang BRE Bucknalls Lane Watford WD25 9XX
Declared/Functional Unit	**Applicability/Coverage**
1 tonne of brick	Sector UK Average
EPD Type	**Background database**
Cradle to Gate with all options plus module D	Ecoinvent 3.2

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☐ External
(Where appropriate [b]) Third party verifier: Click here to enter text.
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A1:2013 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing sites

Manufacturing data was provided by members of the BDA covering 46 UK manufacturing sites and representing 99% of UK brick production. Manufacturers and site addresses are included in the LCA report.

Construction Product:

Product Description

Bricks have a wide range of applications across the construction industry. Most bricks are used in cavity walls in building projects. Bricks generally form the outside face of the wall. Protected by the outer brick there is an insulation filled cavity (either full-filled or part-filled), an internal skin of thermal blockwork, a timber or steel framed structure, finished with either dry lined or a wet plastered finish which completes a typical wall. Bricks are also used fair faced internally replacing the internal blockwork and plasterwork, and for both free standing walls and civil engineering structures.

The members of the BDA manufacture a wide variety of bricks, which can vary in composition, colour, texture, size and production process. There are four main manufacturing processes by which bricks are produced in the UK; extrusion, soft mud moulding, handmade moulding and semi-dry pressing. In the UK, 'extrusion' and 'soft mud' are dominant. This LCA is for a generic UK brick which covers all brick types and production process and is based on data representative of 99% brick production by BDA member companies (with complete data returns from eight companies across 46 manufacturing sites).

Technical Information

Bricks are made to a range of specifications, so characteristics can vary. The basic characteristics of the BDA average UK brick can be seen in the table below. The weight of a standard brick was given as supplied by the BDA to allow conversion of the results per declared unit to a per average brick basis. As other characteristics such as fire resistance and compressive strength vary between types of brick, this information can be found on the datasheets of specific bricks.

Property	Value, Unit
Dimensions	215 mm x 102.5 mm x 65 mm
Dry brick weight	2.13 kg

All UK manufactured bricks are produced according to the requirements of BS EN 771–1: Specification for masonry units: Clay masonry units

Main Product Contents

According to BDA, the average UK brick contains no substances that are listed in the 'Candidate List of Substances of very high concern for authorisation'. The composition of the average product modelled in this project is obtained from the total raw material usages supplied by all participating members.

Composition of the BDA average brick based on input masses of used raw materials can be seen in the table below.

Material/Chemical Input	%
Clays and shales	92
Sand	6
Inorganic additive	2

Manufacturing Process

Most brickworks have their own onsite quarry or are in close proximity to one. However, depending on the type of clay required, clay can also be sourced from quarries further afield. Once extracted from the quarry, the raw clay undergoes a series of processes, which generally includes crushing and mixing with water, in order to transform it into a malleable material.

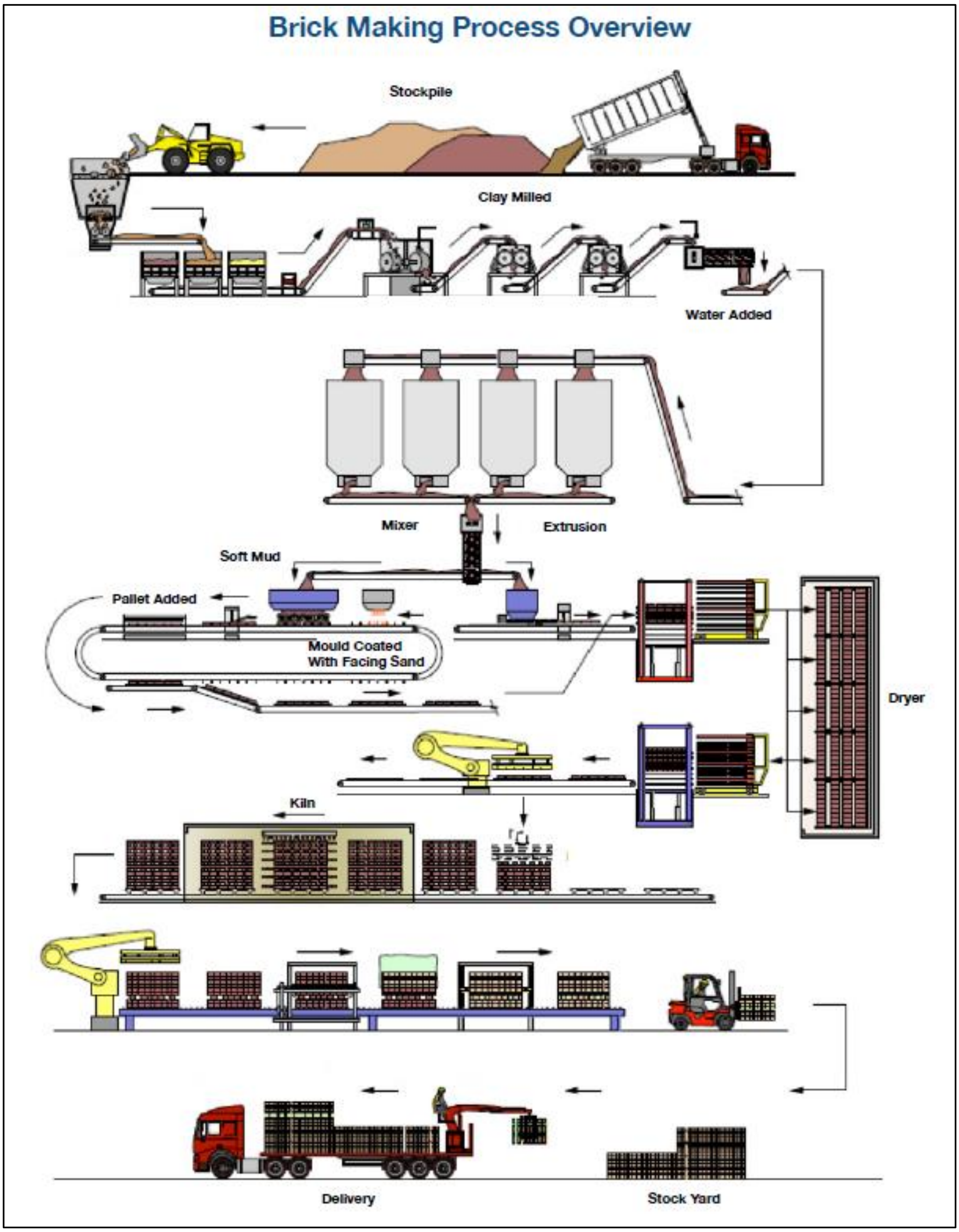
As mentioned previously there are four main manufacturing processes by which bricks are produced in the UK, although extrusion and soft mud moulding are the most dominant. The majority of UK clay types can be used, although the harder less clay rich shales and marls lend themselves more to extrusion with the more clay rich clays used in the soft mud process.

The extrusion process typically produces bricks with perforations within the body of the brick, ranging from highly perforated units through to the more traditional 3 and 10 holes. The perforations aid in the formation process of the bricks allowing the clay to be compressed in the extrusion die, however the main benefits come from the drying and firing process, where the additional voids within the bricks, not only reduce the amount of raw material in the brick, but also increases the surface area thus allowing from more efficient drying and firing.

The extrusion process is also often described as wire cut, as the column of clay is pushed out of the extrusion head the bricks are formed by a wire cutter normally cutting a number of bricks in the column. These bricks are then dried prior to entering the kiln for vitrifying which normally takes place at around 1000°C.
Soft mud bricks are typically 'solid' or 'frogged' in appearance. The 'frog' is the name given to the indentation typically on the upper bedface of the brick, and again reduces the amount of raw material in the brick, and increases the surface area, thus again aiding drying and firing. The frog also aids the structural performance when laid with mortar. Soft mud bricks or 'stock' bricks have higher water absorbency prior to being dried. The characteristic sanded face is part of the requirement to allow the green brick to be released from the mould. After firing and cooling, bricks are sorted, packaged, and then stored in the stockyard or distributed.

Process flow diagram

Typical process flow for the manufacture of moulded clay bricks, provided by the BDA can be seen below.



Construction Installation

Bricks are generally hand by laid, on-site, with a cementitious or lime based mortar to bond the individual units together.

Use Information

The service life of the BDA average UK brick is given as minimum of 150 years for a half brick thick cavity wall. For a full brick construction the minimum life expectancy is 600 years. These figures are derived from a 2007 research thesis by the Engineering and Physical Sciences Research Council. No maintenance of brickwork is expected for a minimum of 60 years. The most common maintenance required at this stage is the repointing of mortar.

End of Life

At the end of life there are a number of common scenarios for brickwork. Firstly brickwork can be dismantled, with the individual units being separated, clean and reused. Secondly the brickwork can be demolished, broken down to a smaller aggregate size and used for a variety of purposes, such as foundation construction.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description

The declared unit is 1 tonne of BDA average UK brick over a 60 year study period.

System boundary

In accordance with the modular approach as defined in EN 15804:2012, this cradle-to-gate with all options plus module D EPD, includes the processes covered in the manufacturing, construction, use and end-of-life stages, as well as considering a benefits and loads beyond the system boundary scenario. The modules covered are A1-A3, A4, A5, B1 – B7, C1 – C4 and D.

Data sources, quality and allocation

Specific primary data derived from total site data provided by BDA members, covering 46 manufacturing sites in the UK, has been modelled. In accordance with the requirements of EN 15804, the most current available data at the time of collection, has been used, covering the period of 1st January 2017 to 31st December 2017. Secondary data has been used for upstream and downstream processes that are beyond the control of the manufacturer such as raw material production. SimaPro v8 software was used to carry out the LCA modelling with background LCI datasets taken from the ecoinvent v3.2 database.

As total values used to create the stated production output were supplied, no allocation was required. For transport of fuels and of packaging materials to site, a nominal value of 50 km by road was assumed.

Cut-off criteria

Full data collected by the BDA as supplied by BDA members for 46 UK manufacturing sites was used. The inventory process in this LCA includes all data related to raw material, packaging material, and their associated transport to the manufacturing site. Process energy and water use, direct production waste, non-production waste, wastewater to sewer, and emissions to air generated by the firing of the green bricks, are included.

LCA Results

The results for the declared unit of 1 tonne of BDA average UK brick can be found below. As the average brick is assumed by the BDA to have a mass of 2.13 kg, results can be calculated per average brick by dividing individual values in results tables by a factor of (1000 / 2.13).

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			GWP	ODP	AP	EP	POCP	ADPE	ADPF
			kg CO_2 equiv.	kg CFC 11 equiv.	kg SO_2 equiv.	kg $(PO_4)^{3-}$ equiv.	kg C_2H_4 equiv.	kg Sb equiv.	MJ, net calorific value.
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	213	1.85e-5	3.49	0.107	0.177	1.24e-4	2370
Construction process stage	Transport	A4	8.026	1.48E-06	0.027	7.08E-03	4.68E-03	2.11E-05	121.2
	Construction	A5	11.466	1.08E-06	0.177	6.07E-03	9.31E-03	8.41E-06	130.9
Use stage	Use	B1	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Replacement	B4	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Refurbishment	B5	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Operational energy use	B6	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Operational water use	B7	MNR	MNR	MNR	MNR	MNR	MNR	MNR
End of life	Deconstruction, demolition	C1	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Transport	C2	0.251	4.62e-8	8.39e-4	2.21e-4	1.46e-4	6.61e-7	3.79
	Waste processing	C3	3.20	5.88e-7	0.0245	0.00610	0.00421	1.10e-6	46.2
	Disposal	C4	1.03	2.73e-7	0.00724	0.00239	0.00120	1.47e-6	25.4
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-16.0	-1.83e-6	-0.0978	-0.0283	-0.0121	-7.70e-5	-229

GWP = Global Warming Potential;
ODP = Ozone Depletion Potential;
AP = Acidification Potential for Soil and Water;
EP = Eutrophication Potential;
POCP = Formation potential of tropospheric Ozone;
ADPE = Abiotic Depletion Potential – Elements;
ADPF = Abiotic Depletion Potential – Fossil Fuels;

LCA Results (continued)

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	120	1.85e-4	120	2430	0	2430
Construction process stage	Transport	A4	1.61	5.99E-06	1.61	120	0.00E+00	120
	Construction	A5	6.16	9.90E-06	6.16	134	0.00E+00	134
Use stage	Use	B1	MNR	MNR	MNR	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR	MNR	MNR	MNR
	Replacement	B4	MNR	MNR	MNR	MNR	MNR	MNR
	Refurbishment	B5	MNR	MNR	MNR	MNR	MNR	MNR
	Operational energy use	B6	MNR	MNR	MNR	MNR	MNR	MNR
	Operational water use	B7	MNR	MNR	MNR	MNR	MNR	MNR
End of life	Deconstruction, demolition	C1	MNR	MNR	MNR	MNR	MNR	MNR
	Transport	C2	0.0503	1.87e-7	0.0503	3.76	0	3.76
	Waste processing	C3	0.274	6.37e-7	0.274	45.5	0	45.5
	Disposal	C4	0.776	2.12e-6	0.776	25.6	0	25.6
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-12.6	-3.68e-5	-12.6	-241	0	-241

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

Parameters describing resource use, secondary materials and fuels, use of water			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	0	0	0	0.861
Construction process stage	Transport	A4	0	0	0	0.026
	Construction	A5	0	0	0	0.046
Use stage	Use	B1	MNR	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR	MNR
	Replacement	B4	MNR	MNR	MNR	MNR
	Refurbishment	B5	MNR	MNR	MNR	MNR
	Operational energy use	B6	MNR	MNR	MNR	MNR
	Operational water use	B7	MNR	MNR	MNR	MNR
End of life	Deconstruction, demolition	C1	MNR	MNR	MNR	MNR
	Transport	C2	0	0	0	8.21e-4
	Waste processing	C3	0	0	0	0.00797
	Disposal	C4	0	0	0	0.0286
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	-0.373

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG
	Total (of product stage)	A1-3	1.39	5.41	0.00697
Construction process stage	Transport	A4	0.051	5.65	8.36E-04
	Construction	A5	0.075	0.86	4.36E-04
Use stage	Use	B1	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR
	Replacement	B4	MNR	MNR	MNR
	Refurbishment	B5	MNR	MNR	MNR
	Operational energy use	B6	MNR	MNR	MNR
	Operational water use	B7	MNR	MNR	MNR
End of life	Deconstruction, demolition	C1	MNR	MNR	MNR
	Transport	C2	0.00159	0.177	2.61e-5
	Waste processing	C3	0.0292	0.0235	3.32e-4
	Disposal	C4	0.0191	100	1.57e-4
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.218	-5.36	-0.00114

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	33.6	0	0	0
Construction process stage	Transport	A4	0	0	0	0
	Construction	A5	51.7	0	0	0
Use stage	Use	B1	MNR	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR	MNR
	Replacement	B4	MNR	MNR	MNR	MNR
	Refurbishment	B5	MNR	MNR	MNR	MNR
	Operational energy use	B6	MNR	MNR	MNR	MNR
	Operational water use	B7	MNR	MNR	MNR	MNR
End of life	Deconstruction, demolition	C1	MNR	MNR	MNR	MNR
	Transport	C2	0	0	0	0
	Waste processing	C3	0	0	0	0
	Disposal	C4	900	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

The beyond-the-gate scenarios modelled and relevant quantities, are described in the table below. Note that unless otherwise stated, values are per declared unit (i.e. per tonne) of BDA average UK brick.

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	As brick delivery could be to almost anywhere, an distance of 100 km was assumed to allow simple extrapolation of results to further distances, if necessary. Fuel consumption is as specified in the ecoinvent v3.2 dataset used (Transport, freight, lorry 16-32 metric ton, EURO5 {GLO}| market for | Alloc Def, U). Capacity utilisation is 50% as measured by BDA (100% full).		
	Lorry - diesel	Fuel consumption (g/tkm)	2.5
	Distance	km	100
	Capacity utilisation (incl. empty returns)	%	50
	Bulk density of transported products	kg/m^3	1485
A5 – Installation in the building	Wastage percentages are based on GreenGuide element 806470537 that element. Uplifts of the equivalent percentage have been applied to A1-A3 and A4, and added to module A5, accordingly.		
	Installation wastage to reuse: brick	%	5
B1 – Use	Bricks do not emit any emissions to air during their use, so this module is not relevant (MNR).		
B2 – Maintenance	Bricks once installed require no maintenance themselves, so this module is not relevant (MNR).		
B3 – Repair	It is assumed that the brick should not need any repair during its service life or the study period, so this module is not relevant (MNR).		
B4 – Replacement	The service life of the brick is at least as long as the 60-year study period and likely life of the building so no replacements are expected. Therefore, this module is not relevant (MNR).		
B5 – Refurbishment	It has been assumed that no refurbishment action that relates to the brick will be required during the 60-year study period, so this module is not relevant (MNR)		
Reference service life	The BDA gives a service life of 150 years for the brick		
B6 – Use of energy	No energy is required for the brick to 'operate' during its use. Therefore, this module is not relevant (MNR).		
B7 – Use of water	No water is required for the brick to 'operate' during its use. Therefore, this module is not relevant (MNR).		
C1 – End-of-life deconstruction	It is assumed that as when the brick is removed from its structure, this is part of demolition of the whole structure. Therefore, impacts must be allocated to the whole structure and it is assumed that those allocated to the brick alone are negligible, and can be assumed to be zero.		
C2 – End-of-life transport	As will be described in module C3 and C4, 10% of the declared unit is assumed to go to landfill whilst the remaining 90% exits the system boundary to be reused on site. It is assumed that the landfill site is local and 15 km away from the construction site. As per module A4, fuel consumption and capacity utilisation are as specified in the ecoinvent v3.2 dataset used (Transport, freight, lorry 16-32 metric ton, EURO5 {GLO}| market for | Alloc Def, U)		
	Lorry - diesel	Fuel consumption (g/tkm)	2.5
	Distance	km	15

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
	Capacity utilisation (incl. empty returns)	%	24
	Bulk density of transported products	kg/m^3	1485
C3 End-of-life pre-processing	As described in module C4 (below), it is assumed that 100% of the brick rubble is crushed. The diesel consumption value was provided and derived by the BDA based on data from members' crushing operations.		
	Diesel consumption for crushing	litres	0.88
C4 End-of-life disposal	This scenario is based on a 90% reuse / 10% landfill split of construction waste, as evidenced in the UK Government statistics on waste (see references). The scenario supplied by the BDA and modelled in this project, assumes that once the wall containing the brick has been knocked down, 100% of it is crushed onsite. 90% of the resulting crushed brick is then usable to go on and leave the system boundary as recycled aggregate onsite, and the remaining 10% is not suitable for reuse, meaning that it goes to landfill		
	Crushed brick leaving system as recycled aggregate: Crushed brick going to landfill:	kg kg	900 100
Module D	After demolition clay brick is crushed on site and used as a replacement of virgin aggregate in onsite roadwork or used as a replacement for normal weight coarse aggregate in the manufacture of concrete blockwork.1 ton of crushed clay brick results in a (net) production of 900 kg of recycled secondary aggregate with 100 kg to landfill from crushing. This recycled secondary aggregate can in turn replace 900 kg of virgin aggregate. The ecoinvent v3.2 dataset used to represent avoided impacts of virgin aggregate was: Gravel, crushed {GLO}| market for | Alloc Def, U		

Interpretation

Figure 1 shows that for the production stage (modules A1 to A3), the majority of the total GWP value arises from onsite energy usage, which includes the use of natural gas, electricity, coal and coke, diesel and LPG fuels. The second highest contributor is from the emissions released from the clay raw materials on firing. The other input processes have relatively low contributions to the total GWP value by comparison.

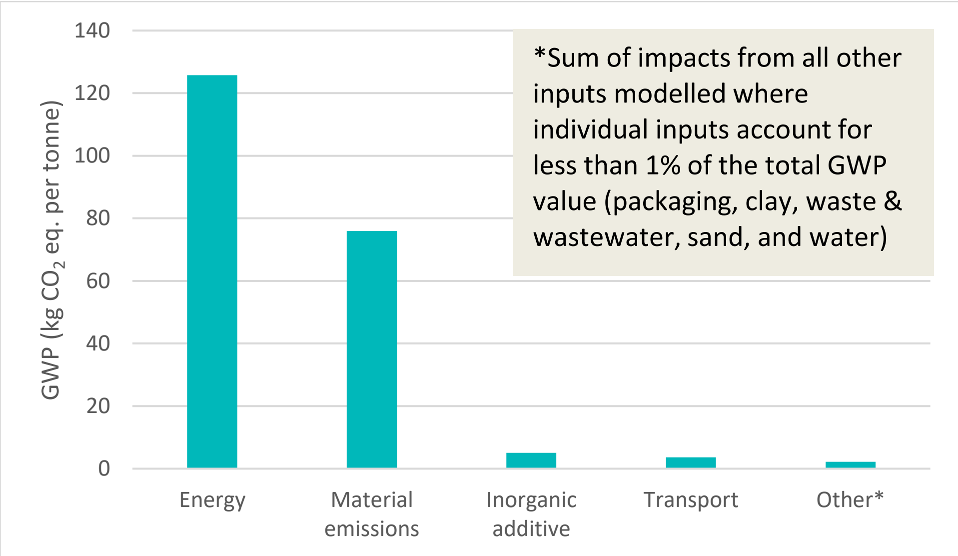


Figure 1: GWP per tonne values by contributing input process

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