B-EPD ENVIRONMENTAL PRODUCT DECLARATION

Belgian Brick Association
Ceramic roof tiles

1 ton of ceramic roof tiles

Issued 23.02.2022
Valid until 23.02.2027

Third party verified
Conform to EN 15804+A2, NBN/DTD B08-001 and ISO 14025

Modules declared Cradle-to-grave + module D					
A123	A4	A5	B	C	D
•	•	•	•	•	•

[B-EPD n° 22_012_003]
V. 00.01

OWNER OF THIS ENVIRONMENTAL PRODUCT DECLARATION
Belgian Brick Association
EPD PROGRAM OPERATOR

Federal Public Service of Health, Food Chain Safety and Environment
www.b-epd.be

The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on www.b-epd.be. The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

PRODUCT DESCRIPTION

PRODUCT NAME
Belgian ceramic roof tiles

PRODUCT DESCRIPTION
Belgian ceramic roof tiles. Members of the Belgian Brick Association produce huge varieties of colors, textures and formats for different applications. The ceramic roof tiles are produced by extrusion of a plastic clay mixture followed by a drying and firing process.

This is a sector EPD from the Belgian Brick Association covering the whole range of the Belgian production of ceramic roof tiles. The results are based on the specific data of a representative production site. A variability study has been performed to prove the representativeness of this production site for all the members of the Belgian Brick Association mentioned in this EPD.

INTENDED USE
The ceramic roof tiles are used for roof covering and external wall covering.

DECLARED UNIT
The declared unit used in this EPD is 1 ton of ceramic roof tiles.
Packaging is included.
The area density of the product is 0,03 - 0,07 ton / m^2 depending on the application and the installation scenario.

INSTALLATION
Materials for fixation and installation are not included as this EPD refers to ceramic roof tiles for which different installation systems exist. Regarding installation this EPD only includes the environmental impact related to the product itself: material losses and packaging EOL. During the construction stage, other materials such as clips will be needed. The impact of these additional products and materials is not included in this EPD and shall be taken into account at building level. More detailed information on these installation scenarios can be found in the chapter “Additional technical information for scenario development at building”.

IMAGES OF THE PRODUCT

COMPOSITION AND CONTENT

Components	Raw materials[1]
Product	*- Clay* *- Sand* *- Other minerals* *- Additives*
Fixation materials	*Not included*
Jointing materials	*Not included*
Treatments	*Not included*

[1] *Due to confidentiality not possible to declare quantity*

Packaging	- *Wooden pallet* - *Plastic foil* - *Cardboard* - *Glue* - *Elastics*

The product does not contain materials listed in the “Candidate list of Substances of Very High Concern for authorization”.

REFERENCE SERVICE LIFE

The reference service life is estimated at 150 years.

The RSL of the ceramic roof tiles is estimated at 150 years. This value has been defined on the basis of the ASRO third-party report (2008), which showed that a service life of 150 years for dwellings in Belgium is not an unrealistic figure. The ASRO report was based on NIS data and Land Registry data. No distinction was made in the method of construction or type of dwelling.

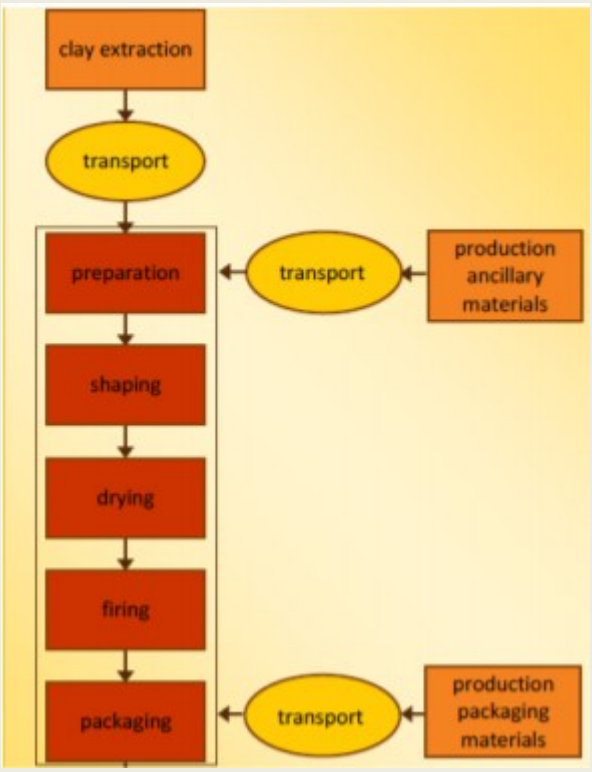
The conditions under which this RSL is valid are as following: natural aging conditions

DESCRIPTION OF GEOGRAPHICAL REPRESENTATIVITY

The EPD is representative for the Belgian market.
The composed datasets for this life cycle assessment are representative and relevant for ceramic roof tiles produced in Belgium. The data describing the direct inputs and outputs of the foreground processes are representative for the members of the Belgian Brick Association.

DESCRIPTION OF THE PRODUCTION PROCESS AND TECHNOLOGY

The production process starts with the preparation of clay mix(es). Afterwards these mixes are shaped, dried and fired. Lastly the roof tiles are packed for transport to the installation site.



TECHNICAL DATA / PHYSICAL CHARACTERISTICS

Here below a limitative list is included of the most relevant technical properties according to European standards.

Technical property	Standard	Value	Unit	Comment
Breaking load: plain tiles	EN538	>600	N	
Breaking load: tiles with closure	EN538	>1200	N	
Water impermeability	EN539-1	≤ 0,5	$cm^3/cm^2.d$	
Frost resistance	EN539-2	Frost resistant	/	

LCA STUDY

DATE OF LCA STUDY
February 2022

SOFTWARE
For the calculation of the LCA results, the software program SimaPro 9.2.0.1 (PRé Consultants, 2021) has been used.

INFORMATION ON ALLOCATION
At the representative site, only roof tiles are produced. There was thus no need to allocate the facility level data (electricity, natural gas, etc.).

INFORMATION ON CUT OFF
The following processes are considered below cut-off:

- Environmental impacts caused by the personnel of the production plants are not included in the LCA, e.g. waste from the cafeteria and sanitary installations, accidental pollution caused by human mistakes, or environmental effects caused by commuter traffic.

The total of neglected input flows is less than 5% of energy usage and mass as prescribed by EN15804+A2.

INFORMATION ON EXCLUDED PROCESSES
Only the processes considered below cut-off are excluded from the study. No additional processes are excluded.

INFORMATION ON BIOGENIC CARBON MODELLING
The packaging of the final product contains biogenic carbon in the form of wooden pallets and cardboard. This biogenic carbon is taken up in module A3 and released in module A5.

	Biogenic carbon content (kg C / FU)
Biogenic carbon content in product (at the gate)	0
Biogenic carbon content in packaging (at the gate)	1,35E+00

INFORMATION ON CARBON OFFSETTING
Carbon offsetting is not allowed in the EN 15804 and hence not taken into account in the calculations.

ADDITIONAL OR DEVIATING CHARACTERISATION FACTORS
The characterization factors from EC-JRC were applied. No additional or deviating characterisation factors were used. }

DESCRIPTION OF THE VARIABILITY
For a sector EPD it is necessary to analyze the variability between the representative site providing specific data for this EPD and the other members of the federation covered by the EPD.
A detailed variability study was done as described in paragraph 6.3.6 in NBN/DTD B 08-001:2017 (B-PCR). The variability for the three main environmental impact indicators, including 'Climate change' has been analyzed.
The background report provides a detailed analysis of the variability and shows that the variability between the different members and production sites is acceptable. Therefore, the selected site is found representative for the Belgian ceramic roof tiles sector.

DATA

SPECIFICITY

The data used for the LCA are specific for this product which is manufactured by multiple manufacturers in multiple production sites.

PERIOD OF DATA COLLECTION

Manufacturer specific data have been collected for the year 2019.

INFORMATION ON DATA COLLECTION

The data for the production stage of this collective EPD is based on specific data from one representative production site. The representativeness has been analyzed in a variability study described in the background report. The data have been collected by the Belgian Brick Association and were provided to VITO. The LCI data for the production stage have been checked by the EPD verifier (Vinçotte). VITO uses publicly available generic data for all background processes such as the production of electricity, transportation by means of a specific truck…

DATABASE USED FOR BACKGROUND DATA

The LCI sources used in this study are the Ecoinvent v3.6 database (Wernet et al., 2016). For some components, the datarecord has been adjusted based on the LCI in Ecoinvent 3.8.

ELECTRICITY MIX

The Belgian electricity mix (consumption mix + import) has been used to model electricity use in life cycle stages A3, A5, C4 and D. The used record is the Ecoinvent record 'Electricity, low voltage {BE}| market for | Cut-off, U' (Wernet et al., 2016). For the own produced solar energy the datarecord 'Electricity, low voltage {BE}| electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted | Cut-off, U' is used.

PRODUCTION SITES

Wienerberger - division Aalbeke, 8511 Aalbeke
Wienerberger - division Mouscron, 7700 Mouscron

SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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 = included in the EPD
MND = module not declared

95% of the product is recycled at its end-of-life. The end-of-waste state is reached after crushing of the demolished roof tiles.

POTENTIAL ENVIRONMENTAL IMPACTS PER REFERENCE FLOW

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
GWP total (kg CO2 equiv/DU)	2,83E+01	3,24E+01	3,45E+02	1,58E+01	2,87E+01	0,00E+00	6,53E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,42E+00	1,55E+00	2,80E-01	-3,99E+00	5,22E+02
GWP fossil (kg CO2 equiv/DU)	3,04E+01	3,23E+01	3,45E+02	1,58E+01	2,52E+01	0,00E+00	6,52E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,42E+00	1,54E+00	2,80E-01	-3,99E+00	5,21E+02
GWP biogenic (kg CO2 equiv/DU)	-2,15E+00	1,39E-02	-9,25E-01	6,48E-03	3,47E+00	0,00E+00	6,11E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,21E-03	5,59E-03	3,68E-04	7,70E-03	4,89E-01
GWP luluc (kg CO2 equiv/DU)	3,69E-02	1,39E-02	9,80E-02	5,25E-03	7,99E-03	0,00E+00	2,38E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,89E-03	2,77E-03	1,52E-04	-4,94E-03	1,91E-01
ODP (kg CFC 11 equiv/DU)	4,66E-06	7,26E-06	4,95E-05	3,62E-06	3,36E-06	0,00E+00	1,00E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,23E-06	2,84E-07	1,18E-07	-3,70E-07	8,01E-05
AP (mol H^+ equiv/DU)	3,12E-01	1,42E-01	1,02E+00	6,50E-02	7,95E-02	0,00E+00	2,35E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,21E-02	7,68E-03	2,41E-03	-3,78E-02	1,88E+00
EP - freshwater (kg P-equiv/DU)	2,34E-03	2,63E-04	1,42E-03	1,23E-04	2,14E-04	0,00E+00	6,37E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,25E-05	5,64E-05	2,95E-06	-1,69E-04	5,10E-03
EP - marine (kg N-equiv/DU)	4,93E-02	4,44E-02	1,20E-01	1,94E-02	1,26E-02	0,00E+00	3,65E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,57E-03	2,33E-03	8,95E-04	-9,95E-03	2,92E-01
EP - terrestrial (mol N-equiv/DU)	5,99E-01	4,90E-01	1,41E+00	2,14E-01	1,46E-01	0,00E+00	4,24E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,26E-02	2,65E-02	9,88E-03	-1,31E-01	3,39E+00
POCP (kg Ethene equiv/DU)	1,70E-01	1,46E-01	4,62E-01	6,67E-02	4,53E-02	0,00E+00	1,32E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,22E-02	7,21E-03	2,81E-03	-3,59E-02	1,05E+00

ADP Elements (kg Sb equiv/DU)	1,56E-03	6,11E-05	1,88E-04	2,72E-05	9,25E-05	0,00E+00	2,77E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,06E-05	2,67E-06	2,83E-07	-3,17E-05	2,21E-03
ADP fossil fuels (MJ/DU)	4,72E+02	4,84E+02	5,37E+03	2,40E+02	3,37E+02	0,00E+00	1,01E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,17E+01	4,57E+01	8,99E+00	-7,85E+01	8,04E+03
WDP (m^3 water eq deprived /DU)	2,10E+01	1,37E+00	2,59E+01	7,11E-01	2,51E+00	0,00E+00	7,45E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,27E-01	4,05E-01	3,88E-02	-3,62E+00	5,96E+01

GWP total = total Global Warming Potential (Climate Change); GWP-luluc = Global Warming Potential (Climate Change) land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

RESOURCE USE

	Production			Construction process		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
PERE (MJ/DU, net calorific value)	3,80E+01	6,96E+00	2,34E+02	3,23E+00	2,70E+01	0,00E+00	5,33E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,13E+00	4,76E+00	3,02E-01	-8,80E+01	3,68E+02
PERM (MJ/DU, net calorific value)	2,54E+01	0,00E+00	4,22E+01	0,00E+00	-9,15E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,84E+01
PERT (MJ/DU, net calorific value)	6,33E+01	6,96E+00	2,76E+02	3,23E+00	1,78E+01	0,00E+00	5,33E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,13E+00	4,76E+00	3,02E-01	-8,80E+01	4,27E+02
PENRE (MJ/DU, net calorific value)	4,64E+02	4,88E+02	5,80E+03	2,42E+02	4,16E+02	0,00E+00	1,10E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,22E+01	4,88E+01	9,03E+00	-8,37E+01	8,65E+03
PENRM (MJ/DU, net calorific value)	9,21E+01	0,00E+00	8,72E+01	0,00E+00	-4,82E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,31E+02
PENRT (MJ/DU, net calorific value)	5,56E+02	4,88E+02	5,89E+03	2,42E+02	3,67E+02	0,00E+00	1,10E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,22E+01	4,88E+01	9,03E+00	-8,37E+01	8,78E+03
SM (kg/DU)	1,12E-01	0,00E+00	0,00E+00	0,00E+00	5,60E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+03	1,18E-01
RSF (MJ/DU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

NRSF (MJ/DU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/DU)	1,11E+00	4,97E-02	7,32E-01	2,46E-02	9,90E-02	0,00E+00	2,92E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,09E-03	1,53E-02	8,74E-03	-3,86E-01	2,34E+00

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 = Net use of fresh water

WASTE CATEGORIES & OUTPUT FLOWS

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
Hazardous waste disposed (kg/DU)	1,61E-03	1,27E-03	7,31E-03	6,14E-04	5,64E-04	0,00E+00	1,66E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,14E-04	4,46E-05	9,89E-06	-2,32E-04	1,33E-02
Non-hazardous waste disposed (kg/DU)	9,78E+00	2,21E+01	9,18E+00	1,47E+01	5,93E+00	0,00E+00	1,65E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,91E+00	9,64E-02	5,00E+01	-9,71E-01	1,32E+02
Radioactive waste disposed (kg/DU)	2,20E-03	3,29E-03	1,47E-02	1,64E-03	1,15E-03	0,00E+00	3,42E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,57E-04	4,10E-04	6,64E-05	-2,56E-04	2,74E-02
Components for re-use (kg/DU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/DU)	0,00E+00	0,00E+00	9,85E-01	0,00E+00	5,04E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,50E+02	0,00E+00	-1,00E+03	1,00E+03
Materials for energy recovery (kg/DU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy (MJ/DU)	0,00E+00	0,00E+00	2,37E+00	0,00E+00	2,10E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,34E+01	2,34E+01

POTENTIAL ADDITIONAL ENVIRONMENTAL IMPACT CATEGORIES

		Production			Construction process		Use stage							End-of-life stage					
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
	PM (disease incidence)	2,83E-06	2,16E-06	1,03E-05	1,20E-06	8,66E-07	0,00E+00	2,56E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,77E-07	1,16E-07	5,04E-08	-6,76E-07	2,05E-05
	IRHH (kg U235 eq/DU)	2,10E+00	2,12E+00	1,56E+01	1,05E+00	1,09E+00	0,00E+00	3,26E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,57E-01	4,64E-01	5,17E-02	-3,07E-01	2,60E+01
	ETF (CTUe/DU)	9,41E+03	3,88E+02	1,02E+03	1,92E+02	5,58E+02	0,00E+00	1,67E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,54E+01	2,29E+01	4,82E+00	-9,47E+01	1,33E+04
	HTCE (CTUh/DU)	9,44E-08	1,12E-08	2,89E-08	5,20E-09	7,94E-09	0,00E+00	2,15E-08	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,84E-09	8,66E-10	1,16E-10	-7,73E-09	1,72E-07
	HTnCE (CTUh/DU)	9,14E-06	4,16E-07	6,43E-07	2,13E-07	5,32E-07	0,00E+00	1,58E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,13E-08	1,88E-08	2,80E-09	-1,18E-07	1,26E-05
	Land Use Related impacts (dimensionless)	4,02E+02	3,34E+02	1,21E+03	2,03E+02	1,13E+02	0,00E+00	3,37E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,63E+01	2,53E+01	1,65E+01	-6,56E+02	2,70E+03

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit)
PM = Particulate Matter (Potential incidence of disease due to PM emissions);
IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

	*Global Warming Potential*	*The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.* *It is split up in 4:* - *Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc* - *Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).* - *Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.[2]* - *Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).*
	*Ozone Depletion*	*Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbonsor halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.*
	*Acidification potential*	*Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.*
	*Eutrophication potential*	*The potential to cause over-fertilization of water and soil, which can result in increased growth of biomass and following adverse effects.* *It is split up in 3:* - *Eutrophication potential – freshwater: The potential to cause over-fertilization of freshwater, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – marine: The potential to cause over-fertilization of marine water, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – terrestrial: The potential to cause over-fertilization of soil, which can result in increased growth of biomass and following adverse effects.*
	*Photochemical ozone creation*	*Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.*
	*Abiotic depletion potential for non-fossil ressources*	*Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimonium (Sb).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Abiotic depletion potential for fossil ressources*	*Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ecotoxicity for aquatic fresh water*	*The impacts of chemical substances on ecosystems (freshwater).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Human toxicity (carcinogenic effects)*	*The impacts of chemical substances on human health via three parts of the environment: air, soil and water.*

[2] Carbon exchanges from native forests shall be modelled under GWP - luluc (including connected soil emissions, derived products or residues), while their CO2 uptake is excluded.

		The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.
	*Human toxicity (non-carcinogenic effects)*	*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Particulate matter*	*Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)*
	*Resource depletion (water)*	*Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ionizing radiation - human health effects*	*This impact category deals mainly with the eventual impact on human health of low dose ionizing radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*
	*Land use related impacts*	*The indicator is the "soil quality index" which is the result of an aggregation of following four aspects:* - *Biotic production* - *Erosion resistance* - *Mechanical filtration* - *Groundwater* *The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

A1 – RAW MATERIAL SUPPLY

This module takes into account the extraction and processing of all raw materials which occur upstream to the studied manufacturing process.

A2 – TRANSPORT TO THE MANUFACTURER

The raw materials are transported to the manufacturing site.

A3 – MANUFACTURING

This module takes into account the production process.

A4 – TRANSPORT TO THE BUILDING SITE

Fuel type and consumption of vehicle or vehicle type used for transport	Truck 16-32 ton (EURO 5)	Truck >32 ton (EURO 5)	Truck 7.5-16 ton (EURO 5)	Truck 3.5-7.5 ton (EURO 5)
Distance	100 (40% from factory to construction site) 35 (60%*85% from supplier to construction site)	100 (60% from factory to supplier)	35 (60%*15% from supplier to construction site)	9 (PE-RT tubes are directly transported from the supplier to the construction site)
Capacity utilisation (including empty returns)	50%	50%	50%	50%
Bulk density of transported products	Ecoinvent	Ecoinvent	Ecoinvent	Ecoinvent
Volume capacity utilisation factor	Ecoinvent	Ecoinvent	Ecoinvent	Ecoinvent

The B-PCR provides default transport scenarios for the transport to the building site for cases where specific data on transport are missing. The B-PCR provides scenario's for this life cycle stage. Bricks are categorized as 'loose products' in table 5 of the B-PCR. The following transport steps apply:

- 40% directly to the construction site over 100 km with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')
- 60% to a supplier over 100 km with a 16 -32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')
- 85% of these 60% is transported over 35 km from supplier to construction site with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')
- 15% of these 60% is transported over 35 km from supplier to construction site with a 7.5-16 ton lorry (ecoinvent record: 'Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, U')

A5 – INSTALLATION IN THE BUILDING

At the construction site, packaging materials are released. Also 5% material losses have been taken into account

Parts of the installation	Description
Processes necessary for the installation of the product	/
Fixation materials	/
Jointing materials	/
Treatments	/
Material losses	*5%*
Packaging	*Wooden pallet* *Plastic foil* *Cardboard* *Glue* *Elastics*

Ancillary materials for installation (specified by material);	NA			
Water use	NA			
Other resource use	5% losses			
Quantitative description of energy type (regional mix) and consumption during the installation process	NA			
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	packaging waste: wood	packaging waste: plastic	packaging waste: cardboard	packaging waste: glue elastics
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	40% recycling 40% incinerated 20% reuse	35% recycling 60% incinerated 5% landfill	95% recycling 5% incinerated	100% incineration
Direct emissions to ambient air, soil and water	NA			
Distance	NA			

B – USE STAGE (EXCLUDING POTENTIAL SAVINGS)

B1: No emissions during the use phase
B2: Every 15 years 5% of the roof tiles are replaced.
B3: No repair is required
B4: No replacement required
B5: No refurbishment
B6: No operational energy use
B7: No operational water use

C: End of life

The default scenario for bricks from NBN/DTD B08-001 is used to model the End-of-life.
C1: It is assumed that no impacts are related to the demolition of the product.[3]
C2: 95% is transported to a sorting facility over a distance of 30 km. 5% is transported to a sorting facility over a distance of 30 km and afterwards transported to landfill over a distance of 50 km.
C3: 95% is recycled
C4: 5% is landfilled

Module C2 – Transport to waste processing					
Type of vehicle (truck/boat/etc.)	Fuel consumption (litres/km)	Distance (km)	Capacity utilisation (%)	Density of products (kg/m³)	Assumptions
Truck 16-32 ton	0,256 l diesel/km	30	50%	Ecoinvent scenario	Ecoinvent scenario
Truck 16-32 ton	0,256 l diesel/km	50	50%	Ecoinvent scenario	Ecoinvent scenario
Truck 16-32 ton	0,256 l diesel/km	100	50%	Ecoinvent scenario	Ecoinvent scenario

End-of-life modules – C3 and C4		
Parameter	Unit	Value
Wastes collected separately	kg	0
Wastes collected as mixed construction waste	kg	1000
Waste for re-use	kg	0
Waste for recycling	kg	950
Waste for energy recovery	kg	0
Waste for final disposal	kg	50

D – Benefits and loads beyond the system boundaries

In module D, following waste streams are considered after their end-of-waste: bricks waste in C3 (95% recycled), paper waste in A3 (95% recycled), hazardous waste in A3 (25% recycled), metal waste in A3 (95% recycled), plastic waste in A3 and A5 (35% recycled), wooden waste in A3 and A5 (60% recycled/reused). Module D contains the energy recovery (or avoided production of energy) due to the incineration process of the packaging materials disposed during the production and the installation stage: paper waste in A3 (5% incinerated), hazardous waste in A3 (75% incinerated), plastic waste in A3 and A5 (60% incinerated), wooden waste in A3 and A5 (40% incinerated).

There are no loads beyond the system boundaries.

Quantitative description of the loads beyond the system boundaries	Treatment of scrap steel to prepare it for to prepare it for recycling at the remelter
	Sorting and shredding of waste wood to prepare it for recycling
	Treatment of plastic to prepare it for recycling
Quantitative description of the benefits beyond the system boundaries	Avoided production cast iron
	Avoided production of sawnwood softwood
	Avoided production of PE granulates
	Avoided production of sulfate pulp
	Avoided production of inorganic chemicals
	Avoided production of crushed gravel
	Avoided production of heat using natural gas
	Avoided production of Belgian electricity mix

[3] Life cycle inventories of waste treatment services: Part V "Building material disposal", page 36, table 3.20

ADDITIONAL INFORMATION ON RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

INDOOR AIR

Not applicable

SOIL AND WATER

Not applicable

DEMONSTRATION OF VERIFICATION

EN 15804+A2 serves as the core PCR
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒
Third party verifier: Ramses Sterckx (Vincotte) Jan Olieslagerslaan 35 1800 Vilvoorde, Belgium rsterckx@vincotte.be

ADDITIONAL TECHNICAL INFORMATION FOR SCENARIO DEVELOPMENT

Materials for fixation and installation are not included. Regarding installation this EPD only includes the environmental impact related to the product itself: material losses and packaging EOL. The impact of these additional products and materials for is not included in this EPD and shall be taken into account at building level. During the construction stage, other materials such as clips will be needed. The impact of these additional products and materials is not included in this EPD and shall be taken into account at building level.
The table below describe the amount of roof tiles in ton/m² for some common application scenario's and dimensions of the roof tiles. The amount of clips are not defined as these depend on various factors, such as the location and the height of the building and the roofpitch.

Application	Min roofpitch	Usefull length (mm)	Usefull width (mm)	Weight/piece	Pieces/m²	Ton/m²
Stormpan 44	22°	248 mm	195 mm	1,91 kg	20,7	0,0395
Stormpan 993	20°	248 mm	210 mm	2,02 kg	19,2	0,0388
Stormpan Vario 18	22°	235 – 260 mm	225 (+/- 2 mm)	2,32 kg	17,1 - 18,9	0,0418
Vlaamse pan 401	22°	300 mm	201 mm	2,56 kg	16,6	0,0423
Oude Pottelbergse pan 451	25°	277 mm	194 mm	2,30 kg	18,6	0,0428
Tegelpan 301	35°	110 mm	170 mm	1,02 kg	54	0,0551
Tegelpan 301	25°	90 mm	170 mm	1,02 kg	66	0,0673
Tegelpan Rustica	35°	110 mm	170 mm	1,07 kg	54	0,0578
Tegelpan Elfino	35°	140 mm	255 mm	2,18 kg	28	0,061
Tegelpan Elfino	25°	130 mm	255 mm	2,18 kg	30,2	0,0658
Tegelpan Plato	35°	145 mm	255 mm	2,3 kg	27	0,0621
Tegelpan Plato	25°	135 mm	255 mm	2,3 kg	29	0,0667

APPLICATION UNIT

Currently TOTEM can only use standard conversion factors based on generic data to convert 1 ton to 1 m². Therefore, it is not necessary to define a specific conversion factor to recalculate the results to 1 m². As a result the application unit that should be defined in the B-EPD database is 1 for the different applications described in the table below.

Application	Application unit
Roofs	*1*
Outer walls	*1*

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General information

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Contact programma operator	epd@environment.belgium.be
Based on following PCR documents	EN 15804+A2:2019 NBN/DTD B 08-001 and its complement
PCR review conducted by	Federal Public Service of Health and Environment & PCR Review committee
Author(s) of the LCA and EPD	Arthur De Jaegher, epd@vito.be, info@enperas.com
Identification of the project report	Life cycle assessment of ceramic roof tiles from the Belgian Brick Association (VITO, 2021)
Verification	External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents
Name of the third party verifier Date of verification	Ranses Sterckx (Vinçotte) 23.02.2022
www.b-epd.be	**www.environmentalproductdeclarations.eu**

Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.
The program operator cannot be held responsible for the information supplied by the owner of the EPD nor LCA practitioner.

LCA practitioner

Building calculator of the regiona authorities

www.totem-building.be

Federal Public Service of Health, Food Chain Safety and Environment

www.b-epd.be

Dieter De Lathauwer (Signature)

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