ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804*

Owner of the Declaration	**Argeton GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-WIN-20140143-ICA2-EN
Issue date	16.08.2019
Valid to	15.08.2024

Argeton
Ceramic facade elements
Argeton GmbH

Institut Bauen und Umwelt e.V.

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1. General Information

Argeton GmbH

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

Declaration number
EPD-WIN-20140143-ICA2-EN

This declaration is based on the product category rules:
Ceramic panelling, 07.2014
(PCR checked and approved by the SVR)

Issue date
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Valid to
15.08.2024

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Argeton

Owner of the declaration
Argeton GmbH
Oldenburger Allee 26
D-30659 Hannover

Declared product / declared unit
1 m² ceramic facade elements with strapping

Scope:
The EPD applies to ceramic facade elements of the Görlitz production facility (Am Dachziegelwerk 1, 02829 Schöpstal, Germany), which are carried by Wienerberger GmbH under the brand name of Argeton. The collected production data refers to 2013. The life cycle assessment based on plausible, transparently comprehensible base data represents the mentioned products at 100%.

The holder of the declaration is liable for the underlying information and evidence; a liability of IBU regarding manufacturer information, life cycle assessment data and evidence is excluded.

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 standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2010*
☐ internally ☒ externally

Patricia Wolf
(Independent verifier appointed by SVR)

2. Product

2.1 Product description/Product definition

Argeton clay brick facades consist of plane ceramic facade panels manufactured from different clay mixtures. Both single-leaf panels and panels with cavities are produced for ventilated facade linings. The facade panels are fit to a primary facade strapping by use of system-oriented aluminium structural systems. Argeton facade panels are available in different shipping sizes and dimensions with or without cavities, hence they differentiate in area density. The raw materials utilized according to recipe and the manufacturing process are identical. The declared area density makes up an annual average based on the production volume manufactured in 2013.

For the placing on the market the national regulations at the place of use apply, in Germany for instance the building regulations of the federal states, as well as the technical specifications based on these regulations.

2.2 Application

Argeton clay brick panels are used as lining material with ventilated facade linings, and with decorative linings for interior work. The facade panels are also used with ceilings, window reveals, window lintels, cover panels, or in the roof section.

2.3 Technical Data

The technical specifications of the product within the scope of the EPD are listed below.

Name	Value	Unit
Gross density	2000 - 2200	kg/m³
Bending strength	12-20	N/mm²
Water absorption /DIN 10545-3/	3-8	%

The sound absorption coefficient is not relevant to the ceramic facade panels case of application.

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision.

2.4 Delivery status

Argeton facade panel dimensions:

Diameter 24 mm (without cavities):
Heights 150-300 mm
Factory lengths up to 800 mm
Area density: approx. 31 kg/m²
Specific density: approx. 2.2 g/cm³

Diameter 24 mm (with cavities):
Heights 150-300 mm
Factory lengths up to 1200 mm
Area density: approx. 33 kg/m²
Bulk density: approx. 2.2 g/cm³

Diameter 30 mm (with cavities):
Heights 150-225 mm
Factory lengths up to 1200 mm
Area density: approx. 42 kg/m²
Bulk density: approx. 2.2 g/cm³

Diameter 30 mm (with cavities):
Heights 237.5-500 mm
Factory lengths up to 1500 mm
Area density: approx. 42 kg/m²
Bulk density: approx. 2.2 g/cm³

2.5 Base materials/Ancillary materials

The Argeton facade system consists of ceramic façade panels and a system-oriented aluminium strapping. The ceramic facade panels comprise 96% of clay (weathered products of feldspathic stones), 1.5% of chamotte (burnt and ground clays), 1% of feldspar, 1.5% of coloured pigments (metallic oxides for pigmentation of the raw material), and 0.2% of surface colour coating (engobes or glazes).
Clays and chamottes originate from the site of Görlitz and the regional facility surrounding. A quantity proportion of approx. 15% originates from Westerwald in Germany. Coloured pigments and surface coatings are additionally purchased from renowned manufacturers of those materials.

No /REACH/-relevant substances according to the candidate list dated 21 June 2013 are used in production.

2.6 Manufacture

Production of Argeton facade panels is made in nine steps:
Raw material extraction, preparation, shaping, dehydration, colouring, burning, cutting, quality control and packaging.
Clay is exploited in clay quarries near the factory. Transport into the factory is followed by the preparation process. It involves milling, mixing, moistening and scouring the clay from foreign particles like stones, and the admixture of construction aggregates. During the extrusion process the clay is pressed through a form(die) and roughly cut to length. During dehydration the soft clay is dehumidified. An engobe or glaze will be applied on the dried square bricks if required. Depending on the clay the square bricks are burnt in a roller kiln at a temperature of 1000°C to 1200°C. The burning process is followed by cutting to the exact length. The square bricks are examined visually and measured randomly in terms of their trueness of shape. Packaging is made semi-automatic with foil and additional packaging materials on pallets.
The quality management system meets the requirements of /ISO 9001/norm.

2.7 Environment and health during manufacturing

All maintenance investments and provisions for the Argeton factory are principally implemented with due regard to the safety and health requirements of employees. The Wienerberger Safety Initiative specifically implements consistent safety standards which led to a clear reduction of accident frequency in the past four years. The safety standards which apply for all Wienerberger factories include the foundation of committees on the topic of safety at work, as well as the definition of responsibilities and the introduction of extensive training.
In addition, a comprehensive inquiry on the subject fine quartz particles will regularly be made on the online platform NEPSI (*Negotiation Platform on Silica*). Data will be collected concerning the potential hazard of employees, health checks, training, the distribution and application of personal protective equipment, and technical arrangements. Noise immissions are constantly monitored regarding the adherence of legal limits, corresponding personal protective equipment will be provided.
The production is certified in compliance with EU environmental standards (/ISO 14001/ and /ISO 50001/) and the occupational health and safety assessment system (/OHSAS 18001/).
It is attempted to minimize the effects on environment and health during the whole production process.

2.8 Product processing/Installation

Installation involves the use of a system-oriented substructure. The installation instructions in the building inspectorate approval must be observed. Corresponding personal protective equipment must be worn as a protection against the influence of dusts containing quartz, potential brick chippings and noise (respiratory protection P2/FFP2, protection goggles and ear protection) during boring and cutting the bricks. A sufficient ventilation of the workstation must be guaranteed, and tools with a low dust exposition like e.g. wet cutters should be used.
Appropriate tools according to custom may be used to work on the system-oriented aluminium strapping. Occupational health and safety regulations must be considered as well.
The ceramic facade panels are held by special aluminium panel holders on vertical T profiles or by aluminium panel cramps on horizontal Alu bearing rails. Alu joint profiles secure a 4 mm or 8 mm wide vertical joint and fix the panels in place.

2.9 Packaging

Products will be packed on reusable EUR-pallets, partially with cardboard or wooden intermediate layers and with PE shrink-wraps. Reusable pallets may be taken back against refund. All the other packaging materials are taken back by the building materials trade to be recycled. Only wooden pallets are considered as part of the life cycle assessment which had to be replaced in 2013.

2.10 Condition of use

Ceramic facade elements do not change after the production process. In keeping with applicable

standards, constantly implemented material controls and more than 30 years of practical experience, the façade elements are weatherproof, frost-proof, acid-proof, alkali resistant, as well as colour-fast and UV-resistant.
Replacing a single or several panels is always possible.

2.11 Environment and health during use
Argeton facade panels are constantly controlled regarding their leaching behaviour by a state-approved inspecting authority. Controlled elements such as arsenic, chrome, fluoride, molybdenum, selenium, sulphate and vanadium come many times below the permitted emission.

2.12 Reference service life
Argeton facade elements will not be changed after completion of the production process. They are indefinitely consistent under normal use. facade elements are frost-resistant as per /DIN EN ISO 10545-12/, resistant to chemical attack as per /DIN EN ISO 10545-13/ and acid-proof / alkali-proof /DIN V 105-100/.

As specified by the manufacturer, the reference service life of the strapping is at least 60 years, the one of the facade panel is 150 years. The RSL considered in this case is 50 years, this corresponds to the RSL of residential buildings according to the DGNB system (Deutsche Gesellschaft für Nachhaltiges Bauen e.V. - German Sustainable Building Council).

2.13 Extraordinary effects

Fire
Argeton facade elements meet the requirements according to /DIN EN 13501/ and /DIN EN 14411/. In case of fire neither toxic gases nor vapours that impede the sight may emerge.

Fire protection

Name	Value
Building material class	A1
Burning droplets	no
Smoke gas development	no

Water
Due to the solid ceramic bond no ingredients that are hazardous to environment and water may be washed out resulting from water action.

Mechanical destruction
After mechanical destruction of Argeton façade elements no negative effects on the environment are to be expected.

2.14 Re-use phase
A re-utilisation of square bricks for facade linings is basically possible even after many years. Varietal brick residues that have been manufactured into chamotte may be recycled in brick production. Further uses of chamotte can be found e.g. in traffic and civil engineering, with flooring materials or with tennis courts. The aluminium strapping is fully recyclable as well.

2.15 Disposal
If there are no recycling possibilities the element residues may be deposited. Disposal code: 170102 (bricks) according to/European list of wastes/
The capacity to deposit facade elements as per landfill class I according to the technical instruction for recovery, treatment and other disposal of municipal waste is guaranteed.

2.16 Further information
For additional information visit
www.argeton.com

3. LCA: Calculation rules

3.1 Declared Unit
The declaration refers to 1 m² of ceramic façade panels inclusive system-oriented aluminium strapping. The average area density of ceramic facade panels (without strapping) is 40 kg/m², the one of the strapping 0,57 kg/m².

Deklarierte Einheit

Name	Value	Unit
Declared unit	1	m^2
Grammage	40.57	kg/m^2
Gross density	2100	kg/m^3
Conversion factor to 1 kg	1/40.57	-

If averages of different products are declared, the averaging shall be explained. For IBU Core EPDs (where chapter 3.6 is not declared):
For average EPDs, an assessment of the robustness of the LCA values must be made, e.g. regarding the variability of the production process, the geographical representativeness and the influence of the background data and intermediate products compared to the environmental impacts caused by the actual production.

3.2 System boundary
EPD type: Cradle to grave.
Life cycle assessment considers raw material production, raw material transports and the actual product manufacturing including consideration of packaging materials (modules A1-A3).
Transport to construction site (module A4) and treatment of packaging materials in refuse destructors after installation of the product (module A5) are part of the system boundaries too.
After the end of service life, the product will be dismantled manually (module C1). After the transport of the dismantled product (module C2) the facade panel is destined for disposal on an inert waste disposal (module C4), the aluminium strapping may be recycled.
Allowances owing to the recycling of primary aluminium are declared in module D. Allowances for electricity and thermal energy owing to the thermal recovery of packing within module A5 are considered in module D as well. The stage of use (modules B1-B5) is considered in this study.
Since modules B6 and B7 refer to the operation of the building they are not declared in the EPD for the Argeton facade system. The use of the product is not related to the operational use of energy and water for buildings.

3.3 Estimates and assumptions

Since the manufacturer does not know the exact composition of the engaged engobes and glazes, a typical composition has been determined in each case as agreed upon with Wienerberger GmbH and with the help of safety data sheets. The mass fraction of engobes and glazes in the final product is 0.1% each. The mixing of the recipe components (mixing energy) is neglected. The influence of these assumptions on the life cycle assessment results is negligibly small.

Energetic expenditures for chamotte production do not exist on the supplier's side. Thus, an estimation was made based on generic data of the GaBi database. The mass fraction of chamotte in the final product is less than 3 %.

According to the manufacturer, the alloys AlMgSi0,5 F25 (EN AW 6063 T66 as per /DIN EN 755/) and AlCuMg1 (3005 H47 as per /DIN 573-3/) are used to produce the aluminium strapping. The data sets *DE: Aluminium extrusion profile* (AlMgSi) and *DE: Aluminium sheet* (AlCu4Mg1) have been used for illustration in the life cycle assessment model.
The influence of the selection of data sets on the results with respect to the specific illustration of the alloy used is of minor importance. For the results of the consideration by module the assumption is rather decisive that engaged secondary aluminium enters modules A1-A3 unencumbered. Allowances for engaged primary aluminium are allocated in module D exclusively. According to the manufacturer, they are producing with secondary aluminium in large part in the different factories of the supplier. Because its application cannot be quantified from the supplier the present life cycle assessment calculates with average data of /EAA/. Thus, the proportion of primary aluminium is estimated 60 % and the proportion of secondary aluminium is estimated 40 %.

3.4 Cut-off criteria

All details from the factory data collection i.e. all raw materials engaged according to recipe, the engaged thermal energy, the demand for electricity and by products have been considered in balancing. Transport expenditures have been considered for all inputs that contribute more than 0,1-M% to product manufacturing. According to /IBU PCR Part A/, also material and energy streams with a proportion of less than 1% regarding the total mass of the product have been considered.
The manufacturing of the machines, plants and other infrastructure required to produce the considered articles are not part of the life cycle assessment.

3.5 Background data

The software system for holistic balancing /GaBi 6/ developed by PE INTERNATIONAL AG was used for modelling the ceramic facade panels as well as the system-oriented strapping. The consistent data sets included in the GaBi database are recorded in the online /GaBi documentation/. The GaBi database basis data was used for energy, transport and auxiliary material. The life cycle assessment was prepared for the reference area of Germany. Consequently, pre-stages like the provision of electricity or energy sources that are relevant for Germany have been used in addition to production processes under these boundary conditions. The 2009 basic year power mix for Germany is applied. Some combustion process emissions have been collected as primary data based on measurements by Wienerberger GmbH. Since the emission measurements were not complete, the generic background data set "*Thermal energy from natural gas"* has been applied for the combustion process, considering all emissions of natural gas combustion. This combustion profile had been adapted to the site with the help of the delivered Wienerberger GmbH emission data, i.e. the difference between generic combustion data and primary data was additionally illustrated in the life cycle assessment model.

3.6 Data quality

The data collected by Wienerberger GmbH for the 2013 year of production has been used for modelling the product development stage of the ceramic facade panel (incl. strapping). All additional relevant background data sets have been obtained from the /GaBi 6/ software database. The database was last updated in 2013.

3.7 Period under review

The data basis of the life cycle assessment is based on data collections from 2013. The data represent an annual average of 12 months.

3.8 Allocation

For the production of ceramic facade panels Wienerberger GmbH uses both synthetic iron oxide and so-called hammer scale or oxide scale for colouring. Those latter iron oxide small plates accumulate as waste in steel plants. During metal working a loss of material occurs on metal surfaces due to the oxidation of the metal at high temperatures or they fly off the work piece during the forging of iron. This non-synthetic iron oxide is regarded as secondary material within the life cycle assessment which enters the production process unencumbered. The mass fraction is below 1 %.
The defective goods of the ceramic facade panels are partially recycled. Arising burning waste is being manufactured into chamotte externally and added again as chamotte to the production process of ceramic façade panels. The resource flow of clay is shown in the model (*closed loop)*.
Another amount of production waste is used for covering own requirements on the factory premises as foundation for streets and squares. A large part is additionally mixed in the clay quarries ("recycling"). These material streams leave the system boundaries value-free and unencumbered.
Environmental encumbrances due to the combustion of packaging (wood, plastic) are attributed to module A5; resulting allowances for thermal and electric energy are declared in module D.
Allowances are made through German average data concerning electric and thermal energy from natural gas.

In addition to wooden pallets and plastic packaging, paper is used as packaging material. Waste paper which is used for modelling paper goes down in the calculation unencumbered. Apart from the use of waste paper an addition of fresh fibres is always considered. It is assumed the paper is brought to paper recycling. Paper recycling is a very complex network which can only be illustrated partly within given system boundaries. The cut-off approach is selected the methodical approach. This means no environmental encumbrances are considered for waste

paper, no allowances are awarded for the resulting paper (module A5). Recycling process and paper production coalesce in the manufacturing process.

The aluminium strapping is made both of primary and of secondary aluminium. The engaged secondary aluminium is regarded as unencumbered in the production. A collection rate of 90 % is estimated to occur as aluminium scrap in the end of life stage. The remelting and cleaning effort is considered for this amount. After deducting the engaged secondary amount, the remaining net aluminium amount is attributed to the system in module D (Data set *DE: Aluminium ingot mix*).

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. A comparison or evaluation of EPD data is basically only possible if all data sets to be compared have been created according to /EN 15804/ and if the context of the building or product-specific features are considered.

4. LCA: Scenarios and additional technical information

The following technical information are the basis for the declared modules.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	100	km
Capacity utilisation (including empty runs)	85	%

Installation into the building (A5)

At the construction site the following packaging materials arise per m² of ceramic facade panel inclusive strapping:

Name	Value	Unit
Wooden pallets	0,19	kg
Plastic waste	0,055	kg
Waste paper	0,19	kg

Use or application of the installed product (B1) see section 2.12 "Use"

During the use of ceramic facade panels (B1) neither additional resources are needed, nor emissions are released. The panels are colour-fast and UV-resistant for the entire life cycle.

Name	Value	Unit
Ressourcen	0	kg
Emissionen	0	kg

Maintenance (B2)

The product declared by Wienerberger GmbH is longlasting and maintenance-free. During the reference service life of Argeton facade system no maintenance (B2) measures are necessary at all. Cleansing the facade is generally not necessary. But the facade may be cleansed with water and brushes, and possibly in addition of gentle detergents usual in trade if required. A moss infestation is not to be expected owing to the ventilation and the constant baking of the bricks as a consequence thereof.
No expenditures are considered in module B2 within life cycle assessment framework at all.

Name	Value	Unit
Maintenance cycle	0	Number/RSL

Repair (B3)

According to the manufacturer, the products do not have to be repaired (B3) during the considered service life.

Name	Value	Unit
Repair cycle	0	Number/RSL
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Material loss	-	kg

Replacement (B4) / Refurbishment (B5)

According to the manufacturer, the product components do not have to be replaced (B4) during the considered service life. According to the manufacturer's information, a renewal of the whole Argeton system (B5) is not necessary during the RSL of 50 years.
In individual cases a replacement of single or several panels may be necessary or required. This can be the case e.g. in the event of damage or optical impairment of the panels.
No expenditures are considered in modules B4 and B5 within the life cycle assessment framework at all.

Name	Value	Unit
Replacement cycle	0	Number/RSL
Electricity consumption	0	kWh
Litres of fuel	0	l/100km
Replacement of worn parts	0	kg

If a **reference service life** is declared in accordance with the applicable ISO standards, the assumptions and conditions of use underlying the identified RSL shall be declared. It must also be stated that the declared RSL only applies under the reference conditions mentioned. The same applies to a service life declared by the manufacturer.
Corresponding information on reference conditions does not have to be declared for a service life according to the table of /BBNB/.

Reference operating life

As specified by the manufacturer, the reference operating life of the strapping is at least 60 years, the one of the facade panel is 150 years. The RSL considered in this case is 50 years, this corresponds to the RSL of residential buildings according to the DGNB system (Deutsche Gesellschaft für Nachhaltiges Bauen e.V. – German Sustainable Building Council).

Name	Value	Unit
Reference service life	50	a

Operational energy use (B6) and Operational water use (B7)

Modules B6 and B7 are not relevant at product level. Since modules B6 and B7 refer to the operation of the building they are not declared in the EPD for the Argeton facade system. The use of the product is unrelated to the operational use of energy and water for buildings.

Name	Value	Unit
Water consumption	-	m^3
Electricity consumption	-	kWh

End of life (C1-C4)

Name	Value	Unit
Recycling For recycling (90 % of the aluminium strapping)	0.513	kg
Landfilling For disposal (facade panel plus 10 % of collective losses of the strapping)	40.06	kg

The facade panel and the strapping are manually dismantled in order to guarantee a selective removal. After the transport of the dismantled product the facade panel is destined for disposal on an inert waste disposal (module C4), the aluminium strapping may be recycled. Allowances and expenditures after the recycling are declared in module D, as the aluminium strapping is expected to obtain the end-of-waste status directly after deduction of collective losses /EMPA/. After deduction of collective losses the remaining aluminium scrap (0,51 kg) passes a recycling process (4 % remelting losses), taking into account that the scrap first returns into production (ModuleA1-A3) in terms of figures (0,22 kg - closed-loop).

The value-free and unencumbered scrap is saturated on the input side this way. For the remaining net scrap volume (0,28 kg) an allowance for primary aluminium will be assigned in module D. Allowances for electricity and thermal energy owing to the thermal recovery of packing within module A5 are considered in module D as well.

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Allowances for primary aluminium 0.28 kg	0,28	kg
Allowance for electricity (from Modul A5)	0,69	MJ
Allowance for thermal energy (from module A5) (from Modul A5)	1,68	MJ

5. LCA: Results

The following tables show the results of the indicators of impact assessment, use of resource, as well as waste and other output flows related to 1 m² ceramic facade panels inclusive system-oriented aluminium strapping.

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

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	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m² keramische Fassadenplatten inklusive Unterkonstruktion

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	4.34E+1	2.36E-1	4.84E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.15E-1	0.00E+0	5.43E-1	-3.18E+0
ODP	[kg CFC11-Eq.]	2.71E-9	1.79E-13	3.59E-13	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.76E-13	0.00E+0	6.81E-12	1.56E-9
AP	[kg SO_2-Eq.]	1.11E-1	5.25E-4	6.81E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.15E-4	0.00E+0	3.45E-3	-1.91E-2
EP	[kg $(PO_4)^{3-}$-Eq.]	1.03E-2	1.03E-4	9.80E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.06E-5	0.00E+0	4.73E-4	-9.12E-4
POCP	[kg ethene-Eq.]	6.68E-3	-1.58E-4	4.99E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-8.88E-5	0.00E+0	3.24E-4	-9.66E-4
ADPE	[kg Sb-Eq.]	2.47E-4	8.10E-9	2.34E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.41E-9	0.00E+0	2.04E-7	-8.14E-7
ADPF	[MJ]	5.99E+2	3.28E+0	1.30E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.57E+0	0.00E+0	7.14E+0	-3.16E+1

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: 1m² keramische Fassadenplatten inklusive Unterkonstruktion

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
PERE	[MJ]	48.00	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
PERM	[MJ]	0.00E+0	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
PERT	[MJ]	48.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.62	-13.40
PENRE	[MJ]	646.00	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
PENRM	[MJ]	0.00E+0	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
PENRT	[MJ]	646.00	3.29	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	7.46	-37.60
SM	[kg]	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	8.56E-2	2.37E-5	1.17E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.00E-5	0.00E+0	-2.25E-2	-2.84E-2

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: 1m² keramische Fassadenplatten inklusive Unterkonstruktion

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
HWD	[kg]	4.49E-2	8.64E-6	1.99E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.99E-6	0.00E+0	3.38E-4	-3.99E-3
NHWD	[kg]	1.32E+0	1.58E-5	1.46E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.01E-4	0.00E+0	4.01E+1	-4.30E-1
RWD	[kg]	1.86E-2	3.86E-6	7.64E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.20E-6	0.00E+0	1.30E-4	-2.38E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.10E-1	0.00E+0	0.00E+0	IND
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
EEE	[MJ]	0.00E+0	0.00E+0	6.95E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
EET	[MJ]	0.00E+0	0.00E+0	1.68E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND

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

The results of the impact assessment represent relative details / potentials and do not illustrate information on concrete environmental impacts (endpoint); neither limit value violations nor risk analyses may be derived from it.

6. LCA: Interpretation

It is evident from the determined LCA results that product manufacturing (modules A1-A3) dominates the life cycle results in all considered evaluation variables. The Ozone Depletion Potential (ODP) is the only exception. The allowances in module D primarily result from the aluminium recycling potential. On consideration of the ODP, however, not allowances but encumbrances are to be recorded resulting from the recycling potential. The reason of this is the fact that electricity is required for the remelting process. The background data sets dominate the ODP results.
The stage of production (modules A1-A3) is considered subsequently. It is evident that the use of energy source in the factory (natural gas) and the power demand contribute most to the use of primary energy resources. While the total use of non-renewable primary energy resources (PENRT) during manufacturing is dominated by natural gas at around 60 %, the total use of renewable primary energy resources (PERT) is defined primarily by electricity from renewables in the power mix. The contribution of the strapping to the total use of renewable primary energy resources (PERT) may as well be attributed to the electricity consumed in preproduction processes. The dominance of the energy sources becomes also apparent on consideration of the global warming potential (GWP). 43 kg of CO2 equivalents are released during the manufacturing (modules A1-A3) of ceramic facade panels inclusive strapping. 19 % of it result from pre-production processes of electricity generation, 57 % from the firing and drying process in the factory and approx. 11 % from pre-production processes of the aluminium strapping manufacturing. As a result of the extraction and manufacturing of further recipe components of ceramic facade panels (in addition to own clay) less than 10 % of the GWP is caused by manufacturing. Pigments account for the highest share of recipe components, especially the extraction and manufacturing of chrome ore in this case. Expenditures for the extraction of own clay do not exist separately, but they are a portion of the factory's total energetic expenditures. About 4 % of the GWP within modules A1- A3 may be attributed to transport processes. Closer consideration of the results (modules A1-A3) of further impact categories also confirms the significant influence of the use of energy source in the factory, both power demand and the natural gas-based firing process and the emissions as a consequence thereof. The manufacturing of the strapping contributes excluding ODP between 9 % (Abiotic Depletion Potential for fossil Fuels - ADPF) to 34 % (PERT) to the results in modules A1-A3.
The significance of pigments becomes particularly apparent with the results of the abiotic depletion potential for elements (ADPE). The environmental performance of pigments is primarily defined using chrome ore in all considered impact categories.

The assumption concerning the volume of the primary aluminium engaged in the manufacturing of the strapping, and the method concerning the unencumbered modelling of scrap in the product system input influence the results significantly. This study proceeds the assumption that 40 % of the aluminium engaged for the strapping consists of recycled scrap, and 60 % of primary aluminium. The scrap enters modules A1-A3 unencumbered. This assumption leads to the fact that compared to other studies which are based e.g. on an LCA assuming a lower scrap rate and hence a higher primary metal rate, the present results lead to comparatively low contributions in modules A1-A3 but on the same time to lower allowances in module D. The proportions of primary and secondary aluminium underlying this study are average values of the European Aluminium Association (EAA), as the exact portion of Wienerberger GmbH (which may not influence this) is not known.
All additional assumptions made influence the results insignificantly

7. Requisite evidence

7.1 Radioactivity

Radioactivity is not relevant for ceramic facade elements.

7.2 Leaching

Test point/record/date: Keramisch- Technologisches-Baustofflaboratorium e.V. Hamburg, Unter den Linden 2, 21465 Reinbek, Germany Test report no. 38 488 dated 4 April 2012 Result: The leaching test refers to the elements of arsenic, chrome, fluoride, molybdenum, sulphate, selenium, and vanadium according to /N EN 7375/. These elements are currently regarded as critical elements.

Using the monitored products is possible without restrictions.

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