ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Confindustria Ceramica
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-COI-20160202-ICG1-EN
ECO EPD Ref. No.	ECO-00000444
Issue date	26/09/2016
Valid to	25/09/2022

Italian Ceramic Tiles

Confindustria Ceramica

Institut Bauen und Umwelt e.V.

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

ECO PLATFORM EPD EN 15804 VERIFIED

CONFINDUSTRIA CERAMICA

1. General Information

Confindustria Ceramica

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

Declaration number
EPD-COI-20160202-ICG1-EN

This Declaration is based on the Product Category Rules:
Ceramic tiles and panels, 07.2014
(PCR tested and approved by the SVR)

Issue date
26/09/2016

Valid to
25/09/2022

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

Dr. Burkhart Lehmann
(Managing Director IBU)

Italian Ceramic Tiles

Owner of the Declaration
Confindustria Ceramica, Viale Monte Santo 40
41049, Sassuolo, Modena
Italy

Declared product / Declared unit
1 m^2 ceramic tile (average)

Scope:
This document refers to an average ceramic tile product manufactured by Confindustria Ceramica's member companies.
The LCA data were collected in 2014 within the members companies of the association.
This study has involved, as primary data 76 companies and 84 plants, that represent 82,6% of the Italian ceramic tiles production. **The final results are representative of Confindustria Ceramica's member companies.**
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

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

Matthias Schulz
(Independent verifier appointed by SVR)

2. Product

2.1 Product description
Ceramic tiles, produced by Confindustria Ceramica's member companies are shaped mainly by dry pressing (but also by extrusion), starting from natural raw materials such as clay, feldspar, sand and kaolin. The main type of ceramic tiles is porcelain stoneware, characterized by a very compact structure and high performances. Other types include single fired tiles, like monoporosa, double fired tiles, etc.
For this study an average ceramic tile product, representative of the whole production of Confindustria Ceramica's member companies, has been identified and adopted.

2.2 Application
The ceramic tiles under study are intended and applied for both floor and wall coverings, installed both in internal and external environments, for residential, commercial and institutional use.

2.3 Technical Data
Ceramic tiles produced by Confindustria Ceramica's member companies conform to the following standards and specifications. According to /EN 14411/ in Europe and /ISO 13006/ in the rest of the world ceramic tiles are classified into five main types based on shaping methods (A = Extrusion, B: Dry pressing) and water absorption level.
Ceramic tiles with the lowest water absorption level (≤ 0.5%) can be designated as porcelain tiles (impervious tiles) Mosaic and trim units are included.

Constructional data

_ Small colour differences may accour, according to /ISO10545-16/, (Delta)Ecmc < 0,75 (GL) / (Delta)Ecmc < 1,0 (UGL)
_ Tactility, according to /CEN/TS 15209/, for tactile paving surface, i.e. when required for blind or vision impaired persons.
_ Others requirements listed in the annexes from A to L of /ISO 13006/ and /EN 14411/ are:
length and width (acc. to /ISO 10545-2 sect. 2/),
thickness (acc. to /ISO 10545-2 sect. 3/),
straightness of sides (acc. to /ISO 10545-2 sect. 4/),
rectangularity (acc. to /ISO 10545-2 sect. 5/),
centre curvature (acc. to /ISO 10545-2 sect. 6/),
edge curvature (acc. to /ISO 10545-2 sect. 6/),
warpage (acc. to /ISO 10545-2 sect. 6/).
_ Surface quality (acc. to /ISO 10545-2 sect. 7/), minimum of 95% of the tiles shall be free from visible defects that would impair the appearance of the major

area of tiles.

Name	Value	Unit
Water absorption acc. to /ISO 10545-3/	0,0 - 20	%
Break load acc. to /ISO 10545-4/	8 - 35 (min)	N/mm^2
Flexural strength acc. to /ISO 10545-4/	200 - 1300 (min)	N/mm^2
Resistance to surface wear – – Glazed tiles acc. to /ISO 10545-7/	0 - 5	Abrasion Class
Coefficient of linear thermal expansion acc. to /ISO 10545-8/	9 E10-6 (max)	1/K
Thermal shock resistance acc. to /ISO 10545-9/	Resistant	
Crazing resistance acc. to /ISO 10545-11/	Resistant	
Frost resistance acc. to /ISO 10545-12/	Resistant	
Nonslip propertie (class A, B oder C) acc. to. /CEN/TS 16165/	Resistant	
Bond strength /adhesion acc. to. /EN 12004/	Resistant	
Impact resistance acc. to /ISO 10545-5/	Resistant	
Reaction to fire NO testing (CWT)	A1-A1FL	
Chemical resistance acc. to /ISO 10545-13/	A-C	
Resistance to household chemicals and swimming pool salts acc. to /ISO 10545-13/	B (min)	
Resistance to low and high concentrations of acids and alkalis acc. to /ISO 10545-13/	Resistant	
Resistance to staining acc. to /ISO 10545-14/	Resistant	
Release of lead and cadmium – Glazed tiles acc. to /ISO 10545-15/	If required	
Moisture expansion acc. to /ISO 10545-10/	Resistant	
Resistance to deep abrasion (ungl. tile) acc. To /ISO 10545-6/	2365 for A,540 for B	mm^3

2.4 Application rules

For the placing on the market in the EU/EFTA, with exception of Switzerland, EU regulation no. 305/2011 applies. The products need a Declaration of Performance taking into consideration /EN 14411/ Ceramic tiles, Definitions, classification, characteristics, evaluation of conformity and the CE-marking.

Some of Confindustria Ceramica member's companies also comply with the following standard:

- /2009/607/EC/ Commission decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label to hard coverings.

2.5 Delivery status

The measurements of products can vary between different formats, thicknesses range from 3 mm (for ultra-thin tiles) to 30 mm (for thickened tiles).

2.6 Base materials / Ancillary materials

Main raw materials for ceramic tile:

- Clay 42%
- Sand 13%
- Feldspar 35%
- Rhyolite 4%

Main glaze components:

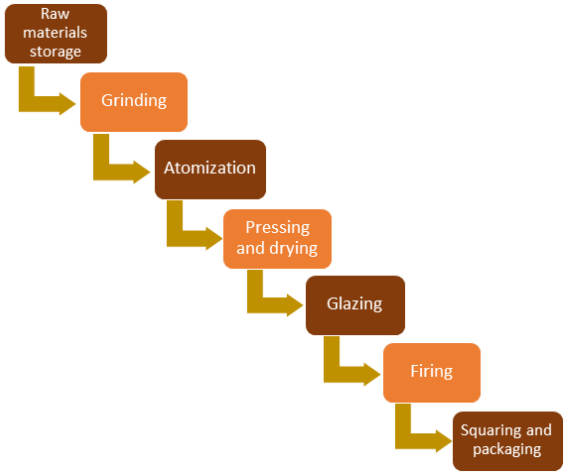
- Clay powder
- Quartz
- Alumina
- Natural pigments
- Frits

Main auxiliary additives:

- Dispersant
- Binder
- Fluidifying agents
- Pigments

2.7 Manufacture

The typical manufacturing process of the ceramic tile object of this EPD is represented and described below.



The required composition of raw materials, including also recycled wastes, is mixed and ground in mills, either in a wet or a dry process.
In the wet process, the slurry produced (with around 25-30 % water) is treated in spray driers that use thermal energy from natural gas and high air pressure in order to produce a dry powder with spherical granules of appropriate size distribution, ready to be pressed. In the drying process the production of energy via cogeneration is a widespread practice. In the dry process, without water, no spray driers are used.

Ceramic tiles are generally formed by dry pressing, using special moulds (isostatic pressing). At present new forming techniques have been developed in particular for thin and large size tiles, using special tape compaction procedures. The required formats are obtained by cutting the initial slabs after compaction. Glazing and decoration are performed on dried tile surfaces. Both wet and dry application techniques can be used. Digital glazing and decoration techniques have been introduced and adopted in the ceramic tile industry, and are at the base of very special ceramic tile surfaces.

The firing phase takes place at different temperatures (depending on the ceramic tile produced, between 1000°C and 1300°C) in order to achieve the typical ceramic tile features of abrasion, water and chemicals resistance and durability.
Before selection and packing lines, rectified products are cut and squared at the desired size.
The final product is packed in cardboard boxes, stacked on wooden pallets and protected with PET film. The tiles are stored in warehouse until the order preparation for customer shipment.

The monitoring of the production performances is implemented mainly by the quality management system (QMS) and process certification in compliance with: / ISO 9001 / ISO 50001 / ISO 14001 / EMAS / OHSAS 18001 /

2.8 Environment and health during manufacturing

Workers are informed about physical and chemical risks associated to their job and workplace. They receive an appropriate training and personal protective equipment. Confindustria Ceramica promoted the adoption of health and safety practices agreed with Trade Unions and HSE local authorities. Furthermore Confindustria Ceramica implemented the Social Dialogue agreement (NEPSI) followed by member companies. Confindustria Ceramica also promoted the adoption of studies and guidelines on environmental management to monitor and increase companies' performances.

Water / soil:

Contamination of water and soil does not occur. Italian ceramic tile companies recycle the total amount of waste water during the drying process in form of steam or release it into the internal waste water treatment and re-use it internally or externally

Air:

For energy production purpose only natural gas is burned. Emissions from the combustion process are under strict limits and monitored. Environmental protection measures are employed.
A broad number of companies use self produced electricity via cogeneration and solar panels.

2.9 Product processing/Installation

Tiles are fixed to the walls and floors surfaces using different materials and amounts, for example, dispersion and cementitious adhesives and mortars, sealants or liquid applied membranes. During the installation, no emissions occur and no health or environmental risks derive from ceramic tile installations.

2.10 Packaging

The tiles are packed in cardboard boxes, wrapped with polyethylene film and plastic straps and stacked on wooden pallets. The amount of packaging material can vary according to the tile size.
Packaging end of life phase includes (according to /Eurosta 2013/):

- Paper: recycling, energy recovery, disposal;
- Plastic: recycling, energy recovery, disposal;
- Wood: reuse, energy recovery, landfill.

2.11 Condition of use

Ceramic tiles are solid and inert due to being burnt at high temperatures. The environmental impacts generated during the B1 phase are very low and therefore can be neglected.

2.12 Environment and health during use

Ceramic is intrinsically inert, chemically stable and therefore, during the use stage, does not emit any pollutants or substances which are harmful to environment and health such as: VOCs and Radon

2.13 Reference service life

The service life of tiles is generally higher than 50 years / BNB 2011 /. According also to /US Green Building Council/ the service life of tiles could be as long as the life of the building itself. Therefore 60 years can be an alternative tile's life for /U.S. GBC/.
The results reported consider the tile's use of 1 year, therefore multiplying B2 values for 50 or 60, it's possible to obtain B2 values referred to 50 or 60 years.
A reference-life according to / ISO 15686 / is not reported.
Influences on ageing when applied in accordance with the rules of technology
.

2.14 Extraordinary effects

Fire

According to /EN 13501-1:2007+A1:2009/, ceramic tiles can be classified as A1 class of fire resistance rating, because they do not contribute to fire.

Water

Ceramic tiles cannot react with water because they are an insoluble material.

Mechanical destruction

Ceramic tiles can be smashed mechanically, but no harmful damage on the environment is expected.

2.15 Re-use phase

After the demolition and deconstruction stage, ceramic tiles can be crushed and then used in a range of different applications, like concrete aggregates or road construction.

2.16 Disposal

According to the /European Waste Catalogue/ (EWC) ceramic tiles waste belongs to the group 17 "Construction and demolition wastes", tiles and ceramic (code:17 01 03).

2.17 Further information

More information can be found at:
www.confindustriaceramica.it
www.laceramicaitaliana.it/

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m^2 ceramic tiles for covering walls and floors with an average mass of 19.9 kg.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	19.9	kg/m^2
Conversion factor to 1 kg	0.0503	-

3.2 System boundary

The entire life cycle of the product is considered (Type of EPD: cradle- to- grave) and the module described below are declared in this EPD.

Modules A1-A3 include those processes that provide energy and material input for the system (A1), transport up to the factory gate of the plant (A2), manufacturing processes as well as waste processing (A3).

Module A4 includes the transport from the production site to the customer or to the point of installation of the tiles.

Module A5 considers all tile installation steps (like adhesives consumption) also packaging waste processing (recycling, incineration, disposal). Credits from energy substitution are declared in module D. During this phase a ceramic material loss of 6,5% has been considered.

Module B1 considers the use of tiles. During the use of ceramic tiles no hazardous indoor emissions are expected to occour.

Module B2 includes the cleaning of the tiles. Provision of water, cleaning agent for the cleaning of the tiles, incl. waste water treatment are considered.

Modules B3-B4-B5 are related to the repair replacement and refurbishment of the tiles. If the tiles are properly installed no repair, replacement or refurbishment processes are necessary.

Modules B6-B7 consider energy use for operating building integrated technical systems (B6) and operational water use for technical building-related systems. No operational energy or water use are considered. Cleaning water is declared under B2.

Module C1 regards demolition and de-construction process of the tiles from the building.

Module C2 considers transportation of the discarded tile to a recycling or disposal process.

Module C3 considers every process (collection, crushing process etc.) properly for recycling the tiles.

Module C4 includes all the landfill disposal processes, including pre-treatment and management of the disposal site.

Module D includes benefits from all net flows in the end-of-life stage that leave the product boundary system after having passed the end-of-waste stage. Loads from packaging incineration and resulted energy credits (electricity and thermal energy) are declared within module D.

3.3 Estimates and assumptions

The modules from A5 to C4 are scenarios based on average data included into the PCR created by the European Ceramic Tile Manufacturers' Federation /CET PCR 2014/.

For those materials, (glaze compost, colorant, and chemical additives) where no primary data were available and an exact chemical composition (coming from datasheet) was unknown an average composition was used, and assumptions were taken based on common chemicals criteria.

3.4 Cut-off criteria

All known inputs and outputs were considered.

3.5 Background data

Background data for the Life Cycle Modelling have been taken from the last version /Gabi 7/ professional database (updated to SP30, year 2016). Other sources for background data used are /ELCD/FEFCO/, /*Perry's Chemical Engineers' Handbook/, /Ceramic Glaze Handbook/, /European Ceramic Tile Manufacturers' Federation/.*

3.6 Data quality

The period of validity of background data from the thinkstep database lies between 2012 and 2018. Most information (energy and water consumption, pollutant emissions powder atomized and ceramic production) are measured or directly calculated at company level and declared in the Italian IPPC document called AIA, that is specific and verified for each plant involved in this study. Emissions of carbon dioxide (connected to carbonate's oxidation) are collected using ETS (Emission Trading System) declaration.
Detailed data was obtained not only for raw material mixtures (collected with specific company primary data) but also for colorants, frits and other raw materials used in the glaze's manufacturing.
The overall data quality can be considered good.

3.7 Period under review

The primary data collected in the study refer to 2014.

3.8 Allocation

Energy and material supplies have been allocated to the product based on annually produced mass of ceramic tiles. No further allocations have been applied within the subsequent module.

Moreover, some ceramic wastes are internally recycled; credits from energy recovery of packaging materials from the end-of-life of the product are taken into account.

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.

4. LCA: Scenarios and additional technical information

The following technical information about declared modules and related scenarios is based on average data, according to the European Ceramic Tile Manufacturers' Federation and in accordance with Confindustria Ceramica.

Transport to the building site (A4)
Confindustria Ceramica's member companies commercialize their ceramic tiles in Italy, Europe and the rest of the world. Average default transportation scenarios are used and displayed below.

Name	Value	Unit
Litres of fuel (per FU)	31	l/100km
Capacity utilisation volume factor (including empty runs)	0.85	-
National destination Truck with a capacity of 27 tons (51 % of tiles sold)	300	km

European destination Truck with a capacity of 27 tons (34% of tiles sold)	1390	km
Transoceanic freight ship	6520	km

Installation into the building (A5)
For the installation stage 3 options are defined, where different materials can be used. For option 1, adhesives, mortar and water, for option 2 mortar dispersion adhesives and polysulfides for option 3 also cementitious adhesives (different quantities for different tile formats). These considerations are based on average data from different manufacturers of ceramic tiles in Europe. In this EPD it is assumed that the tiles are installed using cementitious adhesive (option 3).
For the treatment of packaging waste, a European average scenario is used and shown, taken from /“Eurostat, 2013”/, therefore the end of life is recycling, energy recovery and landfill, for plastic and paper instead reuse, energy recovery and landfill for wood. The ceramic material loss considered is 6,5%.

Name	Value	Unit
Cementitious adhesive	6	kg

Use (B1) Ceramic tiles are robust and have a hard, abrasion-resistant surface. There are no impacts on the environment during the use stage.

Maintenance (B2):
Ceramic covering products shall be cleaned regularly, to a greater or lesser degree, depending on the type of building: residential, commercial, healthcare. Thus, the consumption of water and disinfectant has been considered. The values declared in this stage refer to a time period of 1 year.

Scenario for maintaining ceramic floor and wall tiles:
Residential use: 0.3 ml of detergent and 0.002 l of water are used to wash 1 m^2 of ceramic tiles once a week. This stage scenario is based on average data from different manufacturers of ceramic tiles in Europe.

Name	Value	Unit
Water consumption	0,002	l
Detergent	0,0003	l
Floor tile Maintenance cycle	2400	Number/SL
Wall tile Maintenance cycle	200	Number/SL

Repair, replacement and refurbishment (B3, B4, B5)
In general the service life of ceramic tiles is the same as the building life time. Repair, replacement and refurbishment is not required for ceramic tiles.

Operational energy and water use (B6, B7):
These modules are not relevant for ceramic tiles.

End of life (C1-C4)
C1: This module, according to the PCR developed by the European Ceramic Tile Manufacturers' Federation is not relevant for ceramic tiles.
C2: The ceramic tile demolition waste is transported from the building site to a container or treatment plant by truck and an average distance of 20 km is considered. The return trip shall be included in the system. It can be considered an average distance of 30 km from the container or treatment plant to final destination.

The results for the end-of-life are declared for the 2 different scenarios:

Name	Value	Unit
Scenario No. 1 Recycling percentage	100	%
Scenario No.1 Material to recycling	24,7	kg
Scenario No. 2 Landfill percentage	100	%
Scenario No. 2 Material to landfill	24,7	kg

C3: Recycling scenario includes the treatment of the ceramic material for later use as mineral/raw material. It is divided in 2 sub-scenarios:
1) Recycling 100%
2) Recycling 0%

C4: Landfill disposal scenarios used is divided in the 2 sub-scenarios:
1) Landfilling 0%
2) Landfilling 100%

Benefits and loads beyond the product system boundary (D):
Module D includes credits from materials recycling of tiles and packaging, energy credits from thermal recovery of the packaging.

The results for module D are declared for the 2 different scenarios.

5. LCA: Results

The tables below show the results of the LCA. Basic information on all declared modules are provided in chapter 4. There are two scenarios for the end-of-life (C3, C4 and D): scenario **1** considers 100% recycling, scenario **2** considers 100% landfill disposal.

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

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

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² of average ceramic tile (19,9 kg / m²)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
GWP	[kg CO_2-Eq.]	1.05E+1	9.34E-1	2.80E+0	0.00E+0	8.98E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.86E-2	6.39E-2	0.00E+0	0.00E+0	3.96E-1	-5.00E-1	-4.40E-1
ODP	[kg CFC11-Eq.]	6.10E-10	6.17E-12	4.95E-11	0.00E+0	5.07E-13	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.32E-13	4.79E-12	0.00E+0	0.00E+0	4.36E-12	-6.65E-11	-6.47E-11
AP	[kg SO_2-Eq.]	2.47E-2	4.99E-3	3.75E-3	0.00E+0	1.53E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.25E-4	5.39E-4	0.00E+0	0.00E+0	2.38E-3	-9.19E-4	-6.41E-4
EP	[kg $(PO_4)^{3-}$-Eq.]	2.75E-3	5.97E-4	7.67E-4	0.00E+0	2.71E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.08E-5	1.08E-4	0.00E+0	0.00E+0	3.23E-4	-1.54E-4	-9.67E-5
POCP	[kg ethene-Eq.]	2.37E-3	2.83E-4	3.70E-4	0.00E+0	5.30E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-4.73E-5	7.15E-5	0.00E+0	0.00E+0	2.28E-4	-2.15E-4	-1.82E-4
ADPE	[kg Sb-Eq.]	9.19E-5	6.24E-8	1.46E-5	0.00E+0	3.71E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.90E-9	1.13E-7	0.00E+0	0.00E+0	1.37E-7	-1.49E-7	-1.29E-7
ADPF	[MJ]	1.57E+2	1.25E+1	1.83E+1	0.00E+0	2.31E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.94E-1	1.24E+0	0.00E+0	0.00E+0	5.15E+0	-6.56E+0	-5.84E+0

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

RESULTS OF THE LCA - RESOURCE USE: 1 m² of average ceramic tile (19,9 kg / m²)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PERE	[MJ]	2.28E+1	6.29E-1	1.24E+1	0.00E+0	8.59E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.24E-2	7.67E-2	0.00E+0	0.00E+0	6.06E-1	-2.29E+0	-2.11E+0
PERM	[MJ]	8.27E+0	0.00E+0	-8.27E+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	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	3.11E+1	6.29E-1	4.13E+0	0.00E+0	8.59E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.24E-2	7.67E-2	0.00E+0	0.00E+0	6.06E-1	-2.29E+0	-2.11E+0
PENRE	[MJ]	1.61E+2	1.26E+1	2.05E+1	0.00E+0	2.37E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.96E-1	1.28E+0	0.00E+0	0.00E+0	5.34E+0	-7.53E+0	-6.73E+0
PENRM	[MJ]	1.25E+0	0.00E+0	-1.25E+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	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	1.62E+2	1.26E+1	1.92E+1	0.00E+0	2.37E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.96E-1	1.28E+0	0.00E+0	0.00E+0	5.34E+0	-7.53E+0	-6.73E+0
SM	[kg]	6.39E-1	0.00E+0	4.01E-2	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	2.35E+1	0.00E+0
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	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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	3.14E-2	1.55E-3	9.37E-3	0.00E+0	5.07E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.61E-5	4.00E-4	0.00E+0	0.00E+0	1.09E-3	-2.00E-3	-2.00E-3

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

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:
1 m² of average ceramic tile (19,9 kg / m²)

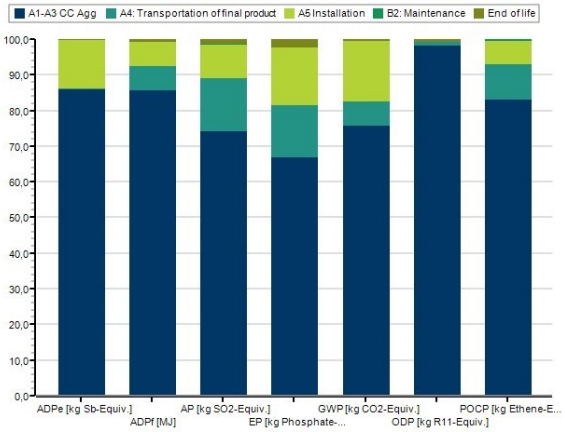
Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
HWD	[kg]	2.06E-4	8.15E-7	1.31E-5	0.00E+0	5.84E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.99E-8	5.39E-8	0.00E+0	0.00E+0	1.22E-7	-7.96E-8	-4.50E-8
NHWD	[kg]	7.53E-1	9.46E-4	1.53E+0	0.00E+0	7.86E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.32E-5	5.50E-4	0.00E+0	0.00E+0	2.47E+1	-1.01E+0	-7.16E-3
RWD	[kg]	4.61E-3	2.53E-5	5.39E-4	0.00E+0	2.68E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.66E-7	1.89E-5	0.00E+0	0.00E+0	7.45E-5	-3.89E-4	-3.53E-4
CRU	[kg]	0.00E+0	0.00E+0	1.84E-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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	1.62E-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	2.47E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	5.60E-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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	1.04E+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	0.00E+0	0.00E+0	0.00E+0

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

6. LCA: Interpretation

A1-A3 are the modules with the majority of the impacts. Overall, most of the impact categories are dominated by energy processes and raw materials consumption for ceramic mixtures.
Global warming potential (**GWP**), into A1-A3 modules, is generated by energy process for 70% and by raw materials for 18%.
Energetic consumption impact also on abiotic fossil depletion (**ADPEf**) for about 61%.
The ozone layer depletion (**ODP**) is driven by the raw materials extraction for 37%, 33% by energy (mainly electricity) and 16% by the glazes.
Eutrophication potential (**EP**) is distributed between energy consumption (20%) and extraction of raw material (13%), transport (14%) but also direct emission due to an atomize process for about 8%.
Production of glazes and colorants for mixture results important for depletion of abiotic elements (**ADPe**) respectively for 84% and 9%, due to the production of natural elements like oxides of zinc, aluminum and lead.
Energy results are also important for **POCP** (46%).

The following figures (refer to 1 year of use and end-of-life Scenario 1) show how impacts are distributed between the phases considered in this EPD:



7. Requisite evidence

Ceramic is inert, therefore during the use stage, do not emit any pollutants or substances which are harmful to environment and health. For this reasons and according to PCR, evidence are not required because they are not relevant for this product group.

8. References

The literature referred to in the Environmental Product Declaration must be quoted in full from the following sources. Standards and standards relating to evidence and/or technical features already fully quoted in the EPD do not need to be listed here. Part B of the PCR document on which they are based must be referred to.

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.): Generation of Environmental Product Declarations (EPDs);
www.ibu-epd.de

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

IBU PCR Part A:2016-18-03 V1.4
Product Category Rules for Building-Related Products and Services.
Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background

Report.

IBU PCR Part B:2014-07-04 V1.6
Product Category Rules for Building-Related Products and Services.
Part B: Requirements on the EPD for Ceramic tiles and panels

GaBi 7
Life cycle assessment software and database, by thinkstep AG, Leinfelden-Echterdingen, 2016 (http://documentation.gabisoftware.com/).

Product Category Rules (PCR), Ceramic Tiles, CET PCR 2014-06-23
European Ceramic Tile Manufacturers' Federation, Brussels

Ceramic of Italy
Ceramics of Italy is the collective label of the Italian ceramic industry (tiles, sanitaryware and tableware). It stands for tradition, quality, innovation and creativity as well as for a guarantee of Made in Italy production. Ceramics of Italy, promoted by Confindustria Ceramica – the Italian association of ceramics – is a registered trademark of Edi.Cer. SpA, the organizer of Cersaie, the most important international exhibition of ceramic tile and bathroom furnishings held every year in Bologna, Italy (www.cersaie.it).

BNB 2011
BBSR table "useful lives of components for Life Cycle Analysis by BNB ", Federal Institute for Building, Urban Affairs and Spatial Development, Division II
Sustainable Building; available online at http://www.nachhaltigesbauen.de/baustoff-undgebaeudedaten/
useful lives-of-bauteilen.html;
stand 12/2015

Ceramic Glaze Handbook, materials, techniques, formulas
Marc Burleson, Lark Books, 2003

US GBC
US Green Building Council, Leed v3, 2009, Whole building life cycle assessment.
LEED BD&C v4 (LEED Building Design & Construction).

Perry's Chemical Engineers' Handbook
Don Green, Robert Perry, 8th edition, 13 November 2007,

ISO 9001 (current version)
Quality management systems Requirements

ISO 50001 (current version)
Energy Management System

ISO 14001 (current version)
Environmental Management System

EMAS (current version)
EU Eco-Management and Audit Scheme

OHSAS 18001 (current version)
Occupational Health and *Safety* Assessment

ECOLABEL (current version)
Product Certification, Labeling system for services and consumer products

EUROSTAT 2013
Waste statistic

ELCD FEFCO
European Database for Corrugated Board Life Cycle Studies by the European Corrugated Packaging Association, 2012

EUROPEAN WASTE CATALOGUE AND HAZARDOUS WASTE LIST
European List of Waste (Commission Decision 2000/532/EC) and Annex III to Directive 2008/98/EC.

DIN EN ISO 15686, 2011-05
Buildings and constructed assets - Service life planning

2009/607/EC: Commission Decision
Decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label to hard coverings (notified under document C(2009) 5613)

This industry-wide EPD was facilitated by Confindustria Ceramica and refers to the production of the following companies:

A.R.P.A. Azienda Rivesimenti Pavimenti Affini SPA
ABK GROUP INDUSTRIE CERAMICHE SPA
ALFREDO SALVATORI SRL
ALTAECO SPA
ANTICA CERAMICA RUBIERA SRL
ANTICHE FORNACI D'AGOSTINO SRL
BOXER SRL
CASALGRANDE-PADANA SPA
CE.SI. CERAMICA DI SIRONE SRL
CEDIR CERAMICHE DI ROMAGNA SPA
CERAMICA ALTA SOC. COOP
CERAMICA DE MAIO FRANCESCO SRL
CERAMICA DEL CONCA SPA
CERAMICA FONDOVALLE SPA
CERAMICA INCONTRO SRL
CERAMICA MANDRIO CORREGGIO CMC SPA
CERAMICA SANT'AGOSTINO SPA
CERAMICA VALSECCHIA SPA
CERAMICA VIETRI ANTICO SRL
CERAMICHE ASCOT SPA
CERAMICHE ATLAS CONCORDE SPA
CERAMICHE BRENNERO SPA
CERAMICHE CAESAR SPA
CERAMICHE CCV CASTELVETRO SPA con socio unico
CERAMICHE DAYTONA
CERAMICHE GARDENIA ORCHIDEA SPA
CERAMICHE GRAZIA SPA
CERAMICHE MAC 3 SRL
CERAMICHE MARCA CORONA SPA
CERAMICHE MARINER SPA
CERAMICHE MOMA SPA
CERAMICHE REFIN SPA
CERAMICHE SAN NICOLA SRL
CERAMICHE SERRA SPA
CERAMICHE SETTECENTO VALTRESINARO SPA
CERINDUSTRIES SPA
CIPA GRES SPA
COEM SPA
COOPERATIVA CERAMICA D'IMOLA S.c.

COTTO PETRUS SRL
DADO CERAMICA SRL
DECORATORI BASSANESI SRL
DOMUS LINEA SRL
EMILCERAMICA SRL - a Socio Unico
ETRURIA Design SRL
FARO CERAMICHE SRL
FINCIBEC SPA
FLORIM CERAMICHE SPA
FORME 2000 SRL
FRANCO PECCHIOLI CERAMICA FIRENZE SRL
GAMBINI GROUP SPA
GAMMA DUE SPA
GIGACER SPA
GIOVANNI DE MAIO SRL
GOLD ART CERAMICA SPA
GRUPPO BETA SPA
GRUPPO CERAMICHE GRESMALT SPA
GRUPPO CERAMICHE RICCHETTI SPA
GRUPPO ROMANI SPA
IL CAVALLINO CERAMICA ARTISTICA
INDUSTRIE CERAMICHE PIEMME SPA
INDUSTRIE COTTO POSSAGNO SPA
INDUSTRIE MATILDICHE SRL
ITA Industrial Tiles Achievements S.p.A. - a Socio Unico
ITALCER SPA
ITALGRANITI GROUP SPA
KERADOM SRL
KERITALY SPA
LA FABBRICA SPA
LAMINAM SPA
MARAZZI GROUP SRL - a Socio Unico
MENESTRELLO CERAMICHE SRL Unico Socio
MIRAGE GRANITO CERAMICO SPA
NOVABELL SPA CERAMICHE ITALIANE
NUOVA RIWAL CERAMICHE SRL
NUOVOCORSO SPA
OSCAR FOR PORCELAIN AND CERAMIC PRODUCTION SRL
PANARIAGROUP INDUSTRIE CERAMICHE SPA
SAN VALENTINO MANIFATTURE CERAMICHE SPA
SANTA MARIA SRL
SAVOIA ITALIA SPA
SAXA GRES SPA - a Socio Unico
SICHENIA GRUPPO CERAMICHE SPA
SICIS SRL - A SOCIO UNICO
SIMA CERAMICHE SRL
TAGINA CERAMICHE D'ARTE SPA
TARGET SRL
TONALITE SPA
TUSCANIA SPA

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

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

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Author of the Life Cycle Assessment
thinkstep Italy
Via Bovini 43
48123 Ravenna
Italy

Tel +39 0544 467132
Fax 39 0544 501464
Mail info@thinkstep.com
Web **www.thinkstep.com**

Owner of the Declaration
Confindustria Ceramica
Viale Monte Santo 40
41049 Sassuolo (MO)
Italy

Tel +39 0536 818 111
Fax +39 0536 807 935
Mail info@confindustriaceramica.it
Web **www.confindustriaceramica.it**

Ceramics of Italy, the collective brand
of the Italian industry of ceramics
Edi.Cer. S.p.A, Via Monte Santo 40
41049 Sassuolo (MO)
Italy

Tel +39 536 804585
Fax +39 536 806510
Mail info@laceramicaitaliana.it
Web **www.laceramicaitaliana.it**