EPD

CERTIFICATION

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INSPIRA COLLECTION

GRUPPO CERAMICHE
GRESMALT

PLANTS:
- Via Mazzalasino, 39 – 42019 Scandiano (RE)
- Via Feleghetti, 26 - 42030 Viano (RE)
- Via Matilde di Canossa, 22 - 41044 Frassinoro (MO)

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ENVIRONMENTAL PRODUCT DECLARATION

Porcelain Stoneware Ceramic Tiles

in compliance with:
ISO 14025:2010 and
EN 15804:2012+A1:2013

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1. GENERAL INFORMATION

OWNER OF THE DECLARATION:	Gruppo Ceramiche Gresmalt S.p.A Strada Statale 467, n°45 – 42013 Casalgrande (RE) Italy
PLANTS INVOLVED IN THE EPD:	D060: Via Mazzalasino, n°39 – 42019 Scandiano (RE) Italy D020: Via Feleghetti, n°26 - 42030 Viano (RE) Italy D240: Via Matilde di Canossa, n°22 - 41044 Frassinoro (MO) Italy
PROGRAM OPERATOR:	EPDITALY (www.epditaly.it) Via Gaetano De Castillia, n° 10 - 20124 Milano, Italy
INDEPENDENT VERIFICATION:	This declaration has been developed in accordance with the EPDItaly Regulations; further information and the Regulations themselves are available on the website: www.epditaly.it. The EN 15804 standard is the framework reference for PCR (PCR ICMQ-001/15 rev 2). The PCR revision was carried out by ICMQ - info@epditaly.it. Independent verification of the declaration and data according to ISO 14025:2010. Internal ○ External ✓ Third party verification performed by: ICMQ S.p.A, Via Gaetano De Castillia, n°10 - 20124 Milan, Italy. Accredited by Accredia.
CPC-BASED CODE:	37370-0
COMPANY CONTACT:	Luca Lazzarini – Gruppo Ceramiche Gresmalt S.p.A Strada Statale 467, n°45 – 42013 Casalgrande (RE) Italy luca.lazzarini@gresmalt.it
TECHNICAL SUPPORT:	Department of Sciences and Methods for Engineering LCA Working Group University of Modena and Reggio Emilia Via Amendola n°2, Pad. Morselli - 42122 Reggio Emilia, Italy
COMPARABILITY:	Environmental declarations of products belonging to the same category but belonging to different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.
RESPONSIBILITY:	Gruppo Ceramiche Gresmalt lifts EPDItaly from any non-compliance with environmental legislation self-declared by the manufacturer itself. The holder of the declaration will be responsible for the information and supporting evidence; EPDItaly declines all responsibility for the manufacturer's information, data, and results of the life cycle assessment.
REFERENCE DOCUMENTS:	This declaration has been developed following the EPDItaly Programme Regulations, available on the website: www.epditaly.it.
PRODUCT CATEGORY RULES (PCR):	PCR ICMQ-001/15 rev2 IBU PCR Part B:30-11-2017 V1.6 EN 15804 provides the framework reference for PCR.

2. COMPANY PROFILE

Since its foundation in 1968, Gruppo Ceramiche Gresmalt has been a leading player in the Italian ceramic industry, becoming a reference in the production and sale of porcelain stoneware for floors and walls.
Based on three manufacturing units located in Italy, the Group has a production capacity of approximately 18 million m^2/year of porcelain stoneware tiles. The manufacturing processes are fully digitized and, through line sensors, real-time monitoring of technological and sustainability KPIs is carried out. In this way it is possible to ensure the quality of the finished product while respecting the environment.
Great importance is given to the relationship with customers by providing them with a customized service that can also include the co-designing of product lines. For this reason, the group has a structure dedicated to R&D and P&D that employs about 40 technicians distributed among the three plants and organized in different laboratories and design centers, according to the functions performed: product development, graphic research, technological testing and production supervision.
The ceramic tile collections cover the different architectural requirements for both floor and wall coverings, through the variety of sizes and thicknesses and the final cutting, rectifying and lapping finishes. These processes are carried out in-house through special departments equipped for this purpose.

SINTESI CERAMICA ITALIANA | ABITARE LA CERAMICA | ermes aurelia | FRASSINORO

The Group, using a modern logistics hub, distributes 75% of its ceramic tile production to the direct sales channel (business-to-consumer) through the B2C (business-to-consumer) and B2B (business-to-business) brands: Sintesi, Abitare la Ceramica and Ermes Aurelia. The remaining 25% is dedicated to the large-scale distribution market under the B2B brand: Frassinoro.
The Group has placed environmental, social and economic sustainability at the center of its business culture since 2005, when it was a pioneer in the ceramic sector and carried out its first environmental impact assessment with an LCA (Life Cycle Assessment) analysis.
Since 2015, through the support of the Italian Ministry of Economic Development and the European Commission, the company is implementing an ambitious innovation project aimed at introducing the three pillars of sustainability (environment, economy and society) into its business model, transforming it from linear to circular.

INNOVABILITY

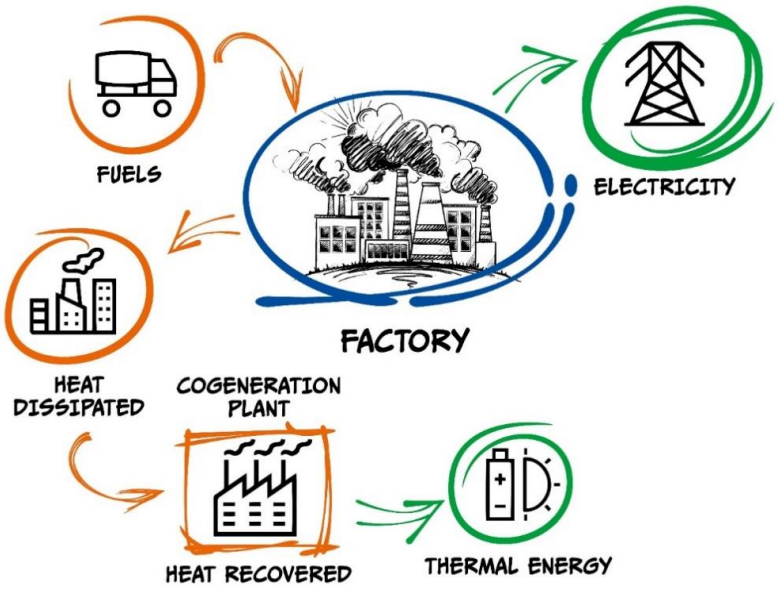
The integration between innovation and sustainability is a strategic line adopted by Gruppo Ceramiche Gresmalt to be a protagonist of a market in rapid and continuous evolution. With Innovability, the Group intends to increase the value of the company with a sense of responsibility towards the environment and the territory, society and future generations.
In the last 5 years, Gresmalt has transformed its manufacturing plants into real smart factories, due to an important investment plan. At the base of the digital transformation there is the convergence between Information and Operational Technologies, i.e. between hardware and software tools for information management, and control and automation solutions to support operations. By integrating all machines and plants with IoT technologies in the Industry 4.0 logic, the Group can provide constant monitoring and process optimization ensuring the constant quality of the ceramic tiles manufactured.
In line with its Innovability Strategy, Gruppo Ceramiche Gresmalt has developed and implemented a tool for real-time environmental, economic, and social impact assessment of production processes. This model is based on a dynamic monitoring system able to measure the environmental and socio-economic impacts of

the production process in real time through the digital technologies of IoT and Industry 4.0, of which all plants' have been progressively equipped. Compared to traditional impact assessment systems, which are based on historical, retrospective, inventory data, the new dynamic and digitized system called DYCTA (DYnamiC susTainability Assessment) is able to determine the impact that production activities have on the environment and society at the same time as they are produced, allowing for any immediate adjustment actions.

The Innovability strategy also translates into concrete actions for a more efficient use of resources and for minimizing the impact of industrial activities on the environment and society.

On the sourcing side, the selection of suppliers is made on the basis of the sharing of principles in the company's code of ethics. For this reason, the raw materials that compose the ceramic body are supplied by mining companies that conduct mining activities with an environmental recovery plan, in compliance with EU Directive 92/43/EEC (conservation of natural habitats and of wild fauna and flora), EU Directive 79/409/EEC (conservation of wild birds) and the 1992 United Nations Convention on Biological Diversity. In addition, for the transport of raw materials from mines to factories, preference is given to means of transport with less environmental impact such as rail, as well as the use of local or regional raw materials to reduce distances and, consequently, transport pollution.

In terms of energy efficiency, in 2019 Gruppo Ceramiche Gresmalt has successfully completed the installation and testing of the new high-efficiency cogeneration plant.



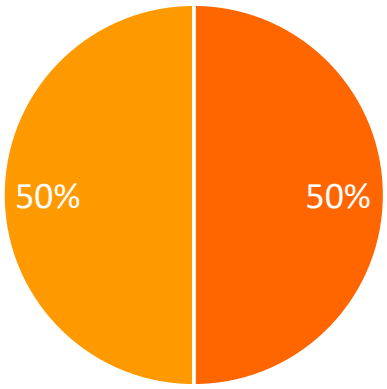
The system can self-produce 50% of the electrical energy needed by the three manufacturing plants. The equipment also provides thermal energy in the form of combustion fumes, which are recovered for the functioning of the spray driers in the ceramic body preparation unit. The new system allows a greater adaptation to the variability of electrical loads, optimizing the electrical production to the level of self-consumption of the factory and ensuring maximum heat recovery on the spray driers.

Gruppo Ceramiche Gresmalt totally recycles the wastewater used for washing plants and production lines, within the preparation phase of the ceramic body. This allows to satisfy 65% of the water requirements for the grinding of raw materials needed for the entire production of the three plants, the remaining 35% is taken from wells and/or the water supply.

ELECTRICITY CONSUMPTION

50 % Electricity produced by cogeneration

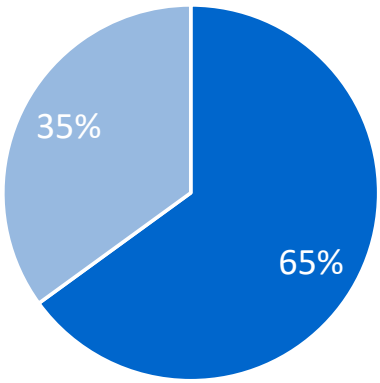
50 % Electricity supplied by the grid



WATER RECYCLING

65 % Re-used water in the grinding phase

35 % Water supplied by well/aqueduct



Raw material waste and waste from the manufacturing process are also totally recycled, introducing them as an additional component to the composition of the ceramic body.
In 2018, the Group achieved the goal of significantly reducing the amount of carbon dioxide (CO_2) emissions, confirming that it is on a good path towards achieving ambitious longer-term targets. Since 2010, the company has reduced CO_2 emissions by about 15% due to the significant investments made to upgrade its production facilities, which have now been transformed into real smart factories. IoT technologies and Industry 4.0 logic have made it possible to achieve greater energy efficiency and reduce water consumption. In addition, the transport system for raw materials has been optimized, favoring, when possible, the train as the most environmentally friendly way considering our supply scenario.
The carbon dioxide emissions are closely monitored with reference to the ETS Directive (European Emissions Trading Scheme). Particular attention is paid to the emissions into the atmosphere that are produced during the manufacturing process, due to the use of highly efficient baghouse filters that retain particulates. In addition, hydrated lime is used to minimize fluorine emissions from the firing process.
The ceramic tiles produced by Gruppo Ceramiche Gresmalt do not contain VOCs (volatile organic compounds) added even as a final finishing treatment. The ceramic product is an inorganic material and any residues of organic chemical compounds, which could generate VOCs, are destroyed during the firing phase at high temperature (> 1200°C) of the tiles. This is the reason why ceramic tiles do not release VOCs, formaldehyde and other toxic substances in indoor environments and are therefore classified A+.

3. SCOPE AND TYPE OF THE EPD

SYSTEM BOUNDARIES

The entire life cycle of the product is considered (cradle-to-grave) and the modules described below are declared in this EPD. In accordance with the framework defined by EN 15804, the following table shows the different phases of the life cycle of the ceramic product and identifies the specific phases (system boundaries) taken into consideration in this EPD.

PRODUCT STAGE			CONSTRUCTION STAGE		USE STAGE							END-OF-LIFE STAGE				RESOURCE RECOVERY STAGE
					Related to the building fabric					Related to the building						
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw materials sourcing	Transport	Manufacturing	Transport to site	Construction - Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery Recycling potential
√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

√: module included in the LCA
MND: Module Not Declared

Modules A1-A3 include the processes of production and consumption of energy and materials in the considered system (A1), transport of raw materials, auxiliary materials and packaging to the factory gate and all internal transports (A2), manufacturing processes, production of auxiliary materials and packaging, process waste treatments, gaseous emissions and the factory (A3).
Module A4 includes transport from the production plant to the customer or to the point of installation/implementation of the product considered.
Module A5 considers all phases of tile installation (such as adhesive consumption) and treatment of packaging waste (recycling). Material and energy credits are declared in module D.
Module B1 takes the use of tiles into consideration. During the use of ceramic tiles, the generation of hazardous indoor emissions is not expected.
Module B2 is about tile cleaning. It is considered the supply of water and detergent for tile cleaning, including wastewater treatment, during the entire life of the tiles (50 years).
Modules B3-B4-B5 refer to the repair, replacement, and renovation of tiles. If the tiles are correctly installed, repair, replacement and renovation processes are not necessary and are therefore not considered in the presented study.
Modules B6-B7 consider the use of energy for the operation of technical systems integrated in the building (B6) and the use of operating water for technical systems related to the building. These consumptions are not considered relevant with respect to the subject matter of this EPD. Cleaning water is declared in module B2.
Module C1 deals with the process of demolition and deconstruction of tiles from the building. It is not considered relevant from the point of view of environmental impacts.
Module C2 considers the transport of the demolished tile to a recycling or disposal process.
Module C3 considers each process (collection, crushing process, etc.) suitable for tile recycling.
Module C4 includes all landfill processes, including pre-treatment and disposal site management.

Module D includes credits from all end-of-life flows that leave the boundaries of the system of the product concerned.

TYPE OF EPD:

EPD related to the average porcelain stoneware tile manufactured in the three plants of Gruppo Ceramiche Gresmalt S.p.a located in Scandiano, Viano and Frassinoro.

GEOGRAPHICAL REPRESENTATIVENESS:

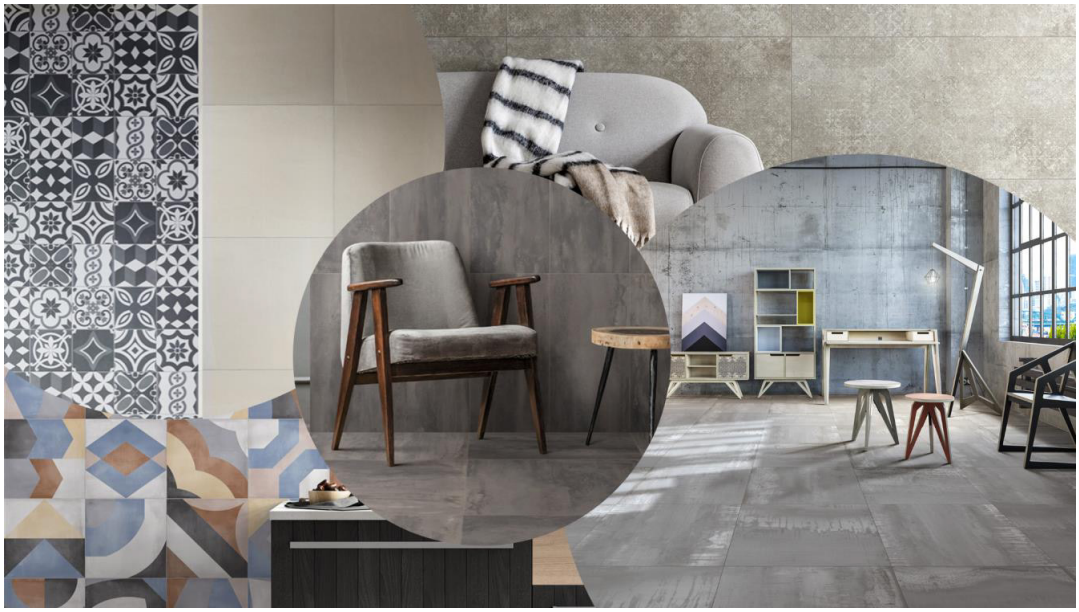
the environmental performance was calculated with reference to the plants in Scandiano (RE), Viano (RE) and Frassinoro (MO) in Italy. The reference market is instead global.

SOFTWARE AND DATABASE:

SimaPro v. 9.1 software was used to carrying out the LCA modelling with background LCI datasets taken from the Ecoinvent database v. 3.6.

4. PRODUCT DESCRIPTION

The production of Gruppo Ceramiche Gresmalt is focused on porcelain stoneware for floors and walls. The term porcelain stoneware refers to ceramic materials with a compact structure, characterized by the simultaneous presence of both the vitreous and crystalline phases, while the second term, porcelain, refers to the technical characteristics of the product, which make it similar to technical porcelain.



Porcelain stoneware is manufactured using inorganic raw materials of natural origin (illitic-caolinitic clays, sodium-potassium feldspars, and feldspathic sands). The tiles are obtained with a single firing cycle at high temperature (1220-1230°C) to achieve complete sintering of the ceramic body, which has antifreeze properties due to water absorption of less than 0.5% by weight.
The glazing and surface decoration gives the product valuable aesthetic effects, as well as resistance to staining agents and chemical reagents, making cleaning operations easier. For these properties, porcelain stoneware is the most performing type of ceramic from a technological point of view and it is used especially in solutions where high mechanical strength, frost resistance and chemical inertia are required.

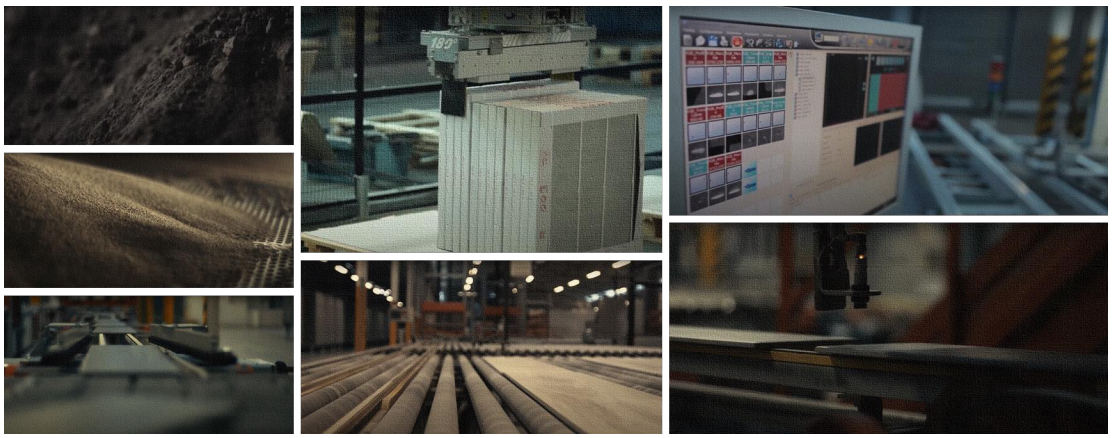
The range of products covered by this EPD includes porcelain stoneware tiles conforming to UNI EN 14411, ISO 13006 and belonging to the BIa Group (water absorption ≤ 0.5%), branded Sintesi, Abitare la Ceramica, Ermes Aurelia and Frassinoro, in different sizes and thicknesses.
Gresmalt porcelain stoneware is an eclectic ceramic material that adapts to style and furnishing requirements due to its wide range of sizes, decorations, and colors, as well as the choice of matt or glossy surfaces. This product complies with the following standards and specifications:

TECHNICAL CHARACTERISTIC	REFERENCE STANDARD	VALUE REQUIRED	COMPLIANCE WITH THE STANDARD
WATER ABSORPTION	ISO 10545-3	≤ 0.5%	according to
BREAKING STRENGTH	ISO 10545-4	thickness ≥ 7.5 mm ≥ 1300 N thickness < 7.5 mm ≥ 700 N	according to
BENDING STRENGTH	ISO 10545-4	≥ 35 N/mm²	according to
RESISTANCE TO ABRASION PEI	ISO 10545-7	according to manufacturer's data	indicated in the catalogue
THERMAL SHOCK RESISTANCE	ISO 10545-9	no sample must show visible defects	according to
FROST RESISTANCE	ISO 10545-12	resistant	resistant
SKID RESISTANCE (RAMP METHOD)	DIN 51130	according to manufacturer's data	indicated in the catalogue
SIZE CHARACTERISTICS	ISO 10545-2	length and width ± 0,6% (max ± 2 mm) thickness ± 5% (max ± 0.5 mm) wedging ± 0.5% (max ± 2 mm) flatness ± 0.5% (max ± 2mm)	according to
LINEAR THERMAL EXPANSION COEFFICIENT	ISO 10545-8	test method available	$\alpha \leq 7 \times 10^{-6}/°C$
RESISTANCE TO CHEMICALS	ISO 10545-13	min. B	according to
SLIP RESISTANCE FACTOR IN THE PRESENCE OF WATER AND BARE FEET	DIN 51097	according to manufacturer's data	indicated in the catalogue
STAIN RESISTANCE	ISO 10545-14	class ≥ 3	according to

The porcelain stoneware produced by Gruppo Ceramiche Gresmalt meets the technical specifications defined by the EN 14411 (ISO 13006) standards and test cases UNI ISO 10545 appendix G for ceramic tiles dry pressed with low water absorption E ≤ 0.5% group BIa.

5. MANUFACTURING PROCESS

The manufacturing process of Gruppo Ceramiche Gresmalt is a complete ceramic cycle that begins with the transformation of raw materials from the mines and ends with the logistics of the finished product.

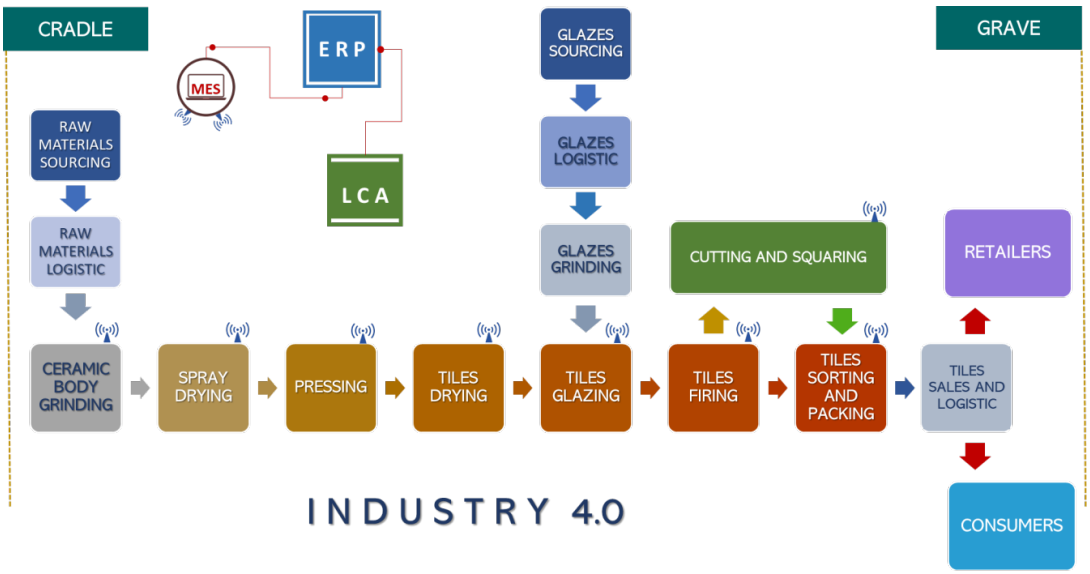


The production of ceramic tiles is a complex process consisting of several sub-processes and phases that have been mapped and schematized, as shown in the figure above.

The raw materials for the ceramic body are generally transported to the factory by trucks and are unloaded and stored in special covered areas, in separate batches depending on the type. From the storage warehouse, the raw materials are sent to the preparation department of the ceramic body for subsequent mixing in the ratios provided by the scheduled formula. The following table shows the compositional range of the porcelain stoneware body.

BODY RAW MATERIALS	MINIMUM (%)	MAXIMUM (%)
Illytic-caolinitic clays	20	35
Caolinitic clays	15	30
Sodium and Potassium feldspars	20	40
Feldspathic sands	5	15
Recycling materials	5	15
Fluidifying agents	0	0.5
Pigments for dry coloring	0	2

The raw materials are mixed and ground with water in continuous rotary mills until a solid/liquid suspension called slip is obtained, containing about 35-40% of water. The slip is then stored in underground tanks equipped with agitators. Then special pumps take the slip and nebulize it inside a vertical dryer (spry-dryer), where it is sprayed against the current with a flow of hot air (500-600◦C) which causes the instantaneous evaporation of most of the water. Through this process round agglomerates of particles with controlled particle size are formed, which are the spray-dried powder suitable for the next pressing phase.
Forming consists of shaping the tiles to the desired size and is carried out in the pressing operation that aims to compact the powders by applying a pressure (varying from 490 to 500 kg/cm^2), which modifies, rearranges and adheres the granules of a spray-dried ceramic body, with the aim of obtaining a raw compacted product. With drying, the residual water of the ceramic body (about 6–7%) is removed from the formed product in accordance with the need to guarantee the integrity of the tiles. This process allows to protect the product from breakage and dimensional distortions during the subsequent glazing, decoration and firing phases.



The preparation of the glazes (grinding in water of the various constituents) has the aim of obtaining the glazes ready for application in the form of an aqueous suspension of fine particles. Glazing and decoration consists of applying glazes and inks to the surface of previously pressed and dried tiles. The main components of the glazes and auxiliary additives used are the following:

GLAZES COMPONENTS	AUXILIARY ADDITIVES
Powdered clays	Suspending agents
Powdered kaolins	Dispersants
Powdered sodium-potassium feldspars	Binders
Powdered quartz	Glaze fixers
Powdered alumina	Primers for inkjet
Ceramic frits	Fluidifying agents
Ceramic stains	Mediums for digital inks

At this point, the pressed, glazed, and decorated tiles are led to the kilns for firing at temperatures that reach 1210–1230◦C with cycles of 35–50 min depending on the size. The firing of the tiles consolidates and sinters the support and/or glaze of the tiles, to give the product its mechanical characteristics of resistance and chemical-physical inertia, adapted to the various specific uses.
After firing, the tiles can be subjected to further processing: cutting, rectifying, polishing, lapping. Polishing consists of the controlled removal of the surface layer by means of special abrasive discs. Lapping is a finishing process consisting in carrying out an abrasion operation that gives the tiles a fairly smooth surface but not completely polished and reflective. Rectification allows to obtain perfectly squared tiles and cutting to obtain complementary formats (smaller) from the basic ones (larger).
For each phase of the process described above, data were collected on material flows, energy consumption (thermal and electrical), and emissions into the atmosphere. This procedure was implemented by exploiting the potential of IoT technologies, as the production plant analyzed was fully digitalized in line with the Industry 4.0 paradigm. As shown in the Figure above, smart meters were installed for each machine to monitor energy consumption in real time and to collect production data. This network of sensors was wirelessly connected with the MES (Manufacturing Execution System), a computer system that governs and controls the entire production process, from the release of the order to the finished product, aligning the business management needs with those of the factory and, thus, bridging the gap between the decision-making level and the executive level. The MES was then integrated with the ERP (Enterprise Resource Planning) providing real-time data on the execution of processes to allow, in addition to the current management of operations, also the inventory analysis for environmental assessment (LCA: Life Cycle Assessment). Since the ERP system is a common and shared database of transactional data from different sources in the organization (accounting, procurement, sales, production, and logistics), it has all the information needed to carry out the inventory analysis for the economic assessment (LCC: Life Cycle Costing).

FUNCTIONAL UNIT AND REFERENCE FLOW:

the covering of 1m^2 of surface (floor and wall) with porcelain stoneware ceramic tiles with an average weigh of 17.47 kg/m^2 and a lifetime of 50 years.

REFERENCE SERVICE LIFE:

the reference service life considered in the EPD is 50 years. The results of the Module B2 are referred to 50 years of maintenance of the tiles.

6. LIFE CYCLE ASSESSMENT RESULTS

The following tables show the results of the LCA (Life Cycle Assessment) study for 1 m^2 of porcelain stoneware tiles, corresponding to 17.47 kg/m^2. It is possible to convert the results referring to the kg using the following conversion factor 0.0572. The calculation method used for the analysis of the environmental impact is CML-IA baseline v. 3.06. The results of the Module B2 are referred to 50 years of maintenance of the tiles.

In addition, the results will be provided including the impacts of the infrastructures and machineries included in the process (Paragraphs 9.1, 9.2, 9.3).

6.1 ENVIRONMENTAL IMPACT

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
GWP	[kg CO_2 eq.]	8.69E+00	1.59E+00	3.13E+00
ODP	[kg CFC-11 eq.]	1.11E-06	2.93E-07	9.52E-08
AP	[kg SO_2 eq.]	1.97E-02	4.84E-03	1.14E-02
EP	[kg $(PO_4)^{3-}$ eq.]	5.96E-03	5.20E-04	2.80E-03
POCP	[kg C_2H_4 eq.]	1.07E-03	2.10E-04	5.80E-04
ADPE	[kg Sb eq.]	2.53E-05	1.07E-07	1.41E-06
ADPF	[MJ]	1.24E+02	2.26E+01	1.71E+01

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
GWP	[kg CO_2 eq.]	0.00E+00	1.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ODP	[kg CFC-11 eq.]	0.00E+00	5.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP	[kg SO_2 eq.]	0.00E+00	5.93E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP	[kg $(PO_4)^{3-}$ eq.]	0.00E+00	4.87E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
POCP	[kg C_2H_4 eq.]	0.00E+00	6.86E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ADPE	[kg Sb eq.]	0.00E+00	1.38E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ADPF	[MJ]	0.00E+00	1.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
GWP	[kg CO_2 eq.]	0.00E+00	1.17E-01	4.92E-02	1.25E-02	-7.95E+00
ODP	[kg CFC-11 eq.]	0.00E+00	2.16E-08	9.09E-09	2.25E-09	-2.24E-07
AP	[kg SO_2 eq.]	0.00E+00	1.95E-04	8.19E-05	9.44E-05	-2.56E-02
EP	[kg $(PO_4)^{3-}$ eq.]	0.00E+00	2.47E-05	1.04E-05	2.11E-05	-6.37E-03
POCP	[kg C_2H_4 eq.]	0.00E+00	9.84E-06	4.13E-06	1.92E-06	-1.71E-03
ADPE	[kg Sb eq.]	0.00E+00	8.12E-09	3.41E-09	5.92E-09	-1.14E-03
ADPF	[MJ]	0.00E+00	1.67E+00	7.01E-01	1.75E-01	-2.96E+02

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

6.2 RESOURCE USE

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
PERE	[MJ]	3.63E+00	3.26E-02	4.20E+00
PERM	[MJ]	1.96E+00	0.00E+00	0.00E+00
PERT	[MJ]	5.59E+00	3.26E-02	4.20E+00
PENRE	[MJ]	1.26E+02	2.26E+01	1.95E+01
PENRM	[MJ]	2.14E+00	0.00E+00	0.00E+00
PENRT	[MJ]	1.28E+02	2.26E+01	1.95E+01
SM	[kg]	1.65E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	1.08E-01	3.73E-05	1.29E-02

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.

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
PERE	[MJ]	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	[MJ]	0.00E+00	1.75E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	0.00E+00	1.75E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	0.00E+00	3.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+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 = Use of net fresh water.

1 m2 of Porcelain Stoneware Tiles (17.47kg/m2, S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
PERE	[MJ]	0.00E+00	2.41E-03	1.01E-03	2.07E-03	-1.77E+01
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	0.00E+00	2.41E-03	1.01E-03	2.07E-03	-1.77E+01
PENRE	[MJ]	0.00E+00	1.67E+00	7.02E-01	1.75E-01	-3.07E+02
PENRM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	0.00E+00	1.67E+00	7.02E-01	1.75E-01	-3.07E+02
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	0.00E+00	3.28E-06	1.38E-06	4.17E-06	-1.23E-01

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.

6.3 OUTPUT FLOWS AND WASTE CATEGORIES

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
HWD	[kg]	1.56E-02	0.00E+00	0.00E+00
NHWD	[kg]	1.48E-03	0.00E+00	0.00E+00
RWD	[kg]	0.00E+00	0.00E+00	0.00E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	8.17E-01	0.00E+00	1.43E+00
MER	[kg]	2.73E-03	0.00E+00	0.00E+00
EEE	[MJ]	2.12E-01	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00

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.

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
HWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	4.88E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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.

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
HWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	[kg]	0.00E+00	0.00E+00	0.00E+00	5.24+00	0.00E+00
RWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	1.22E+01	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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.

6.4 TRACI INDICATORS

According to UL, USA program operator, TRACI indicators (version 2.1), from EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts, are listed below:

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
Global Warming	[kg CO_2 eq]	8.63E+00	1.59E+00	3.12E+00
Ozone Depletion	[kg CFC-11 eq]	1.36E-06	3.91E-07	1.22E-07
Acidification	[kg SO_2 eq]	2.23E-02	4.59E-03	1.17E-02
Eutrophication	[kg N eq]	9.64E-03	1.15E-03	5.09E-03
Smog	[kg O_3 eq]	4.67E-01	4.71E-02	1.41E-01

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
Global Warming	[kg CO_2 eq]	0.00E+00	1.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ozone Depletion	[kg CFC-11 eq]	0.00E+00	7.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acidification	[kg SO_2 eq]	0.00E+00	6.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication	[kg N eq]	0.00E+00	1.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Smog	[kg O_3 eq]	0.00E+00	5.56E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
Global Warming	[kg CO_2 eq]	0.00E+00	1.17E-01	4.92E-02	1.25E-02	-7.79E+00
Ozone Depletion	[kg CFC-11 eq]	0.00E+00	2.88E-08	1.21E-08	3.00E-09	-3.03E-07
Acidification	[kg SO_2 eq]	0.00E+00	1.91E-04	8.04E-05	1.22E-04	-2.53E-02
Eutrophication	[kg N eq]	0.00E+00	4.53E-05	1.90E-05	1.14E-05	-1.19E-02
Smog	[kg O_3 eq]	0.00E+00	2.47E-03	1.04E-03	3.76E-03	-3.06E-01

6.5 INTERPRETATION OF THE RESULTS

A1-A3 are the modules with most of the impact ranging from 41.7% (Photochemical oxidation category) to 69.8% (Ozone layer depletion category). In particular, the major impacts on global warming potential (GWP) category are generated by *carbon dioxide fossil* emission the during atomization and firing phases. The ozone layer depletion (ODP) category is affected by *methane, bromochlorodifluoro* (*Halon 1211*) emission in air generated during the transport of the natural gas with pipelines. Eutrophication potential (EP) is influenced by *nitrogen oxides* emission in air generated by water transport of raw materials and by *phosphate* emission in water due to the production of electric energy used in the manufacture process. *Sulfur dioxide* emission in air produced by natural gas consumption afflicts both Photochemical oxidation category (POCP) and Acidification potential (AP) categories. Abiotic depletion potential for non-fossil resources (ADPE) is primary affected by *gold* needed for the zinc production used to manufacture the corrugated boards for the packaging; finally, natural gas consumption controls abiotic fossil depletion (ADPF).

7. CALCULATION RULES

FUNCTIONAL UNIT:

NAME	AMOUNT	UNIT
Functional unit	1	m^2
Weight	17.47	kg/m^2
Conversion factor	0.0572	-

ASSUMPTIONS:

The transport scenario considered in Module A4 and also the data related to module A5-C4 have been taken from the PCR "European Federation of Ceramic Tile Manufacturers", subsequently implemented by the PCRb of the IBU program operator "Ceramic tiles and panels v1.6".

CUT OFF RULES:

all input and output processes were considered in the analysis and thus in the final results without any exclusion (cut-off: 0).

DATA QUALITY:

for the product stages (A1-A3), primary data relating to consumption of raw and auxiliary materials, water consumption, energy consumption, waste production, atmospheric emissions, distances, and types of transport relating to the production plants concerned were used. In compliance with the requirements of standard EN 15804, the most updated data available for the 1-year production period (01/01/2018 - 31/12/18) were considered. For the upstream and downstream phases, which are outside the manufacturer's direct control, secondary data from the international database Ecoinvent v. 3.6 were used.

ALLOCATIONS:

input and output processes refer to the total annual production of each plant. As regards the cogeneration process, the allocations are based on the thermal and electrical efficiency of the plant.

8. SCENARIOS AND ADDITIONAL INFORMATION

The following technical information regarding the declared modules and their scenarios is based on average data, in accordance with the "European Federation of Ceramic Tile Manufacturers" and subsequently implemented by the PCRb of the IBU program operator "Ceramic tiles and panels v1.6".

Transport (A4): the freight transport products describe the transport services in metric ton-kilometres with average load factors that include the average share of empty return trips; this assumption is valid for all the transports in this analysis. Additional information for the transport related to Module A4 are reported in the following table.

NAME	VALUE	UNITS
National destination truck with a capacity of 16-32 tons (51 % of tiles sold)	300	km
European destination truck with a capacity of 16-32 tons (34% of tiles sold)	1390	km
Transoceanic freight ship	6520	km

Installation in the building (A5): For the installation phase, 3 options are defined in which different materials can be used. For option 1, adhesives, mortar, and water, for option 2 mortar and polysulphide dispersion

adhesives, for option 3 also cement adhesives (different quantities for different tile sizes). These considerations are based on average data provided by different ceramic tile manufacturers in Europe. In this EPD it is assumed that the tiles are installed using cementitious adhesive (option 3). For the treatment of packaging waste end-of-life consists of recycling has been considered for plastic, cardboard, and wood. The loss of ceramic material considered is 6.5%.

NAME	VALUE	UNITS
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 50 years for residential use and are described in the table below.

NAME	VALUE	UNITS
Water consumption	0.1	l
Detergent	0.2	ml
Floor tile maintenance cycle	2400	Number/LS
Wall tile Maintenance cycle	200	Number/LS

Residential use: 0.2 ml of detergent and 0.1 l of water are used to wash 1 m^2 of ceramic tiles once a week for floor covering. The scenario of this phase is based on average data provided by different ceramic tile manufacturers in Europe.
Repair, replacement, and refurbishment (B3, B4, B5): In general, the service life of ceramic tiles is the same as the building lifetime. 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 (C3-C4), the end-of-life scenario is described in the following table:

NAME	VALUE	UNITS
Percentage of recycled material (C3)	70	%
Percentage of material in landfill (C4)	30	%

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

9. ADDITIONAL ENVIRONMENTAL INFORMATION

Porcelain stoneware tiles are a ceramic material that is intrinsically inert, chemically stable and therefore, during the use phase, does not emit pollutants or substances hazardous to the environment and health, for example: VOCs and radon.
The design and construction of new buildings are activities that have a significant environmental impact on the territory. To regulate these activities, the Italian Ministry of the Environment introduced in 2017 the Minimum Environmental Criteria, also known by the acronym CAM. They are aimed at directing Public Administrations towards a rationalization of consumption and purchases by providing indications for the identification of design solutions, products or services that are better from an environmental point of view.

CAM are therefore parameters established by the Italian State to regulate the construction of new buildings, their design, but also the renovation and maintenance of existing buildings. On the public administration side, they represent the environmental requirements for the various phases of the public administration's purchasing process, aimed at identifying the best design solution, product or service from an environmental point of view along the life cycle, taking into account the market availability.
CAM are regulated by art. 18 of Law no. 221/2015 and, subsequently, by art. 34 containing "Criteria of energy and environmental sustainability" of Legislative Decree no. 50/2016 "Procurement Code" (amended by Legislative Decree no. 11 October 2017), which made it mandatory for all contracting stations to apply them. The porcelain stoneware manufactured by Gruppo Ceramiche Gresmalt complies with CAM requirements, as shown in the table below.

REQUIREMENT	PARAMETER	DECLARED VALUE	EXCLUSION THRESHOLD	UNIT	TEST METHOD
WATER CONSUMPTION AND USE	Fresh water consumption (Cwp-a) in production	< 1	> 1	l/kg	-
	Quotient of wastewater recycling in production	> 90	< 90	%	-
AIR EMISSIONS	Particulates (dust), cold emissions	< 5	> 5	g/m²	EN 13284-1
	Particulates (dust), firing	< 200	> 200	mg/m²	EN 13284-1
	Fluorides (HF)	< 200	> 200	mg/m²	ISO 15713
EMISSIONS INTO WATER	Emissions of suspended solids into water	0.0	> 40	mg/l	ISO 5667-17
	Cd emissions into water	0.0	> 0.015	mg/l	ISO 8288
	Cr(VI) emissions into water	0.0	> 0.15	mg/l	ISO 11083
	Pb emissions into water	0.0	> 0.15	mg/l	ISO 8288
WASTE RECOVERY	Recovery of total waste generated by the process(es) (1)	> 85	< 85	wt %	-

Note (1): evaluated according to the general terms and definitions contained in Council Directive 75/442/EEC. Process waste does not include maintenance waste, organic waste, and municipal waste from ancillary and administrative activities.

For ceramic tiles, the criterion uses the following parameters among those adopted at European level for the award of the Ecolabel to the "hard coverings" category (Decision 2009/607/EC).

9.1 ENVIRONMENTAL IMPACT OF THE SCENARIO WITH INFRASTRUCTURES AND MACHINERIES

For a more detailed analysis, the results of the assessment have been also provided including the impacts of infrastructures, plants and machineries involved in the process, in order to evaluate their contribution for each category.
The results related to output flows and waste categories remain unchanged.

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
GWP	[kg CO_2 eq.]	9.35E+00	1.94E+00	3.23E+00
ODP	[kg CFC-11 eq.]	1.17E-06	3.51E-07	1.06E-07
AP	[kg SO_2 eq.]	2.36E-02	6.77E-03	1.21E-02
EP	[kg $(PO_4)^{3-}$ eq.]	7.60E-03	1.21E-03	3.05E-03
POCP	[kg C_2H_4 eq.]	1.28E-03	3.10E-04	6.16E-04
ADPE	[kg Sb eq.]	8.99E-05	4.63E-05	1.81E-05
ADPF	[MJ]	1.32E+02	2.85E+01	1.83E+01

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
GWP	[kg CO_2 eq.]	0.00E+00	1.38E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ODP	[kg CFC-11 eq.]	0.00E+00	6.92E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP	[kg SO_2 eq.]	0.00E+00	6.92E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP	[kg $(PO_4)^{3-}$ eq.]	0.00E+00	5.31E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
POCP	[kg C_2H_4 eq.]	0.00E+00	7.38E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ADPE	[kg Sb eq.]	0.00E+00	4.09E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ADPF	[MJ]	0.00E+00	1.65E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
GWP	[kg CO_2 eq.]	0.00E+00	1.42E-01	5.97E-02	2.22E-02	-8.65E+00
ODP	[kg CFC-11 eq.]	0.00E+00	2.60E-08	1.09E-08	8.69E-09	-2.68E-07
AP	[kg SO_2 eq.]	0.00E+00	3.36E-04	1.41E-04	1.62E-04	-2.79E-02
EP	[kg $(PO_4)^{3-}$ eq.]	0.00E+00	7.40E-05	3.11E-05	3.62E-05	-1.02E-02
POCP	[kg C_2H_4 eq.]	0.00E+00	1.72E-05	7.20E-06	5.58E-06	-1.89E-03
ADPE	[kg Sb eq.]	0.00E+00	3.57E-06	1.50E-06	2.11E-07	-1.33E-03
ADPF	[MJ]	0.00E+00	2.11E+00	8.85E-01	7.12E-01	-3.04E+02

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

9.2 RESOURCE USE OF THE SCENARIO WITH INFRASTRUCTURES AND MACHINERIES

1 m^2 of Porcelain Stoneware Tiles (17.47kg/m^2, S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
PERE	[MJ]	4.53E+00	4.64E-01	4.40E+00
PERM	[MJ]	1.96E+00	0.00E+00	0.00E+00
PERT	[MJ]	6.49E+00	4.64E-01	4.40E+00
PENRE	[MJ]	1.34E+02	2.92E+01	2.08E+01
PENRM	[MJ]	2.14E+00	0.00E+00	0.00E+00
PENRT	[MJ]	1.36E+02	2.92E+01	2.08E+01
SM	[kg]	1.65E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00
FW	[m^3]	1.60E-01	3.48E-03	1.38E-02

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.

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
PERE	[MJ]	0.00E+00	1.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	0.00E+00	1.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	[MJ]	0.00E+00	1.90E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	0.00E+00	1.90E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	0.00E+00	3.52E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+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 = Use of net fresh water.

1 m2 of Porcelain Stoneware Tiles (17.47kg/m2, S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
PERE	[MJ]	0.00E+00	3.29E-02	1.38E-02	1.14E-02	-1.96E+01
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	0.00E+00	3.29E-02	1.38E-02	1.14E-02	-1.96E+01
PENRE	[MJ]	0.00E+00	2.16E+00	9.05E-01	7.23E-01	-3.15E+02
PENRM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	0.00E+00	2.16E+00	9.05E-01	7.23E-01	-3.15E+02
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	0.00E+00	2.53E-04	1.06E-04	8.66E-04	-1.30E-01

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.

9.3 TRACI INDICATORS OF THE SCENARIO WITH INFRASTRUCTURES AND MACHINERIES

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		PRODUCT STAGES		
Parameter	Unit	A1-A3	A4	A5
Global Warming	[kg CO_2 eq]	9.29E+00	1.94E+00	3.22E+00
Ozone Depletion	[kg CFC-11 eq]	1.44E-06	4.65E-07	1.36E-07
Acidification	[kg SO_2 eq]	2.64E-02	6.65E-03	1.24E-02
Eutrophication	[kg N eq]	1.29E-02	2.42E-03	5.57E-03
Smog	[kg O_3 eq]	5.25E-01	8.30E-02	1.51E-01

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		USE STAGES						
Parameter	Unit	B1	B2	B3	B4	B5	B6	B7
Global Warming	[kg CO_2 eq]	0.00E+00	1.38E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ozone Depletion	[kg CFC-11 eq]	0.00E+00	8.41E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acidification	[kg SO_2 eq]	0.00E+00	7.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication	[kg N eq]	0.00E+00	1.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Smog	[kg O_3 eq]	0.00E+00	6.52E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 m² of Porcelain Stoneware Tiles (17.47kg/m², S.L. 50 years)		END-OF-LIFE STAGES				
Parameter	Unit	C1	C2	C3	C4	D
Global Warming	[kg CO_2 eq]	0.00E+00	1.42E-01	5.97E-02	2.21E-02	-8.48E+00
Ozone Depletion	[kg CFC-11 eq]	0.00E+00	3.45E-08	1.45E-08	1.16E-08	-3.57E-07
Acidification	[kg SO_2 eq]	0.00E+00	3.43E-04	1.44E-04	1.96E-04	-2.81E-02
Eutrophication	[kg N eq]	0.00E+00	1.36E-04	5.71E-05	3.63E-05	-2.02E-02
Smog	[kg O_3 eq]	0.00E+00	5.14E-03	2.16E-03	5.23E-03	-3.65E-01

10. REFERENCES

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