Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Slate stone pieces

from

MICAPEL SLATE

Programme:	The International EPD® System EPD registered through the fully aligned regional programme: Hub EPD Brasil. More information at www.environdec.com
Programme operator:	EPD International AB, Regional Hub: EPD Brasil. www.environdec.com
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Valid until:	2029-02-28

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *Construction products, 2019:14, version 1.3.1, UN CPC Code 37690*
PCR review was conducted by: *The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com. The review panel may be contacted via info@environdec.com.*
Life Cycle Assessment (LCA)
LCA accountability: *Henrique Rogerio Antunes de Souza Junior, EnCiclo Soluções Sustentáveis*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Alejandro Pablo Arena* *Universidad Tecnologica Nacional (UTN-FRM)* Approved by: The International EPD® System
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by accredited certification body Third-party verification: <*name, organisation*> is an approved certification body accountable for the third-party verification The certification body is accredited by: <*name of accreditation body & accreditation number, where applicable*>
OR

Independent third-party verification of the declaration and data, according to ISO 14025:2006 via:

☐ EPD verification by EPD Process Certification*

Internal auditor: *<name, organisation>*

Third-party verification: *<name, organisation>* is an approved certification body accountable for third-party verification

Third-party verifier is accredited by: *<name of accreditation body & accreditation number, where applicable>*

*For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI.

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

List of changes

Date	Rev.	Notes
2024-04-08	1.0	First issue
2024-05-22	1.1	• Adjustment in all tables of modules C1 and C3 to '0.00E+00' (were 'ND'); • Addition of column 'D' in all tables, also with values '0.00E+00'; • Adjustment of all values to scientific notation (1.23E+45)

Company information

Owner of the EPD: MICAPEL SLATE

Contact: Mariângela Kohler [mariangela.kohler@micapel.combr]

Description of the organisation:

Since 1988, MICAPEL SLATE is one of the leading companies in prospecting, extraction, processing, and export slate of the world. Offering products that follow a high standard of quality and are available in a wide variety of colours, finishes and applications. MICAPEL are specialized in serving distributors and companies in need of slate products, such as slabs, floors, tiles, wall coverings, mosaics and bands, shards, benches, barrels, fillets, and other special pieces that fit into different designs.

MICAPEL SLATE has qualified and updated professionals with the technologies and processes to produce in a more efficient way, following carefully all the steps of production of the orders of its clients. Through various measures, MICAPEL works to preserve the environment, establishing partnerships and cooperating with national, state, and local bodies, keeping up with legislation and supporting initiatives that contribute to the preservation and less environmental impact in its deposits and units.

Product-related or management system-related certifications:

BS EN 12372:2022. Natural Stone Test Methods. Determination of Flexural Strength Under Concentrated Load.

BS EN 1341:2012. Slabs of natural stone for external paving. Requirements and test methods.

BS EN 12326-1:2014. Slate and stone for discontinuous roofing and external cladding. Specifications for slate and carbonate slate

Name and location of production site(s):

INDUSTRIAL PLANT

Rodovia MG 420, KM 30 – Fazenda São José da Vereda Zona Rural, Papagaios – MG, 35669-000

Minas Gerais – Brasil

Product information

Product name: Slate stone pieces

Product identification: Decorative slate stones are remarkably versatile natural materials that boast aesthetic appeal, originating from layers of clayey shale subjected to high pressures and temperatures over thousands of years. Arising from the metamorphism of sedimentary rocks, particularly shale, these metamorphic rocks primarily comprise minerals like mica, quartz, and chlorite, among other silicates. This unique geological process imparts slate with a smooth, uniform texture and a diverse array of colours and patterns, ranging from shades of grey, black, green, and purple to occasional hints of red. Notably, these stones stand out not only for their strength and durability but also for the rich palette of natural hues they offer, rendering them highly sought after for both functional and decorative applications in architectural and design projects.

Product description: Thanks to their inherent properties, slate stones find versatile and creative applications in both indoor and outdoor settings. Serving as roof tiles, flooring, wall cladding, decorative panels, or even in furniture such as countertops and tabletops, these stones provide virtually limitless design possibilities. Beyond their physical qualities, their decorative potential shines particularly bright. The varied shades and textures enable the creation of unique, elegant spaces, and the careful selection of stone colours and sizes can be tailored to match the style and preferences of each project. By combining durability with aesthetics, decorative slate stones can transform spaces into visual works of art, enhancing the intrinsic beauty of materials in architectural and decorative applications.

UN CPC code:

376 Monumental or building stone and articles thereof.

37690 Other worked monumental or building stone and articles thereof; other artificially coloured granules, chippings, and powder of natural stone; articles of agglomerated slate.

Characteristics	Description/values
Applications	Floor; Roof tile; Polished pieces; Natural pieces; Calibrated slate blocks; Brushed slate blocks; Natural slate blocks.
Sizes*	300 mm x 300 mm; 300 mm x 600 mm; 400 mm x 600 mm; 400 mm x 800 mm; 500 mm x 500 mm; 600 mm x 600 mm; 700 mm x 700 mm; 800 mm x 800 mm; 900 mm x 600 mm; 900 mm x 900 mm; 1000 mm x 1000 mm.
Thickness*	7 mm – 35 mm.
Specific weight	2,740 kg/m³
Rupture strength	Class 5
Abrasion resistance	23.5 mm – 25 mm
Slip resistance	39 – 57
Thermal resistance	T1
Water absorption	0.33% – 0.36% A1
Non-carbonated carbon	0.04% – 0.07%
Calcium carbonate	0.9% – 1.3%
Sulphur dioxide	S1
Fire resistance	Class A1

*Special sizes and thicknesses, ranging from 100x100mm to 1200x600mm, can be produced according to customer specifications.

LCA information

Declared unit: 1 kg of slate stone pieces.

Reference service life:

No declaration by the RSL according to the standard is given. With reference to long-term professional experience, a use period of more than 50 years is possible.
Furthermore, according to the US Green Building Council this could have the same duration as the useful life of the building itself; therefore, a duration of **60 years** represents an alternative service life value for the slate stone pieces.

Time representativeness: January 2022 to December 2022.

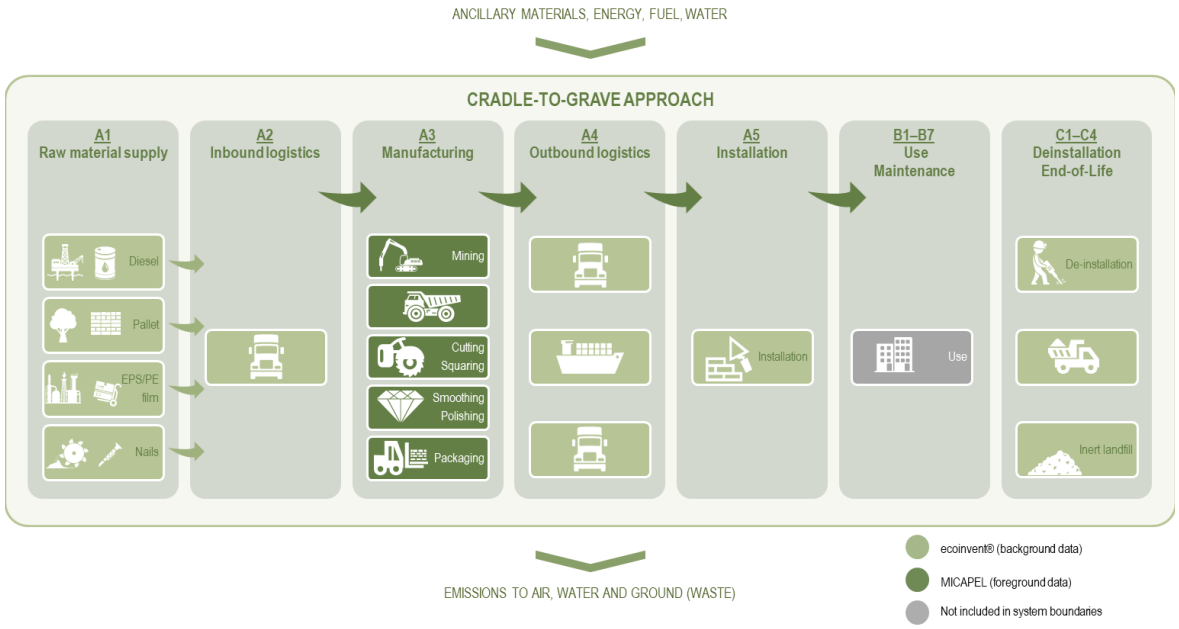
Database(s) and LCA software used:

openLCA® (2.0.2) software developed by GreenDelta was used to create product system model.
ecoinvent® (3.9.1) database provided the life cycle background data for product system modelling.

System boundaries:

Cradle to gate with options (modules A4 and A5), modules C1–C4, and module D.

System diagram:



Description of system boundaries:

Raw Materials supply:

Diesel fuel is a common distillate fuel oil sold used in motor vehicles with compression ignition engine. Diesel is consumed to supply the rock extraction machinery, as well as the trucks that transport the extracted rocks to the factory. Wooden pallets are made using the core of a tree as raw material. The lumber used to make pallets is a mixture of hardwood or softwood species. The pieces are put together by hand with pneumatic nailers and staplers. Nails are used as fasteners to join the wooden pallet parts together. The polymers are synthesized via polymerization, a process in the petroleum industry where light olefin gases (gasoline) such as ethylene, propylene, butylene (i.e., monomers) are converted into higher molecular weight hydrocarbons (polymers such as polyethylene/PE and expanded polystyrene/EPS). At MICAPEL product system, PE and EPS are used as primary packaging to assure the stone integrity during outbound logistics.

Inbound logistics:

Auxiliary products are received at the factory after being transported by truck, consuming diesel. They arrive in bulk in a tanker truck, and other products are transported in trucks without specification. Both consume diesel in the transport stage.

Manufacturing:

The natural slate production process starts with the extraction in an open-cast mine. Slate is extracted directly from the mountain surface in an open cast site which can be identified as quarry mine using mainly two different saws to produce vertical or horizontal cuts in the rock: disc/crosscut saw or a chain saw. The main steps followed in mining are quarry stripping, blasting, extraction, and transportation to processing. Quarry stripping refers to the process of removing all dirt and unwanted disintegrated material from the quarry face. This process is typically done at the beginning of quarry operations and involves stripping the overburden, which is the soil and subsoil above the bedrock. The overburden is removed using an excavator or other heavy equipment. During the quarrying phase, a primary cut is carried out to open a bench, which is subsequently tipped and divided into blocks of commercial dimensions (Bianco and Blengini, 2019). According to the quality and the characteristics of the specific blocks (presence of fractures, color, dimensions, etc.), they are classified and destined to different uses. This process is applied in case of hard stone or hard rock which does not contain any cracks or fissures. When extraction and mining are finished, the stone is sent to the factory for the finishing stages where the product is molded according to the application and desired characteristics. The transport is made by trucks, consuming diesel in the process. Processing adds value to the product and enables its industrial use. During cutting, stone blocks are transported to processing plants and cut into slabs, tiles, or thickness, according to the market requests. When necessary, a previous squaring of the block is carried out (Bianco and Blengini, 2019). Finally, with the finishing phase, stone products can be submitted to different surface treatments according to the customer requests (such as smoothing, polishing, sand blasting, etc.). For the product system under assessment, smoothing and polishing are applied. The smoothing of the surface of the stone produces an even finish and removes most traces of toolmarks. It is a mechanical process able to eliminate the surface irregularities of the cutting phase and improve the planarity. Generally, smoothing and polishing are carried out in succession by the same machinery (Bianco and Blengini, 2019). Polishing treatment is posterior to the smoothing, where cement-based, resin-based, or acidic-based pads with different abrasion properties are used to rub the stone mechanically until it attains natural glossy shining. Beyond the brightness, this treatment is also useful to close the stone superficial pores to limit water infiltrations. Primary packaging is essential to guarantee the safety and integrity of the product until it reaches the market. It is composed by a blanket made from expanded polystyrene (EPS) placed in the slate and packed with polyethylene (PE) canvas and straps. After the primary packaging, the products are placed in wooden pallets for distribution.

Outbound logistics:

After the finishing process, the product is packaged and stored for distribution. The product is shipped worldwide, with a particular focus on Europe. It departs by truck in containers from the state of Minas Gerais to the port of Rio de Janeiro. From there, the product is exported and transported by ship to various ports around the world, where it undergoes further distribution. The transportation to retail stores and distribution centers is conducted by trucks, which involves diesel consumption in the process.

Installation:

The product is purchased by the final consumer in retail stores and installed according to the instructions given by the manufacturer. Installing natural stone flooring must be carried out carefully and by specialized personnel. As with most products, the first step is to prepare the substrate, the surface on which the stone tile will be laid. Concrete and plywood are the most common surface on which stone and tile are installed. For stone and tile installation any subfloor that could shrink, expand, or move in anyway requires a cement backer unit, or cementitious backer unit (CBU), to provide stability and act as a moisture barrier. Polymer based adhesives are highly recommended to glue the stone surface to the substrate. At MICAPEL product system, only the breakage was considered at baseline scenario.

Use/Maintenance:

If necessary, during the use phase of the life cycle, the flooring can be repaired to maintain the quality of the installation. Uneven or rocking stones can be rebedded in coarse sand or hydraulic lime mortar, although slight undulations might be reduced with simple matting. Deep holes or chipped edges in stone flooring can be filled with a hydraulic lime mortar. Old stone floors usually only require regular sweeping or vacuuming and occasional washing with minimal quantities of water. Since repair/maintenance is highly dependent on the consumers use pattern and often do not occur during the reference service life of the slate stone, this step was not considered in this LCA/EPD.

De-installation:

The manual removal of slate stones from a construction involves the detachment of stones using appropriate tools such as chisels, levers, or even picks and sledgehammers. Once removed, the stones are stacked or placed in suitable containers to facilitate transportation to the designated landfill site. At the landfill, the stones are unloaded and arranged in accordance with local regulations and landfill procedures. The primary focus is on the proper disposal of the slate stones, with less attention given to the integrity of the stones since they will not be reused in other projects.

End-of-life (EoL):

Construction and demolition waste, dirt, rocks, debris, etc. are classified as inert waste. This class of waste has a specific destination in inert waste landfills, disposal facilities that accept only wastes that will not or are not likely to cause production of leachate of environmental concern. This LCA/EPD considers the EoL of the stone as disposed into inert landfill.

More information:

Cut-off criteria:

According to the EN 15804:2012+A2:2019 (BSI, 2019) standard, the criteria for excluding inputs and outputs (cut-off criteria) are intended to enable efficient modelling procedures and should not be used to conceal data. The following procedures must be followed for the exclusion of inputs and outputs (BSI, 2019):

- All inputs and outputs of a process (unit) for which data is available must be included in the calculation. Data gaps can be filled with conservative assumptions using average or generic data. Any assumptions for such choices should be documented;

- In case of insufficient input data or data gaps for a process unit, the cut-off criteria should be 1% of the energy use and 1% of the total mass input of that process unit. The total of neglected input flows should not exceed 5% of energy consumption and mass;
- Special care should be taken to include material and energy flows known to have the potential for causing significant emissions to air, water, or soil related to the environmental indicators of the study in question;
- Conservative assumptions combined with considerations of plausibility and expert opinion can be used to demonstrate compliance with these criteria.

Therefore, for the present study, the aim was to consider the entirety of input and output flows of the entire product system. However, in compliance with the criteria defined by BS EN 15804:2012+A2:2019 (BSI, 2019), aspects and impacts associated with the infrastructures of any stage in the slate stone pieces product system life cycle were not taken into account due to their extended lifespan. This fact is reflected in an infinitesimal fraction (both in terms of mass and energy) when proportionally distributed for the execution of the defined declared unit.

Allocation:

ISO 14044 provides a stepwise procedure (section 4.3.4.2) to recommend the choice of an allocation approach for the foreground processes. For the background datasets (unit process) from ecoinvent® database it was assumed the default allocation based on the economic value for the multi-output processes. More information on the allocation procedures by ecoinvent® database can be found on Weidema et al. (2013). Regarding the foreground model, no allocation criteria needed to be applied along the central reference flows, as all data had already been proportionally assigned. As for the waste flows exiting the system for recycling purposes which take place outside the boundaries of the product system, only impacts related to the transport of the waste to the treatment platform were considered (following the recommendation of PCR 2019:14: “At the system boundary, cut-off allocation shall be applied, i.e., all unit processes before the point of end-of-waste shall be assigned to the product system generating the waste and all unit processes after the point of end-of-waste shall be assigned to the subsequent product system”).

The cut-off is an allocation method rule that assumes that all environmental burdens and benefits remain with the user of the recycled materials, i.e., the subsequent systems that use the waste generated from the first system as raw materials. This is a simpler allocation approach and a more conservative one that assumes the waste generated by the first systems has zero value and begins to gather value and function from the collection point for the second system (recycler).

Emission factor for the electricity production:

0.1687 kg CO_2 eq./kWh (represents the GWP-GHG of the Brazilian national grid).

Name and contact information of LCA practitioner:

EnCiclo SOLUÇÕES SUSTENTÁVEIS	**EnCiclo Soluções Sustentáveis Ltda. Florianópolis, Brazil**	Tel:	Florianópolis: +55 48 99144-9245 São Paulo: +55 11 95694-7217
		Mail:	guilherme@enciclo.com.br
		Web:	www.enciclo.com.br

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	NR	NR	NR	NR	NR	NR	NR	X	X	X	X	X
Geography	BR	BR	BR	Global	Global	Global	Global	Global	Global	Global	Global	Global	Global	Global	Global	Global	Global
Specific data used	>95%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X = module included in EPD
NR = module not relevant (does not indicate zero impact result)

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Natural stone, slate	1 kg	0 kg – 0%	0 kg – 0%
-	-	-	-
TOTAL	1 kg	0 kg – 0%	0 kg – 0%
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Wood [eucalyptus/pinus]	0.0567 kg	5.67%	0.0283
Styrofoam/blanket/EPS	1.09E-04 kg	0.01%	0.0000
PE Straps	1.59E-04 kg	0.02%	0.0000
PE Canvas	4.21E-04 kg	0.04%	0.0000
Nails	4.43E-04 kg	0.04%	0.0000
-	-	-	-
TOTAL	0.0574 kg	5.74%	0.0283

Substances of very high concern (SVHC)

These products contain no substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency.

Results of the environmental performance indicators

Mandatory impact[1] category indicators according to EN 15804

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	1.20E-01	1.99E-01	2.03E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.30E-03	0.00E+00	1.20E-02	0.00E+00
GWP-biogenic	kg CO_2 eq.	-1.25E-01	9.51E-04	1.39E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.18E-05	0.00E+00	2.95E-05	0.00E+00
GWP-luluc	kg CO_2 eq.	4.65E-03	2.42E-03	1.19E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.42E-06	0.00E+00	1.87E-05	0.00E+00
GWP-total	kg CO_2 eq.	-9.92E-04	2.03E-01	1.41E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.33E-03	0.00E+00	1.21E-02	0.00E+00
ODP	kg CFC 11 eq.	5.64E-09	4.31E-09	4.02E-11	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.99E-10	0.00E+00	2.84E-10	0.00E+00
AP	mol H^+ eq.	8.51E-04	4.03E-03	1.51E-05	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.23E-05	0.00E+00	7.91E-05	0.00E+00
EP-freshwater	kg P eq.	1.13E-05	1.02E-05	4.72E-07	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.54E-07	0.00E+00	1.06E-06	0.00E+00
EP-marine	kg N eq.	3.48E-04	1.09E-03	7.22E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.68E-05	0.00E+00	3.04E-05	0.00E+00
EP-terrestrial	mol N eq.	3.58E-03	1.18E-02	7.19E-05	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.80E-04	0.00E+00	3.25E-04	0.00E+00
POCP	kg NMVOC eq.	1.11E-03	3.29E-03	2.06E-05	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.28E-05	0.00E+00	1.11E-04	0.00E+00
ADP-minerals&metals*	kg Sb eq.	2.80E-07	2.52E-07	3.60E-09	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.07E-08	0.00E+00	1.87E-08	0.00E+00
ADP-fossil*	MJ	1.63E+00	2.58E+00	2.58E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.31E-01	0.00E+00	2.44E-01	0.00E+00
WDP*	m^3	9.00E-01	5.81E-02	1.17E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.46E-04	0.00E+00	9.39E-03	0.00E+00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption															

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

[1] The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[2]	kg CO_2 eq.	1.27E-01	1.99E-01	1.99E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.14E-03	0.00E+00	1.18E-02	0.00E+00
PM	disease inc.	6.94E-08	1.13E-08	2.05E-10	ND	ND	ND	ND	ND	ND	ND	0.00E+00	7.31E-10	0.00E+00	1.56E-09	0.00E+00
IRP*	kBq U-235 eq	3.77E-03	1.79E-03	2.95E-05	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.81E-04	0.00E+00	1.89E-04	0.00E+00
ETP-fw**	CTUe	3.43E+00	4.24E+00	3.19E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.22E-01	0.00E+00	2.34E-01	0.00E+00
HTP-c**	CTUh	7.84E-11	1.02E-10	2.98E-12	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.95E-12	0.00E+00	5.75E-12	0.00E+00
HTP-nc**	CTUh	1.66E-09	2.21E-09	1.40E-10	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.30E-10	0.00E+00	1.52E-10	0.00E+00
SQP**	Pt	1.31E+02	1.26E+00	1.87E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	8.74E-02	0.00E+00	3.04E-01	0.00E+00
Acronyms	GWP-GHG = supplementary indicator for climate impact, with characterization factors (CFs) based on IPCC (2013); PM = Potential incidence of disease due to PM emissions; IRP = Potential Human exposure efficiency relative to U235; ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c = Potential Comparative Toxic Unit for humans; HTP-nc = Potential Comparative Toxic Unit for humans; SQP = Potential soil quality index															

** Disclaimer 1: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*

*** Disclaimer 2: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

[2] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Resource use indicators

Results per functional or declared unit															
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1.76E+00	3.13E-02	4.36E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.07E-03	0.00E+00	2.65E-03	0.00E+00
PERM	MJ	1.01E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	2.77E+00	3.13E-02	4.36E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.07E-03	0.00E+00	2.65E-03	0.00E+00
PENRE	MJ	1.73E+00	2.77E+00	2.79E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.40E-01	0.00E+00	2.61E-01	0.00E+00
PENRM	MJ	3.15E-02	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.76E+00	2.77E+00	2.79E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.40E-01	0.00E+00	2.61E-01	0.00E+00
SM	kg	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	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	ND	ND	ND	ND	ND	ND	ND	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	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.97E-03	1.16E-03	9.02E-05	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.55E-05	0.00E+00	2.62E-05	0.00E+00
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water														

Waste indicators

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	1.55E+01	0.00E+00	4.00E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.67E-02	ND	1.00E+00	0.00E+00
Radioactive waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00

Output flow indicators

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	1.36E-05	0.00E+00	6.89E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional environmental information

Environmental profile of Slate stone pieces when installed with mortar

Depending on the type of slate piece and its application, the use of mortar for installation may be required. Thus, when applicable, the application of a mortar layer with a thickness of one-third of the thickness of the slate piece was estimated. Due to the difference in densities between the stone and the mortar, this ratio translates to 22% of the stone's mass (i.e. 0.22 kg/kg of installed slate stone piece). It is important to note that the potential environmental impacts of the mortar are not included in the environmental profile of the baseline scenario. However, the environmental profile of the mortar to be applied per kilogram of the installed slate piece (per DU) is available to be added to the environmental profile of the slate piece when it is installed using the mortar application.

Impact categories	Unit	A5 – mortar
GWP-fossil	kg CO_2 eq	5.95E-02
GWP-biogenic	kg CO_2 eq	1.40E-03
GWP-luluc	kg CO_2 eq	3.95E-05
GWP-total	kg CO_2 eq	6.10E-02
ODP	kg CFC11 eq	3.21E-10
AP	mol H+ eq	2.21E-04
EP-freshwater	kg P eq	8.37E-06
EP-marine	kg N eq	6.28E-05
EP-terrestrial	mol N eq	6.77E-04
POCP	kg NMVOC eq	1.99E-04
ADP-minerals&metals	kg Sb eq	1.43E-07
ADP-fossil	MJ	3.98E-01
WDP	m^3 depriv.	1.41E-02
PM	disease inc.	2.60E-09
IRP	kBq U-235 eq	1.12E-03
ETP-fw	CTUe	1.04E+00
HTP-c	CTUh	2.09E-11
HTP-nc	CTUh	5.61E-10
SQP	Pt	4.27E-01

When integrated to the EPD presentation profile, the environmental profile would be added to the 'A5 – installation' column resulting in environmental profile:

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	1.20E-01	1.99E-01	2.02E-01	ND	0.00E+00	9.30E-03	0.00E+00	1.20E-02	0.00E+00
GWP-biogenic	kg CO_2 eq.	-1.25E-01	9.51E-04	6.16E-02	ND	0.00E+00	2.18E-05	0.00E+00	2.95E-05	0.00E+00
GWP-luluc	kg CO_2 eq.	4.65E-03	2.42E-03	4.07E-05	ND	0.00E+00	4.42E-06	0.00E+00	1.87E-05	0.00E+00
GWP-total	kg CO_2 eq.	-9.92E-04	2.03E-01	1.40E-01	ND	0.00E+00	9.33E-03	0.00E+00	1.21E-02	0.00E+00
ODP	kg CFC 11 eq.	5.64E-09	4.31E-09	3.62E-10	ND	0.00E+00	1.99E-10	0.00E+00	2.84E-10	0.00E+00
AP	mol H^+ eq.	8.51E-04	4.03E-03	2.37E-04	ND	0.00E+00	4.23E-05	0.00E+00	7.91E-05	0.00E+00
EP-freshwater	kg P eq.	1.13E-05	1.02E-05	8.84E-06	ND	0.00E+00	6.54E-07	0.00E+00	1.06E-06	0.00E+00
EP-marine	kg N eq.	3.48E-04	1.09E-03	7.00E-05	ND	0.00E+00	1.68E-05	0.00E+00	3.04E-05	0.00E+00
EP-terrestrial	mol N eq.	3.58E-03	1.18E-02	7.49E-04	ND	0.00E+00	1.80E-04	0.00E+00	3.25E-04	0.00E+00
POCP	kg NMVOC eq.	1.11E-03	3.29E-03	2.20E-04	ND	0.00E+00	6.28E-05	0.00E+00	1.11E-04	0.00E+00
ADP-minerals&metals	kg Sb eq.	2.80E-07	2.52E-07	1.47E-07	ND	0.00E+00	2.07E-08	0.00E+00	1.87E-08	0.00E+00
ADP-fossil	MJ	1.63E+00	2.58E+00	4.24E-01	ND	0.00E+00	1.31E-01	0.00E+00	2.44E-01	0.00E+00
WDP	m^3	9.00E-01	5.81E-02	1.53E-02	ND	0.00E+00	9.46E-04	0.00E+00	9.39E-03	0.00E+00
PM	disease inc.	6.94E-08	1.13E-08	2.81E-09	ND	0.00E+00	7.31E-10	0.00E+00	1.56E-09	0.00E+00
IRP	kBq U-235 eq	3.77E-03	1.79E-03	1.15E-03	ND	0.00E+00	1.81E-04	0.00E+00	1.89E-04	0.00E+00
ETP-fw	CTUe	3.43E+00	4.24E+00	1.07E+00	ND	0.00E+00	1.22E-01	0.00E+00	2.34E-01	0.00E+00
HTP-c	CTUh	7.84E-11	1.02E-10	2.39E-11	ND	0.00E+00	4.95E-12	0.00E+00	5.75E-12	0.00E+00
HTP-nc	CTUh	1.66E-09	2.21E-09	7.00E-10	ND	0.00E+00	1.30E-10	0.00E+00	1.52E-10	0.00E+00
SQP	Pt	1.31E+02	1.26E+00	4.46E-01	ND	0.00E+00	8.74E-02	0.00E+00	3.04E-01	0.00E+00

Environmental profile of Slate stone pieces based on installation destination

MICAPEL's slate stone pieces are supplied to clients across the world, with the baseline distribution scenario ('A4 – transport out') being a weighted average of sales volumes over the past 10 years of MICAPEL's operations. To assess the sensitivity of this weighting and enable a customized adjustment for the 'A4 – transport out' process, the following table was devised with environmental profiles for the entire logistics distribution process. This encompasses road transportation in Brazil (622 km), maritime transportation to the customer's continent, and road transportation within the destination continent (considered as 100 km). The influence of maritime routes in the distribution of MICAPEL's slate stone pieces is highlighted. Consequently, it is advisable to update the baseline environmental profile presented here based on the destination of the slate stone pieces.

Impact categories	Unit	A4 – transport out	A4 – transport EU	A4 – transport USA	A4 – transport ASIA	A4 – transport LATAM
GWP-fossil	kg CO_2 eq	1.99E-01	1.86E-01	1.81E-01	3.33E-01	1.51E-01
GWP-biogenic	kg CO_2 eq	2.42E-03	2.41E-03	2.40E-03	2.52E-03	2.38E-03
GWP-luluc	kg CO_2 eq	9.51E-04	9.53E-04	9.53E-04	9.32E-04	9.58E-04
GWP-total	kg CO_2 eq	2.03E-01	1.90E-01	1.84E-01	3.37E-01	1.54E-01
ODP	kg CFC11 eq	4.31E-09	4.12E-09	4.03E-09	6.30E-09	3.60E-09
AP	mol H+ eq	4.03E-03	3.65E-03	3.48E-03	7.94E-03	2.62E-03
EP-freshwater	kg P eq	1.02E-05	9.75E-06	9.56E-06	1.45E-05	8.59E-06
EP-marine	kg N eq	1.09E-03	9.96E-04	9.52E-04	2.07E-03	7.37E-04
EP-terrestrial	mol N eq	1.18E-02	1.08E-02	1.03E-02	2.26E-02	7.89E-03
POCP	kg NMVOC eq	3.29E-03	3.01E-03	2.88E-03	6.21E-03	2.23E-03
ADP-minerals&metals	kg Sb eq	2.52E-07	1.93E-07	1.89E-07	2.91E-07	1.69E-07
ADP-fossil	MJ	2.58E+00	2.42E+00	2.35E+00	4.18E+00	1.99E+00
WDP	m^3 depriv.	5.81E-02	5.75E-02	5.72E-02	6.49E-02	5.57E-02
PM	disease inc.	1.13E-08	1.10E-08	1.08E-08	1.51E-08	9.98E-09
IRP	kBq U-235 eq	1.79E-03	1.71E-03	1.68E-03	2.56E-03	1.51E-03
ETP-fw	CTUe	4.24E+00	4.11E+00	4.05E+00	5.60E+00	3.75E+00
HTP-c	CTUh	1.02E-10	9.69E-11	9.44E-11	1.60E-10	8.17E-11
HTP-nc	CTUh	2.21E-09	2.14E-09	2.10E-09	2.99E-09	1.93E-09
SQP	Pt	1.26E+00	1.24E+00	1.24E+00	1.38E+00	1.21E+00

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