ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for

MAPEPLAN TT
MAPEPLAN TT D
MAPEPLAN TT ST

THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM EPD EN 15804 VERIFIED

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

Programme:	Programme operator:	EPD registration number:	Publication date:	Valid until:	Revision date:	Geographical scope:
The International EPD® System; www.environdec.com	**EPD International AB**	**S-P-02140**	**2021-02-02**	**2026-02-01**	**2021-12-03**	**International**

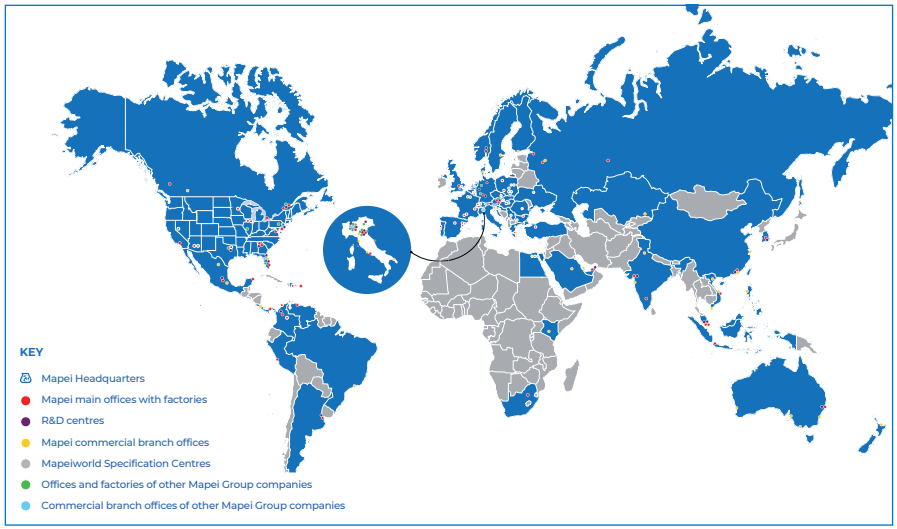
MAPEI®

1. COMPANY DESCRIPTION / GOAL & SCOPE

Founded in 1937 in Milan, Italy, Mapei produces adhesives and complementary products for laying all types of floor, wall and coating materials, and also specializes in other chemical products used in the building industry, such as waterproofing products, specialty mortars, admixtures for concrete, cement additives, products for underground constructions and for the restoration of concrete and historical buildings.

There are currently 89 subsidiaries in the Mapei Group, with a total of 81 production facilities located around the world in 36 different countries and in 5 different continents. Mapei also has 31 central laboratories. Most locations are ISO 9001 and ISO 14001 or EMAS-certified.

Mapei invests 12% in its company's total work-force and 5% of its turnover in Research & Development; in particular, 70% of its R&D efforts are directed to develop eco-sustainable and environmentally friendly products, which give important contribution to all major green rating systems for eco-sustainable buildings such as LEED and BREEAM.



LEED V4 is the latest version of Leadership in Environmental and Energy Design, an American protocol that enables buildings to be certified as eco-sustainable according to parameters and credits described in the most widely adopted green building criteria in the world. Issued by the GBC US, it is mandatory for all LEED projects registered after October 2016.

Numerous changes have been made to the previous version: Mapei products play a part in obtaining important credits thanks to their EPD's (type III environmental declarations) and their products with very low emission of VOC.

Launched in the UK in 1990, **BREEAM** (BRE Environmental Assessment Method) is a protocol for sustainable building practices adopted mainly in the United Kingdom and in Scandinavian countries with the version BREEAM NOR.

By adopting this protocol, thanks to their EPD's and very low emission of VOC, Mapei products help towards obtaining relative credits.

Furthermore, Mapei has developed a sales and technical service network with offices all over the world and offers an efficient Technical Assistance Service that is valued by architects, engineers, contractors and owners.

The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR 2019:14 Environdec (version 1.11, 2021-02-05) under EN 15804:2012+A2:2019 and to have more comprehension about the environmental impacts related to **Mapeplan TT**, **Mapeplan TT D** and **Mapeplan TT ST**, manufactured in Polyglass S.p.A. located in Ponte di Piave (Italy), in year 2020, including packaging of the finished products.

Target audiences of the study are customers and other parties with an interest in the environmental impacts of environmental impacts related to **Mapeplan TT**, **Mapeplan TT D** and **Mapeplan TT ST**. This analysis shall not support comparative assertions intended to be disclosed to the public.

2. PRODUCT DESCRIPTION

Mapeplan TT, **Mapeplan TT D** and **Mapeplan TT ST** are transparent PVC-P synthetic waterproofing membranes. They can be applied as a water barrier in tunnels and underground constructions.
All the membranes comply with EN 13491. In addition:

- Mapeplan TT complies Fascicule 67, titre III, du CCTG

The products are supplied in rolls of 20 m length and 2,10 m width, delivered on wooden pallet wrapped with LD-PE film.
For more information about the products see the TDS (Technical Data Sheet) on Mapei website.

3. CONTENT DECLARATION

The main components and ancillary materials of the products included in this EPD are the following:

Table 1: Composition referred to 1m² of packaged product

Materials	Percentage (%) by mass
Polyvinyl chloride (PVC)	< 65%
Plasticizers	< 40%
Additives	< 12%
Packaging	**Percentage (%) by mass**
Cardboard	< 2%
PP	< 0,02%
LD-PE	< 0,2%
Wood	< 2%

The products contain in a concentration higher than 0,1% (by unit weight) neither carcinogenic substances nor substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency.

4. DECLARED UNIT AND REFERENCE SERVICE LIFE

The declared unit is 1 m² of packaged finished product having a thickness of 2 mm.

The reference service life of the membranes, according to Polyglass SpA experience, is estimated at least 30 years, if professionally installed and properly used.

5. SYSTEM BOUNDARIES AND ADDITIONAL TECHNICAL INFORMATION

The approach is a "cradle to gate" with options, modules A1-A3 + A4-A5 + C + D. The following modules have been considered:

- A1 – A3 (Product stage): extraction and transport of raw materials, packaging included, production process
- A4 – A5 (Construction process stage): transport of the finished product to final customers and installation into the building
- C1 – C4 (End of life stage): with a collection rate of 100% as C&D waste, the transports are carried out by lorry (EURO 4) over 100 km (C2). In this EPD it is used a conservative approach by considering the 100% of waste to be disposed in landfill (Italian scenario).
- D (Resource recovery stage): due to the absence of specific membrane recycling (module C3), this module is considered zero.

Table 2: System boundaries

	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	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	EU, IT	EU, IT, GLO	IT	EU, IT, GLO	EU	-	-	-	-	-	-	-	EU, IT	EU	EU	EU	EU
Specific data	> 90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	< 10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not-relevant					-	-	-	-	-	-	-	-	-	-	-	-

MND: Module Not Declared

A brief description of production process is the following:

The production process of PVC-P waterproofing membranes is a multi-extrusion coating process. PVC powders are mixed inside a turbomixer with other additives and liquid plasticizers. The mixture is stored under mixing, drained inside a hopper by a vacuum equipment, and finally sent to the extruders. The hot melt compound comes out and the membrane is cooled and finally sent to the packaging area, ready to ship.

Figure 1: Production process

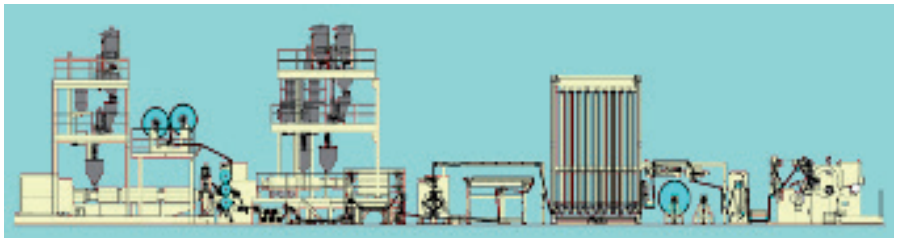


Figure 2: Production equipment

Table 3: Transport to the building site (A4)

Scenario information	Value	Unit
Means of transport: truck euro 4 with 27 tons of payload & ship with a 27500 DWT		
Litres of fuel (diesel for truck)	0,002	l/100km
Litres for fuel (HFO for ship)	0,0004	l/100km
Transport distance	1800	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	~ 1200	kg/m³
Capacity utilisation volume factor	100	%

Table 4: Installation into the building (A5)

Scenario information	Value	Unit
Ancillary materials for installation	-	kg
Water use	-	m³
Other resources use	-	kg
Energy type and consumption	0,019, European Grid Mix	kWh/m²
Output materials as result of waste processing at the building site	~ 0,06	kg
Overlaps (membrane)	5,5	%
Waste materials on building site before waste processing	0,0507 (Wood) 0,0549 (Cardboard) 0,0031 (Plastics)	kg

Table 5: End of Life (C1-C4)

Scenario information	Value	Unit
Collected separately	-	kg
Collected with mixed construction waste	~ 2	kg
Reuse/Recycling/Energy recovery	-	kg
Transport to recycling /disposal facility	100	km
Products or materials for final deposition	~ 2	kg

6. CUT-OFF RULES AND ALLOCATION

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA, information modules and any additional information are intended to support an efficient calculation procedure. They are not applied in order to hide data.
The following procedure is applied for the exclusion of inputs and outputs:

- All inputs and outputs to a unit process, for which data are available, are included in the calculation
- Cut-off criteria, where applied, are described in Table 6

Input flows are covered for the whole formula.

Table 6: Cut-off criteria

Process excluded from study	Cut-off criteria	Quantified contribution from process
A3: production (auxiliary materials)	Less than 10^{-5} kg/kg of finished product	Sensitivity study demonstrates a relative contribution lower than 0,5%
A3: particle emission	Less than 10^{-5} kg/kg of finished product	Sensitivity study demonstrates a relative contribution lower than 0,5%

For the allocation procedure and principles, consider the table 7.

Table 7: Allocation procedure and principles

Module	Allocation Principle
A1	All data are referred to 1 kg of product A1: electricity is allocated to the specific production line
A3	All data are referred to 1 kg of packaged product A3-wastes: all data are allocated to the whole production plant

7. ENVIRONMENTAL PERFORMANCE AND INTERPRETATION

GWP

Climate change
GWPtotal - Global Warming Potential refers to the emission/presence of GHGs (greenhouse gases) in the atmosphere (mainly CO_2, N_2O, CH_4) which contribute to the increase in the temperature of the planet.
GWP-total considers:
- GWP-fossil
- GWP-biogenic
- GWP-luluc (land use and land use change)

ODP

Ozone Depletion
Ozone Depletion Potential refers to the degradation of the stratospheric layer of the ozone involved in blocking the UV component of sunrays. Depletion is due to particularly reactive components that originate from chlorofluorocarbon (CFC) or chlorofluoromethane (CFM).

AP

Acidification
Acidification Potential refers to the emission of specific acidifying substances (i.e. NOx, SOx) in the air. These substances decrease the pH of the rainfall with predictable damages to the ecosystem.

EP

Eutrophication
Eutrophication Potential refers to the nutrient enrichment, which determines unbalance in ecosystems and causes the death of the fauna and decreased biodiversity in flora.
It considers:
- EP-freshwater: acquatic freshwater
- EP-marine: acquatic marine
- EP-terrestrial

POCP

Photochemical ozone formation
The Photochemical Ozone Creation Potential is the ozone formation in low atmosphere. This is quite common in the cities where a great amount of pollutants (like VOC and NOx) are emitted every day (industrial emissions and vehicles). It is mainly diffused during the summertime.

ADP minerals&metals

Depletion of abiotic resources – minerals and metals
Abiotic Depletion Potential elements refers to the depletion of the mineral resources.

ADP - fossil

Depletion of abiotic resources – fossil fuel
Abiotic Depletion Potential fossil fuel refers to the depletion of the fossil fuel resources.

WDP

Water use
It expresses the potential deprivation of water, that consists in not having the water needs satisfied.

The following tables show the environmental impacts for the products considered according to the requirements of EN15804:2012+A2:2019. The results are referred to the declared unit (see § 4). The additional environmental indicators are not declared (ref. §7.2.3.2 EN15804:2012+A2:2019).

MAPEPLAN TT

(1 m² product + packaging)

Table 8: MAPEPLAN TT: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP_{TOTAL}	(kg CO_2 eq.)	6,02E+00	1,91E-01	1,95E-01	0,00E+00	3,12E-02	0,00E+00	3,84E-02	0,00E+00
GWP_{FOSSIL}	(kg CO_2 eq.)	6,02E+00	1,90E-01	1,58E-02	0,00E+00	3,10E-02	0,00E+00	3,94E-02	0,00E+00
$GWP_{BIOGENIC}$	(kg CO_2 eq.)	-5,03E-03	-1,96E-04	1,79E-01	0,00E+00	-3,72E-05	0,00E+00	-1,14E-03	0,00E+00
GWP_{LULUC}	(kg CO_2 eq.)	1,61E-03	1,42E-03	1,75E-05	0,00E+00	2,56E-04	0,00E+00	1,16E-04	0,00E+00
ODP	(kg CFC 11 eq.)	1,37E-07	2,40E-17	2,09E-16	0,00E+00	6,17E-18	0,00E+00	1,53E-16	0,00E+00
AP	(mol H^+ eq.)	1,53E-02	1,69E-03	5,72E-05	0,00E+00	1,69E-04	0,00E+00	2,81E-04	0,00E+00
$EP_{FRESHWATER}$	(kg P eq.)	1,54E-04	5,18E-07	6,25E-07	0,00E+00	9,29E-08	0,00E+00	6,61E-08	0,00E+00
$EP_{FRESHWATER}$	(kg $(PO_4)^{3-}$ eq.)	4,73E-04	1,59E-06	1,92E-06	0,00E+00	2,85E-07	0,00E+00	2,03E-07	0,00E+00
EP_{MARINE}	(kg N eq.)	3,16E-03	6,60E-04	2,41E-05	0,00E+00	8,21E-05	0,00E+00	7,28E-05	0,00E+00
$EP_{TERRESTRIAL}$	(mol N eq.)	3,34E-02	7,29E-03	1,93E-04	0,00E+00	9,10E-04	0,00E+00	8,00E-04	0,00E+00
POCP	(kg NMVOC eq.)	1,35E-02	1,43E-03	1,03E-04	0,00E+00	1,59E-04	0,00E+00	2,21E-04	0,00E+00
$ADP_{MINERALS\&METALS}$*	(kg Sb eq.)	1,65E-06	1,37E-08	2,85E-09	0,00E+00	2,77E-09	0,00E+00	3,72E-09	0,00E+00
ADP_{FOSSIL}*	(MJ)	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,17E-01	0,00E+00	5,23E-01	0,00E+00
WDP*	(m^3 world eq.)	5,67E+00	1,53E-03	1,92E-03	0,00E+00	2,90E-04	0,00E+00	4,23E-03	0,00E+00

GWP_{TOTAL}: Global Warming Potential total; **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; **$EP_{FRESHWATER}$**: Eutrophication Potential, freshwater; **EP_{MARINE}**: Eutrophication Potential, marine; **$EP_{TERRESTRIAL}$**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **$ADP_{MINERALS\&METALS}$**: Abiotic Depletion Potential for non-fossil resources; **ADP_{FOSSIL}**: Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

** The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experienced with the indicator*

Table 9: MAPEPLAN TT: Potential environmental impact – additional mandatory and voluntary indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	(kg CO_2 eq.)	5,91E+00	1,88E-01	1,18E-01	0,00E+00	3,07E-02	0,00E+00	3,88E-02	0,00E+00

GWP-GHG: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 10: MAPEPLAN TT: Use of resources referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	9,18E+00	1,29E-01	7,32E-02	0,00E+00	2,40E-02	0,00E+00	7,04E-02	0,00E+00
PERM	MJ	1,80E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,10E+01	1,29E-01	7,32E-02	0,00E+00	2,40E-02	0,00E+00	7,04E-02	0,00E+00
PENRE	MJ	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,18E-01	0,00E+00	5,23E-01	0,00E+00
PENRM	MJ	1,50E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,67E+02	2,53E+00	2,50E-01	0,00E+00	4,18E-01	0,00E+00	5,23E-01	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	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	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	0,00E+00
FW	m³	1,32E-01	1,48E-04	8,18E-05	0,00E+00	2,75E-05	0,00E+00	1,29E-04	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 (primary energy and primary energy resources used as raw materials); **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 (primary energy and primary energy resources used as raw materials); **SM**: Use of secondary material; **RSF**: Use of renewable secondary fuels; **NRSF**: Use of non-renewable secondary fuels; **FW**: Net use of fresh water.

** Referred only to 1 kg of product without packaging*

Table 11: MAPEPLAN TT: Waste production and output flows referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	4,70E-03	1,18E-10	5,69E-11	0,00E+00	2,20E-11	0,00E+00	5,55E-11	0,00E+00
NHWD	kg	1,54E-02	3,65E-04	7,06E-02	0,00E+00	6,56E-05	0,00E+00	2,61E+00	0,00E+00
RWD	kg	7,18E-04	3,04E-06	2,24E-05	0,00E+00	7,58E-07	0,00E+00	5,49E-06	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,15E-01	0,00E+00	0,00E+00	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	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	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	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

Table 12: MAPEPLAN TT: Information on biogenic carbon content at the factory gate referred to 1 m² membrane having 2 mm thickness

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	4,15E-02

MAPEPLAN TT D and MAPEPLAN TT ST

(1 m² product + packaging)

Mapeplan TT D and **Mapeplan TT ST** have similar environmental loads with differences lower than ±10%. According to the GPI – General Program Instruction (ref. §9.3), the results are shown as average in a single set of tables.

Table 13: MAPEPLAN TT D and MAPEPLAN TT ST: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP_{TOTAL}	(kg CO_2 eq.)	6,07E+00	1,91E-01	1,95E-01	0,00E+00	3,12E-02	0,00E+00	3,84E-02	0,00E+00
GWP_{FOSSIL}	(kg CO_2 eq.)	6,08E+00	1,90E-01	1,58E-02	0,00E+00	3,10E-02	0,00E+00	3,94E-02	0,00E+00
$GWP_{BIOGENIC}$	(kg CO_2 eq.)	-3,60E-03	-1,96E-04	1,79E-01	0,00E+00	-3,72E-05	0,00E+00	-1,14E-03	0,00E+00
GWP_{LULUC}	(kg CO_2 eq.)	2,01E-03	1,42E-03	1,75E-05	0,00E+00	2,56E-04	0,00E+00	1,16E-04	0,00E+00
ODP	(kg CFC 11 eq.)	1,37E-07	2,40E-17	2,09E-16	0,00E+00	6,17E-18	0,00E+00	1,53E-16	0,00E+00
AP	(mol H^+ eq.)	1,55E-02	1,69E-03	5,72E-05	0,00E+00	1,69E-04	0,00E+00	2,81E-04	0,00E+00
$EP_{FRESHWATER}$	(kg P eq.)	1,55E-04	5,18E-07	6,25E-07	0,00E+00	9,29E-08	0,00E+00	6,61E-08	0,00E+00
$EP_{FRESHWATER}$	(kg $(PO_4)^{3-}$ eq.)	4,76E-04	1,59E-06	1,92E-06	0,00E+00	2,85E-07	0,00E+00	2,03E-07	0,00E+00
EP_{MARINE}	(kg N eq.)	3,43E-03	6,60E-04	2,41E-05	0,00E+00	8,21E-05	0,00E+00	7,28E-05	0,00E+00
$EP_{TERRESTRIAL}$	(mol N eq.)	3,63E-02	7,29E-03	1,93E-04	0,00E+00	9,10E-04	0,00E+00	8,00E-04	0,00E+00
POCP	(kg NMVOC eq.)	1,41E-02	1,43E-03	1,03E-04	0,00E+00	1,59E-04	0,00E+00	2,21E-04	0,00E+00
$ADP_{MINERALS\&METALS}$*	(kg Sb eq.)	1,59E-06	1,37E-08	2,85E-09	0,00E+00	2,77E-09	0,00E+00	3,72E-09	0,00E+00
ADP_{FOSSIL}*	(MJ)	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,17E-01	0,00E+00	5,23E-01	0,00E+00
WDP*	(m^3 world eq.)	5,69E+00	1,53E-03	1,92E-03	0,00E+00	2,90E-04	0,00E+00	4,23E-03	0,00E+00

GWP_{TOTAL}: Global Warming Potential total; **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; **$EP_{FRESHWATER}$**: Eutrophication Potential, freshwater; **EP_{MARINE}**: Eutrophication Potential, marine; **$EP_{TERRESTRIAL}$**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **$ADP_{MINERALS\&METALS}$**: Abiotic Depletion Potential for non-fossil resources; **ADP_{FOSSIL}**: Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

** The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experienced with the indicator*

Table 14: MAPEPLAN TT D and MAPEPLAN TT ST: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 m2 membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	(kg CO_2 eq.)	5,96E+00	1,88E-01	1,18E-01	0,00E+00	3,07E-02	0,00E+00	3,88E-02	0,00E+00

GWP-GHG: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 15: MAPEPLAN TT D and MAPEPLAN TT ST: Use of resources referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	9,21E+00	1,29E-01	7,32E-02	0,00E+00	2,40E-02	0,00E+00	7,04E-02	0,00E+00
PERM	MJ	1,80E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,10E+01	1,29E-01	7,32E-02	0,00E+00	2,40E-02	0,00E+00	7,04E-02	0,00E+00
PENRE	MJ	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,18E-01	0,00E+00	5,23E-01	0,00E+00
PENRM	MJ	1,50E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,18E-01	0,00E+00	5,23E-01	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	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	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	0,00E+00
FW	m³	1,33E-01	1,48E-04	8,18E-05	0,00E+00	2,75E-05	0,00E+00	1,29E-04	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 (primary energy and primary energy resources used as raw materials); **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 (primary energy and primary energy resources used as raw materials); **SM**: Use of secondary material; **RSF**: Use of renewable secondary fuels; **NRSF**: Use of non-renewable secondary fuels; **FW**: Net use of fresh water.

** Referred only to 1 kg of product without packaging*

Table 16: MAPEPLAN TT D and MAPEPLAN TT ST: Waste production and output flows referred to 1 m² membrane having 2 mm thickness

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	4,24E-03	1,18E-10	5,69E-11	0,00E+00	2,20E-11	0,00E+00	5,55E-11	0,00E+00
NHWD	kg	1,70E-02	3,65E-04	7,06E-02	0,00E+00	6,56E-05	0,00E+00	2,61E+00	0,00E+00
RWD	kg	7,72E-04	3,04E-06	2,24E-05	0,00E+00	7,58E-07	0,00E+00	5,49E-06	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,15E-01	0,00E+00	0,00E+00	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	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,15E-01
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	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

Table 17: MAPEPLAN TT D and MAPEPLAN TT ST: Information on biogenic carbon content at the factory gate referred to 1 m2 membrane having 2 mm thickness

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	4,15E-02

To obtain the results for different thicknesses, please use the following multiplicative coefficients:

Table 18: Multiplicative coefficients for calculating the Environmental Impacts (EI) for different thickness

	THICKNESS						
	1,5 mm	**2,0 mm**	**2,1 mm**	**2,2 mm**	**2,5 mm**	**3,0 mm**	**3,1 mm**
Mapeplan TU – TU S – TU WL – TU S WL	–	$EI_{2,0}$ * 1	–	–	–	–	–
Mapeplan TU – TU S – TU WL – TU S WL	$EI_{2,0}$ * 0,75	$EI_{2,0}$ * 1	$EI_{2,0}$ * 1,05	–	$EI_{2,0}$ * 1,25	$EI_{2,0}$ * 1,5	$EI_{2,0}$ * 1,55
Mapeplan TU CH	$EI_{2,0}$ * 0,75	$EI_{2,0}$ * 1	$EI_{2,0}$ * 1,05	–	$EI_{2,0}$ * 1,25	$EI_{2,0}$ * 1,5	$EI_{2,0}$ * 1,55

$EI_{2,0}$: Environmental Indicator for 2,0 mm thickness

Tables from 5 to 17 show absolute results for all the environmental categories considered. The module A1 gives an important contribute for most environmental categories considered and it is responsible up to 99% of the impact (considering the different environmental indicators declared in this EPD). The transport modules (A2, A4 and C2) affect several environmental categories; e.g. GWP, EP and POCP, with relative contributions up to 30%. The installation module A5, is the main contributes regarding the environmental category GWP (biogenic) due to the EoL of the different packaging components which are all landfilled.

Table 19: Some environmental impacts of the products studied as average

MAPEPLANs (average)	A1-A3	A4	A5	C1	C2	C3	C4	TOT
CLIMATE CHANGE (total)	6,05E+00	1,91E-01	1,95E-01	0,00E+00	3,12E-02	0,00E+00	3,84E-02	6,50 kg CO_2 eq.
ACIDIFICATION	1,54E-02	1,69E-03	5,72E-05	0,00E+00	1,69E-04	0,00E+00	2,81E-04	1,76E-02 mol H+ eq.
DEPLETION OF ABIOTIC RESOURCES (fossil)	1,66E+02	2,53E+00	2,50E-01	0,00E+00	4,17E-01	0,00E+00	5,23E-01	170 MJ
WATER USE	5,68E+00	1,53E-03	1,92E-03	0,00E+00	2,90E-04	0,00E+00	4,23E-03	5,69 m^3 world eq.

More details about electrical mix used in this EPD, is shown below:

	Data source	GWP_{TOTAL}	Unit
Residual electricity grid mix (IT) – 2019	AIB	0,535*	kg CO_2-eqv/kWh
Electricity from photovoltaic (IT) – 2017	Sphera database	0,0519*	kg CO_2-eqv/kWh

** CML2001 – Aug. 2016*

8. DATA QUALITY

Table 20: Data quality

Dataset & Geographical reference	Database (source)	Temporary reference
A1; A3		
PVC Compounds	Sphera Database; ecoinvent 3.7	2020
Fillers (EU)	Sphera Database;	2020
Additives (EU)	Sphera Database; ecoinvent 3.7	2020
Plasticizers	Sphera Database	2020
Residual electricity grid mix (IT)	AIB	2019
Packaging components (EU)	Sphera Database, PlasticsEurope	2005 – 2020
A2		
Truck, Euro 5, 27t payload (GLO)	Sphera Database	2020
Diesel for transport (EU)	Sphera Database	2017
A4		
Truck, Euro 4, 27t payload (GLO)	Sphera Database	2020
Container ship, 5,000 to 200,000 dwt payload (GLO)	Sphera Database	2020
Diesel for transport (EU)	Sphera Database	2017
Heavy fuel oil (EU)	Sphera Database	2017
A5		
Electricity grid mix (EU)	Sphera Database	2017
Plastic waste on landfill	Sphera Database	2020
Untreated wood on landfill	Sphera Database	2020
Paper waste on landfill	Sphera Database	2020
C1 – C4		
Construction waste treatment (EU)	Sphera Database	2020
Construction waste dumping (EU)	Sphera Database	2020
Electricity grid mix (IT)	Sphera Database	2017
Truck, Euro 6, 9.3t payload (GLO)	Sphera Database	2020
Diesel for transport (EU)	Sphera Database	2017

All data included in table above refer to a period between 2005 and 2020; the most relevant ones are specific from supplier, while the others (i.e. transport and minor contribution dataset), come from European and global databases.

All dataset are not more than 10 years old according to EN 15804 §6.3.8.2 “Data quality requirements”. The only exception is represented by one raw material used for one packaging component production. The Quality level concerning datasets used in the EPD can be considered as ”very good” or ”good” according to Annex E of the EN 15804 (current version); the only exception is represented by a packaging component which has a quality level classified as ”poor” in terms of time representativeness.

Primary data concern the year 2020 and represent the whole annual production.

9. SIGNIFICANT CHANGES FROM PREVIOUS VERSION

In this version, new primary data referred to 2020 has been adopted; more info regarding the end of life stages and module D has been added in chapter 5. Moreover, additional data quality information has been included in chapter 8. Minor editorial changes have been made in the document.

10. VERIFICATION AND REGISTRATION

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

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

CEN standard EN15804 served as the Core Product Category Rules (PCR)	
PCR:	PCR 2019:14 Construction products (EN 15804:A2), Version 1.11, 2021-02-05, UN CPC code 54
PCR review was conducted by:	The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	☒ EPD Process Certification ☐ EPD Verification
Third party verifier:	Certiquality S.r.l. Number of accreditation: 003H rev15
Accredited or approved by:	Accredia
Procedure for follow-up of data during EPD validity involves third-party verifier	☒ Yes ☐ No

11. REFERENCES

- EN 13491: GEOSYNTHETIC BARRIERS - CHARACTERISTICS REQUIRED FOR USE AS A FLUID BARRIER IN THE CONSTRUCTION OF TUNNELS AND ASSOCIATED UNDERGROUND STRUCTURES
- EN 15804: SUSTAINABILITY OF CONSTRUCTION WORKS - ENVIRONMENTAL PRODUCT DECLARATIONS - CORE RULES FOR THE PRODUCT CATEGORY OF CONSTRUCTION PRODUCTS
- EUROPEAN RESIDUAL MIXES VERSION 1.1, 2020-09-08 (AIB: ASSOCIATION OF ISSUING BODIES)
- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 3.01
- ISO 14025 ENVIRONMENTAL LABELS AND DECLARATIONS - TYPE III ENVIRONMENTAL DECLARATIONS - PRINCIPLES AND PROCEDURES
- ISO 14044 ENVIRONMENTAL MANAGEMENT – LIFE CYCLE ASSESSMENT – REQUIREMENTS AND GUIDELINES
- PCR 2019:14 CONSTRUCTION PRODUCTS (EN 15804: A2), UN CPC CODE 54; VERSION 1.11
- FASCICULE 67, TITRE III, DU CCTG: ÉTANCHÉITÉ DES OUVRAGES SOUTERRAINS

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