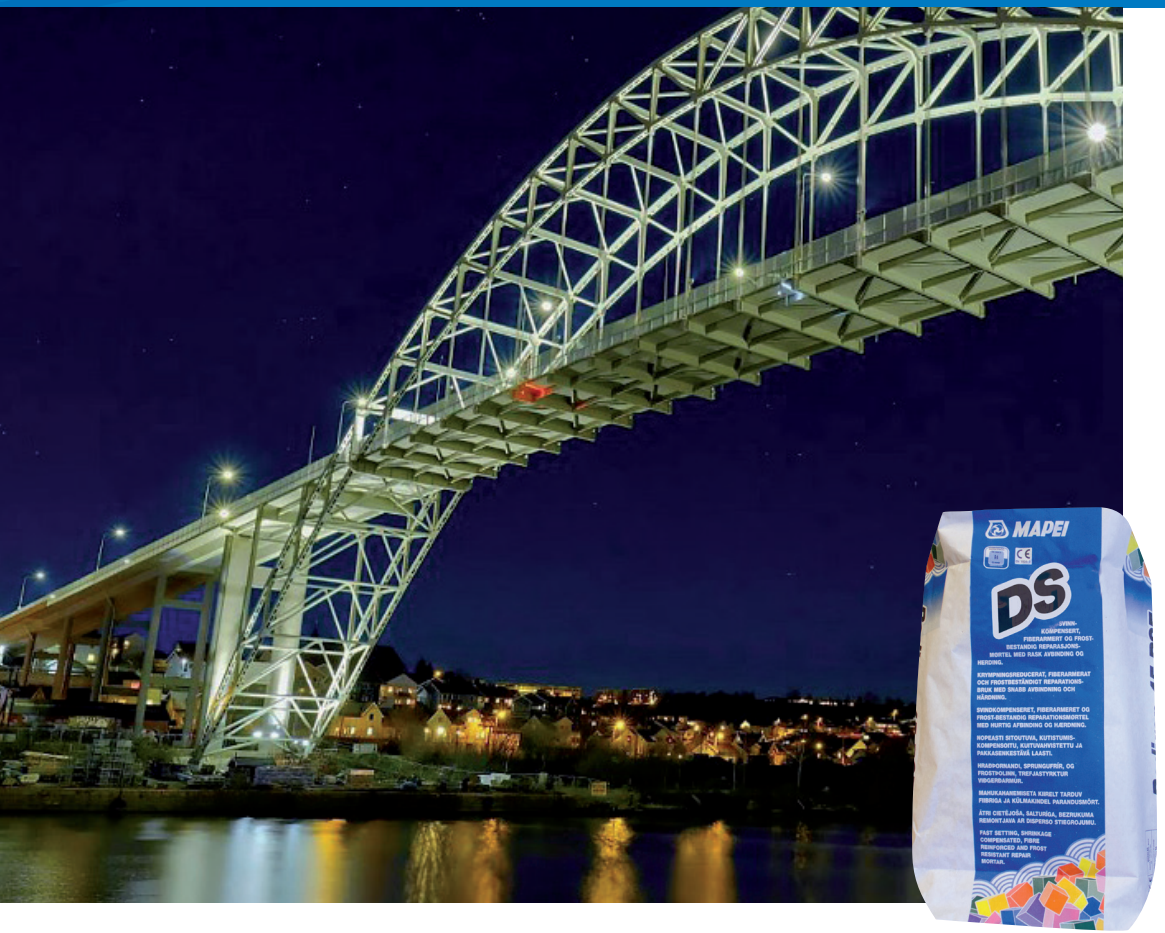


ENVIRONMENTAL PRODUCT DECLARATION

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

DS

THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM EPD 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.

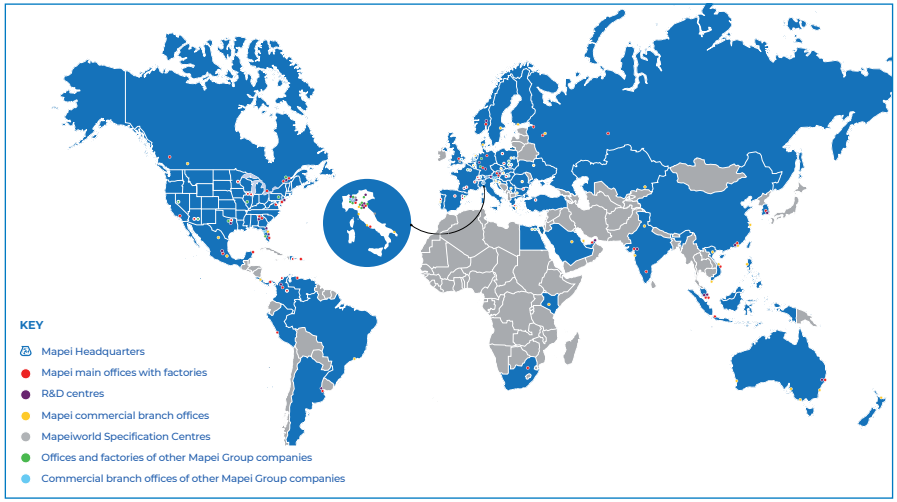
Programme:	Programme operator:	EPD registration number:	Publication date:	Valid until:	Geographical scope:
The International EPD® System; www.environdec.com	**EPD International AB**	**S-P-08317**	**2023-03-13**	**2028-03-12**	**Global**

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 100 subsidiaries in the Mapei Group, with a total of 86 production facilities located around the world in 36 different countries and in 5 different continents. Mapei also has 32 central laboratories. Most locations are ISO 9001 and ISO 14001 or EMAS-certified.

Mapei invests 12% in its company's total workforce 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 V4.1 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.

Mapei Nordic production site is located in Sagstua, Norway. The production site consists of 5 factories: Two factories for powder-based products, two factories for liquid admixtures and one factory for thermosetting plastic-based products.

The total size of the buildings is 24.000 sqm. The energy in these factories is provided from water electricity, geothermal heating and remaining approximately 10 % heated by bio-oil.

Mapei Nordic focuses both on energy and on logistic optimisation,

as for example the systematic Lean based improvement work. With 60 – 80 trailers per day, and 600 transport lines, requires Mapei to work actively on optimizing our logistic process.
The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR Environdec (version 1.11, 2021-02-05) under EN 15804:2012+A2:2019/AC:2021 and to have more comprehension about the environmental impacts related to **DS** manufactured in Mapei AS located in Sagstua (NO), including packaging of the finished products.
Target audiences of the study are customers and other parties with an interest in the environmental impacts of **DS**. This analysis shall not support comparative assertions intended to be disclosed to the public.

2. PRODUCT DESCRIPTION

DS is a dry mortar specifically designed for repairs, reinforcement and maintenance of concrete in thickness 10 – 50 mm in areas where strength and density are crucial.

DS is supplied in 25 kg sacks and 1200 kg big bags.

For more information about the product see the TDS (Technical Data Sheet) on Mapei AS website (www.mapei.com/NO).

3. CONTENT DECLARATION

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

Table 1: Composition referred to 1 kg of product

Materials	Percentage (%) by mass
Inorganic binder	<35% (5% recycled pre-consumer)
Filler	<80%
Additives	<1%
Packaging	**Percentage (%) by mass**
Paper (bag)	< 0,3 (0,1% of biogenic carbon)
LDPE (bag and wrap)	< 0,1%
PP (bigbag)	< 0,5%
Pallet (WOOD)	< 2 % (0,9 % of biogenic carbon)

The product does not contain a concentration higher than 0,1% (by unit weight) of either carcinogenic substances or 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 kg of finished product with packaging.

Due to the selected system boundary, the reference service life of the product is not specified.

5. SYSTEM BOUNDARIES AND ADDITIONAL TECHNICAL INFORMATION

The approach is “cradle to gate” (A1–A3) with modules C1–C4 and module D and optional modules (A4 – A5):

- A1, A2, A3 (Product stage): extraction and processing of raw materials and packaging (A1), transportation up to the factory gate (A2), manufacturing of the finished product (A3).
- A4 – A5 (Construction process stage): transport of the finished product to final customers and installation into the building.
- C1, C2, C3, C4 (End of Life stage): With a collection rate of 100% as C&D waste, the transports are carried out by lorry over 100 km (C2). A recycling ratio (C3) of 70% is considered in accordance with the European Directive 2008/98/CE. The remaining 30% is landfilled (C4).
- D (Resource recovery stage): reuse, recovery and/or recycling potentials, expressed as net impacts and benefit.

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	NO	NO, EU	NO	EU	EU	-	-	-	-	-	-	-	EU	EU	EU	EU	EU
Specific data	> 90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not-relevant					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not-relevant					-	-	-	-	-	-	-	-	-	-	-	-

MND: Module Not Declared

A brief description of production process is the following:

The production process starts from raw materials, that are purchased from external and intercompany suppliers and stored in the plant. Bulk raw materials are stored in specific tanks and added in the production mixer, according to the formula of the product. Other raw materials, supplied in bags, tanks, drums and cans, are stored in the warehouse and added manually in the mixer. The production is a discontinuous process, in which all the components are mechanically mixed in batches. The semi-finished product is then filled in IBC, drums, buckets or cans, put on wooden pallets and stored in the finished products warehouse. The quality of final products is controlled before the sale.

Figure 1: Production process detail - © Photo Halvor Gudim

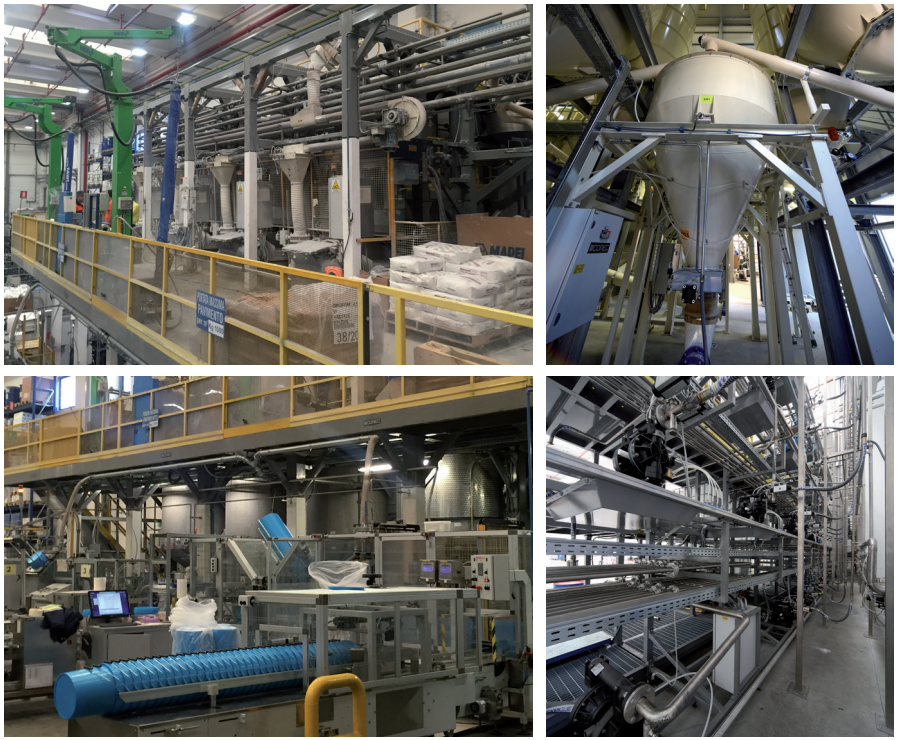


Table 3: Transport to the building site (A4)

Scenario information	Value	Unit
Means of transport: truck-trailer euro 6, gross weight 34-40 t, payload capacity 27 t		
Diesel consumption	0,002	l/100km
Transport distance	1000	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	~ 1400	kg/m³
Capacity utilisation volume factor	1	-

Table 4:Installation into the building (A5)

Scenario information	Value	Unit
Ancillary materials for installation	0	kg
Water use	0,000135	m³
Other resources use	0	kg
Electricity (Norwegian grid mix)	0,00675	MJ
Waste materials on building site before waste processing, generated by the product's installation (specified by type)	0,0103 (C&D) 0,02 (wood) 0,00356 (bag) 0,000375 (plastic)	kg
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	0,0103 (landfill) 0,024 (energy recovery)	kg
Direct emission to ambient air, soil and water	0	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. Cut-off criteria, where applied, are described in Table 5.

Table 5: 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%

For the allocation procedure and principles consider the following table (Table 6):

Table 6: 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/AC:2021. The results are referred to the declared unit (see § 4). The additional environmental indicators are not declared.

DS

(1 kg of product in 25kg bag)

Table 7: DS: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 kg of product in 25kg bag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP_{TOTAL}	(kg CO_2 eq.)	1,73E-01	2,00E-02	-1,96E-02	1,73E-01	4,95E-02	6,40E-02	2,29E-03	7,08E-03	2,68E-03	4,47E-03	-1,03E-02
GWP_{FOSSIL}	(kg CO_2 eq.)	1,73E-01	1,98E-02	7,91E-03	2,00E-01	4,91E-02	3,09E-02	2,26E-03	7,00E-03	2,65E-03	4,44E-03	-1,02E-02
$GWP_{BIOGENIC}$	(kg CO_2 eq.)	4,98E-05	6,84E-05	-2,75E-02	-2,74E-02	1,50E-04	3,31E-02	2,22E-05	2,46E-05	1,93E-05	1,50E-05	-3,13E-05
GWP_{LULUC}	(kg CO_2 eq.)	1,29E-05	1,30E-04	1,46E-05	1,58E-04	2,73E-04	3,54E-06	4,81E-07	4,73E-05	1,22E-05	8,20E-06	-3,94E-06
ODP	(kg CFC 11 eq.)	5,84E-10	1,95E-15	4,55E-11	6,29E-10	2,93E-15	5,72E-15	3,32E-14	6,89E-16	3,94E-15	1,04E-14	-1,35E-14
AP	(mol H^+ eq.)	1,33E-04	8,30E-05	3,66E-05	2,52E-04	4,37E-05	1,74E-05	4,95E-06	7,69E-06	1,37E-05	3,15E-05	-1,05E-05
$EP_{FRESHWATER}$	(kg P eq.)	1,09E-06	6,93E-08	5,57E-07	1,72E-06	1,46E-07	6,30E-09	6,64E-09	2,51E-08	7,60E-09	7,53E-09	-5,91E-09
EP_{MARINE}	(kg N eq.)	4,15E-05	3,50E-05	1,15E-05	8,79E-05	1,30E-05	6,58E-06	1,11E-06	2,43E-06	6,25E-06	8,06E-06	-4,42E-06
$EP_{TERRESTRIAL}$	(mol N eq.)	5,33E-04	3,90E-04	1,25E-04	1,05E-03	1,58E-04	7,50E-05	1,17E-05	2,93E-05	6,90E-05	8,85E-05	-4,88E-05
POCP	(kg NMVOC eq.)	1,19E-04	7,17E-05	3,26E-05	2,23E-04	3,76E-05	1,73E-05	3,01E-06	6,54E-06	1,70E-05	2,45E-05	-1,15E-05
$ADP_{MINERALS\&METALS}$*	(kg Sb eq.)	8,02E-08	1,97E-09	1,04E-08	9,26E-08	4,10E-09	2,31E-10	6,19E-10	7,08E-10	2,94E-09	4,55E-10	-8,45E-10
ADP_{FOSSIL}*	(MJ)	8,53E-01	2,59E-01	1,66E-01	1,28E+00	6,55E-01	2,24E-02	4,10E-02	9,22E-02	5,18E-02	5,82E-02	-1,61E-01
WDP*	(m^3 world eq.)	1,86E+00	2,18E-04	2,30E-03	1,87E+00	4,39E-04	9,61E-03	5,09E-04	7,86E-05	5,11E-04	4,87E-04	-8,68E-05

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 8: DS: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 kg of product in 1200kg bigbag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	(kg CO_2 eq.)	1,72E-01	1,96E-02	7,71E-03	1,99E-01	4,85E-02	3,09E-02	2,25E-03	6,93E-03	2,60E-03	4,38E-03	-1,01E-02

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 9: DS: Use of resources referred to 1 kg of product in 25kg bag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	2,05E-01	1,76E-02	3,53E-01	5,76E-01	3,72E-02	1,21E-02	2,28E-02	6,39E-03	4,16E-03	8,74E-03	-7,39E-03
PERM	MJ	0,00E+00	0,00E+00	4,37E-01	4,37E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,05E-01	1,76E-02	7,90E-01	1,01E+00	3,72E-02	1,21E-02	2,28E-02	6,39E-03	4,16E-03	8,74E-03	-7,39E-03
PENRE	MJ	8,53E-01	2,60E-01	1,67E-01	1,28E+00	6,56E-01	2,25E-02	4,10E-02	9,25E-02	5,19E-02	5,83E-02	-1,61E-01
PENRM	MJ	0,00E+00	0,00E+00	2,65E-02	2,65E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,53E-01	2,60E-01	1,93E-01	1,31E+00	6,56E-01	2,25E-02	4,10E-02	9,25E-02	5,19E-02	5,83E-02	-1,61E-01
SM	kg	5,00E-02	0,00E+00	0,00E+00	5,00E-02	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	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	0,00E+00	0,00E+00	0,00E+00
FW	m^3	1,10E-03	2,04E-05	6,17E-05	1,18E-03	4,21E-05	2,38E-04	2,16E-05	7,38E-06	1,45E-05	1,48E-05	-2,24E-05

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.

Table 10: DS: Waste production and output flows referred to 1 kg of product in 25kg bag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	1,43E-05	1,37E-12	6,13E-06	2,05E-05	3,14E-12	1,59E-12	3,55E-12	4,90E-13	6,49E-13	2,99E-12	-3,24E-11
NHWD	kg	1,70E-02	4,21E-05	6,16E-03	2,32E-02	9,40E-05	1,45E-02	3,10E-05	1,51E-05	1,38E-05	2,98E-01	-1,45E-02
RWD	kg	3,30E-05	4,84E-07	3,37E-06	3,69E-05	8,08E-07	7,84E-07	6,54E-06	1,72E-07	6,83E-07	6,49E-07	-7,20E-07
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	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	2,58E-03	2,58E-03	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	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	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	0,00E+00	0,00E+00	0,00E+00

HWD: Hazardous waste disposed; **NHWD**: Non-Hazardous waste disposed; **RWD**: Radioactive waste disposed

Table 11: DS: Information on biogenic carbon content at the factory gate referred to 1 kg of product in 25kg bag

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	9,94E-03

DS

(1 kg in 1200kg bigbag)

Table 12: DS: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 kg of product in 1200kg bigbag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP_{TOTAL}	(kg CO_2 eq.)	1,73E-01	2,00E-02	-1,19E-02	1,81E-01	4,94E-02	5,15E-02	2,29E-03	7,08E-03	2,68E-03	4,47E-03	-1,03E-02
GWP_{FOSSIL}	(kg CO_2 eq.)	1,73E-01	1,98E-02	1,04E-02	2,03E-01	4,90E-02	2,82E-02	2,26E-03	7,00E-03	2,65E-03	4,44E-03	-1,02E-02
$GWP_{BIOGENIC}$	(kg CO_2 eq.)	4,98E-05	6,84E-05	-2,22E-02	-2,21E-02	1,50E-04	2,33E-02	2,22E-05	2,46E-05	1,93E-05	1,50E-05	-3,13E-05
GWP_{LULUC}	(kg CO_2 eq.)	1,29E-05	1,30E-04	1,45E-05	1,58E-04	2,73E-04	3,33E-06	4,81E-07	4,73E-05	1,22E-05	8,20E-06	-3,94E-06
ODP	(kg CFC 11 eq.)	5,84E-10	1,95E-15	1,68E-10	7,52E-10	2,93E-15	5,27E-15	3,32E-14	6,89E-16	3,94E-15	1,04E-14	-1,35E-14
AP	(mol H^+ eq.)	1,33E-04	8,30E-05	6,50E-05	2,81E-04	4,36E-05	1,60E-05	4,95E-06	7,69E-06	1,37E-05	3,15E-05	-1,05E-05
$EP_{FRESHWATER}$	(kg P eq.)	1,09E-06	6,93E-08	1,30E-06	2,46E-06	1,46E-07	5,96E-09	6,64E-09	2,51E-08	7,60E-09	7,53E-09	-5,91E-09
EP_{MARINE}	(kg N eq.)	4,15E-05	3,50E-05	1,63E-05	9,27E-05	1,30E-05	6,04E-06	1,11E-06	2,43E-06	6,25E-06	8,06E-06	-4,42E-06
$EP_{TERRESTRIAL}$	(mol N eq.)	5,33E-04	3,90E-04	1,81E-04	1,10E-03	1,57E-04	6,88E-05	1,17E-05	2,93E-05	6,90E-05	8,85E-05	-4,88E-05
POCP	(kg NMVOC eq.)	1,19E-04	7,17E-05	4,85E-05	2,39E-04	3,76E-05	1,59E-05	3,01E-06	6,54E-06	1,70E-05	2,45E-05	-1,15E-05
$ADP_{MINERALS\&METALS}$*	(kg Sb eq.)	8,02E-08	1,97E-09	3,28E-08	1,15E-07	4,09E-09	2,17E-10	6,19E-10	7,08E-10	2,94E-09	4,55E-10	-8,45E-10
ADP_{FOSSIL}*	(MJ)	8,53E-01	2,59E-01	2,58E-01	1,37E+00	6,53E-01	2,09E-02	4,10E-02	9,22E-02	5,18E-02	5,82E-02	-1,61E-01
WDP*	(m^3 world eq.)	1,86E+00	2,18E-04	2,87E-03	1,87E+00	4,39E-04	9,28E-03	5,09E-04	7,86E-05	5,11E-04	4,87E-04	-8,68E-05

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 13: DS: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 kg of product in 1200kg bigbag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	(kg CO_2 eq.)	1,72E-01	1,96E-02	1,00E-02	2,02E-01	4,84E-02	2,82E-02	2,25E-03	6,93E-03	2,60E-03	4,38E-03	-1,01E-02

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 14: DS: Use of resources referred to 1 kg of product in 1200kg bigbag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	2,05E-01	1,76E-02	2,49E-01	4,72E-01	3,71E-02	1,18E-02	2,28E-02	6,39E-03	4,16E-03	8,74E-03	-7,39E-03
PERM	MJ	0,00E+00	0,00E+00	3,80E-01	3,80E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,05E-01	1,76E-02	6,29E-01	8,52E-01	3,71E-02	1,18E-02	2,28E-02	6,39E-03	4,16E-03	8,74E-03	-7,39E-03
PENRE	MJ	8,53E-01	2,60E-01	2,59E-01	1,37E+00	6,55E-01	2,09E-02	4,10E-02	9,25E-02	5,19E-02	5,83E-02	-1,61E-01
PENRM	MJ	0,00E+00	0,00E+00	8,42E-02	8,42E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,53E-01	2,60E-01	3,43E-01	1,46E+00	6,55E-01	2,09E-02	4,10E-02	9,25E-02	5,19E-02	5,83E-02	-1,61E-01
SM	kg	5,00E-02	0,00E+00	0,00E+00	5,00E-02	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	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	0,00E+00	0,00E+00	0,00E+00
FW	m^3	1,10E-03	2,04E-05	6,77E-05	1,18E-03	4,20E-05	2,30E-04	2,16E-05	7,38E-06	1,45E-05	1,48E-05	-2,24E-05

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.

Table 15: DS: Waste production and output flows referred to 1 kg of product in 1200kg bigbag

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	1,43E-05	1,37E-12	6,12E-06	2,05E-05	3,14E-12	1,47E-12	3,55E-12	4,90E-13	6,49E-13	2,99E-12	-3,24E-11
NHWD	kg	1,70E-02	4,21E-05	6,05E-03	2,31E-02	9,39E-05	1,42E-02	3,10E-05	1,51E-05	1,38E-05	2,98E-01	-1,45E-02
RWD	kg	3,30E-05	4,84E-07	2,35E-06	3,59E-05	8,07E-07	7,29E-07	6,54E-06	1,72E-07	6,83E-07	6,49E-07	-7,20E-07
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	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	2,58E-03	2,58E-03	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	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	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	0,00E+00	0,00E+00	0,00E+00

HWD: Hazardous waste disposed; **NHWD**: Non-Hazardous waste disposed; **RWD**: Radioactive waste disposed

Table 16: DS: Information on biogenic carbon content at the factory gate referred to 1 kg of product in 25kg bag

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	8,60E-03

Tables from 7 to 16 show absolute results for all the environmental categories considered.

The main contribution to the environmental impact categories in the product life cycle comes from **module A1** (extraction and processing of raw materials). Its relative contribution is over 50% in most of them, and over 90% for the WDP. Referring to the biogenic carbon stored in the packaging, the negative impacts on GWPbiogenic (in **module A3**) is compensated in the **module A5**, when the packaging reaches its end of life. A minor contribution in EPs and ADPfossil is due to the manufacturing process (**Module A3**). The secondary material contained in the product is showed under the indicator SM in the Table of results.

An overview about the average contribution to the different modules considered in the system boundaries are shown in Table 17.

Table 17: Some environmental impacts of DS

ENVIRONMENTAL IMPACTS	A1-A3	A4	A5	C1	C2	C3	C4	D	TOT
CLIMATE CHANGE (FOSSIL)	1,73E-01	2,00E-02	-1,57E-02	1,77E-01	4,95E-02	5,78E-02	2,29E-03	7,08E-03	**4,70E-01** kg CO_2 eq.
ACIDIFICATION	1,33E-04	8,30E-05	5,08E-05	2,67E-04	4,36E-05	1,67E-05	4,95E-06	7,69E-06	**6,06E-04** mol H+ eq.
DEPLETION OF ABIOTIC RESOURCES (FOSSIL)	8,53E-01	2,59E-01	2,12E-01	1,32E+00	6,54E-01	2,17E-02	4,10E-02	9,22E-02	**3,46E+00** MJ
WATER USE	1,86E-00	2,18E-04	2,5E-03	1,87E+00	4,39E-04	9,45E-03	5,09E-04	7,86E-05	**3,75E+00** m^3 world eq.

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

	Data source	GWP - GHG	Unit
Residual electricity grid mix (NO) – 2021	AIB	0,46*	kg CO_2-eqv/kWh

CML2001 - Aug. 2016

8. DATA QUALITY

Table 18: Data quality

Dataset & Geographical reference	Database (source)	Temporary reference
A1; A3		
Inorganic binder	NEPD-3945-2910-NO	2022
Filler (EU)	Sphera Database; Ecoinvent 3.8	2021
Additives (EU)	Ecoinvent 3.8	2021
Residual electricity grid mix (NO)	Sphera Database	2021
Packaging components (EU)	Sphera Database; Ecoinvent 3.8	2020
A2		
Truck, Euro 5, 27t payload (GLO)	Sphera Database	2021
Light train, gross tonne weight 500t / 363t payload (GLO)	Sphera Database	2021
Oceanic ship (27500 DWT – GLO)	Sphera Database	2021
Diesel for transport (EU)	Sphera Database	2018
Heavy Fuel Oil (EU)	Sphera Database	2018
Electricity grid mix (EU)	Sphera Database	2018
A4		
Truck, Euro 6, 27t payload (GLO)	Sphera Database	2021
Diesel for transport (EU)	Sphera Database	2018
A5		
Tap water from surface water	Sphera Database	2021
Commercial waste in municipal waste incineration plant	Sphera Database	2021
Inert matter on landfill	Sphera Database	2021
Electricity grid mix (EU)	Sphera database	2018
C1 – C4		
Truck (EURO 6 - 9,3 ton payload – GLO)	Sphera Database	2021
Electricity grid mix (EU)	Sphera Database	2018
Diesel for transport (EU)	Sphera Database	2018
Construction waste dumping (EU)	Sphera Database	2021
Construction waste treatment (EU)	Sphera Database	2021

All data included in table above refers to a period between 2018 and 2022; 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 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).
Primary data concern the year 2021 and represent the whole annual production.

9. REQUISITE EVIDENCE

9.1 Indication for the calculation of Module A4 (Transport from the factory to the jobsite)

To calculate the impact of transporting 1 kg of product from the factory gate (Sagstua) to the jobsite, use the following formula:

*Transport Impact = EF (kg/DU) * distance (km)*

EF: Emission Factor; DU: declared Unit

Table 19: The EFs are related to 1 kg of product transported with truck EURO 5 and EURO 6

Impact Category	Unit	EF (EURO 5)	Unit (EURO 6)
GWP_{TOTAL}	(kg CO_2 eq.)/km	4,79E-05	4,83E-05
GWP_{FOSSIL}	(kg CO_2 eq.)/km	4,81E-05	4,85E-05
$GWP_{BIOGENIC}$	(kg CO_2 eq.)/km	-4,70E-07	-4,75E-07
GWP_{LULUC}	(kg CO_2 eq.)/km	3,24E-07	3,28E-07

ODP	(kg CFC 11 eq.) /km	4,72E-18	4,77E-18
AP	(mol H+ eq.) /km	1,46E-07	5,04E-08
$EP_{FRESHWATER}$	(kg P eq.) /km	1,72E-10	1,74E-10
EP_{MARINE}	(kg N eq.) /km	6,58E-08	1,54E-08
$EP_{TERRESTRIAL}$	(mol N eq.) /km	7,39E-07	1,87E-07
POCP	(kg NMVOC eq.)/km	1,31E-07	4,27E-08
$ADP_{MINERALS\&METALS}$	(kg Sb eq.) /km	4,84E-12	4,90E-12
ADP_{FOSSIL}	(MJ) /km	6,31E-04	6,38E-04
WDP	(m^3 world eq.) /km	5,38E-07	5,44E-07

Example:

If the product is transported by truck (EURO 5) from Sagstua (production plant) to Oslo (Jobsite) for approximately 90 km, the GWP impact will be:

$$GWP_{TOTAL} = 4{,}79E\text{-}05 * 90km = 4{,}31E\text{-}03\ kg\ CO_2eq$$

9.2 Recycled content

DS contains 5% of recycled material pre-consumer.

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 conduct-ed 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 declara-tion 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 verifi-er	☒ Yes ☐ No

11. REFERENCES

- EN 15804: SUSTAINABILITY OF CONSTRUCTION WORKS - ENVIRONMENTAL PRODUCT DECLARATIONS - CORE RULES FOR THE PRODUCT CATEGORY OF CONSTRUCTION PRODUCTS
- EUROPEAN DIRECTIVE 2008/98/EC
- EUROPEAN RESIDUAL MIXES VERSION 1.0, 2022-05-31 (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

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