ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**Sto SE & Co. KGaA**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-STO-20170136-IBG1-EN
Issue date	07.12.2017
Valid to	06.02.2019

Mineral pre-made mortar: rendering mortar – normal/finishing render

Sto SE & Co. KGaA

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

1. General Information

Sto SE & Co. KGaA

Rendering mortar – normal/finishing render

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

Owner of the Declaration
Sto SE & Co. KGaA
Ehrenbachstraße 1
D-79780 Stühlingen
Germany

Declaration number
EPD-STO-20170136-IBG1-EN

Declared product / Declared unit
1 kg rendering mortar as a mineral pre-made mortar, normal/finishing render product group with a dry bulk density greater than 1300 kg/m³ and less than 1800 kg/m³.
Product names:
Sto Grundputz CP, Sto Putsbruk CP, Sto Putsbruk CP, Sto Pudsmørtel CP, Sto Rappauslaasti CP, (DE, SE, NO, DK, FI); Sto Grundputz BP, Sto Putsbruk BP, Sto Putsbruk BP, Sto Pudsmørtel BP, Sto Rappauslaasti BP, (DE, SE, NO, DK, FI); Sto Grundputz A, Sto Putsbruk A, Sto Putsbruk A, Sto Pudsmørtel A, Sto Rappauslaasti A, (DE, SE, NO, DK, FI); Sto Grundputz B, Sto Putsbruk B, Sto Putsbruk B, Sto Pudsmørtel B, Sto Rappauslaasti B, (DE, SE, NO, DK, FI); Sto Grundputz C, Sto Putsbruk C, Sto Putsbruk C, Sto Pudsmørtel C, Sto Rappauslaasti C, (DE, SE, NO, DK, FI); Sto Kalkmörtel, Sto Kalkbruk, Sto Kalkbruk, Sto Kalkmørtel, Sto Kalkkilaasti, (DE, SE, NO, DK, FI); Sto-Hydraulischer Kalkmörtel Kh, Sto Hydrauliskt Kalkbruk Kh, Sto Hydraulisk Kalkbruk Kh, Sto Hydraulisk Kalkmørtel Kh, Sto Hydraulinen kalkkilaasti Kh, (DE, SE, NO, DK, FI); Sto-Hydraulischer Kalkmörtel KKh, Sto Hydrauliskt Kalkbruk KKh, Sto Hydraulisk Kalkbruk KKh, Sto Hydraulisk Kalkmørtel KKh, Sto Hydraulinen kalkkilaasti KKh, (DE, SE, NO, DK, FI);

This Declaration is based on the Product Category Rules:
Mineral factory-made mortar, 07.2014
(PCR tested and approved by the SVR)

Issue date
07.12.2017

Valid to
06.02.2019

Scope:
This validated declaration authorises the holder to bear the official stamp of the Institut Bauen und Umwelt e.V. It applies to rendering mortar – normal/finishing render as mineral pre-made mortar for factories in Germany, and is valid until five years after being issued. This is an association EPD whereby the product – which demonstrated the highest environmental impact of the group – was selected from that group for calculating the Life Cycle Assessment of the product. This EPD is based on the association EPD: EPD-IWM-20130242-IBG1-DE. The members of the association can be found on the homepage of the association.

Although the products named above are produced in Sweden, the associated environmental performance is still found to be representative of the association EPD:EPD-IWM-20130242-IBG1-DE, which was confirmed by an individual LCA study.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

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

Verification

The CEN Norm /EN 15804/ serves as the core PCR

Independent verification of the declaration according to /ISO 14025/

☐ internally ☒ externally

Dr. Burkhart Lehmann
(Managing Director IBU)

Matthias Schulz
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

Mineral pre-made mortars are mortars whose constituent substances are mixed at the factory and not at the construction site. According to how the mortar is being used, it can be categorised into three types of pre-made mortar: masonry mortar, rendering mortar, and screed material.
Mineral rendering mortars are mixtures of one or more mineral binders, aggregates, water, and additions or admixtures, if necessary, for the production of external render or internal plaster. Rendering mortars are applied to walls and ceilings in one or more layers as required. In addition to the aesthetic design of the surface, they are used as an external render for guarding against the effects of the weather and as internal plasters for providing an even substrate when applying paint coats or wallpaper. In the case of reinforced-concrete ceilings and stairs, renders are also used for fire protection, as well as for thermal protection with the addition of porous aggregates.
Depending on the technical data, the base materials and processing aids used, and the practical application, rendering mortars can be categorised in the product groups of normal/finishing render, normal/finishing render with special properties, lightweight render, Reinforcement Fibre Plaster, and insulating render with an especially high proportion of lightweight aggregates.

2.2 Application

Rendering mortar produced in the factory for use as a base coat or finishing render on walls, ceilings, piers, and separating walls of structures which comply with the applicable standards, or on similar primers (e.g. in existing buildings).
Normal render for the production of internal plaster and external render without special properties.

2.3 Technical Data

Constructional data

Name	Value	Unit
Compressive strength /DIN EN 1015-11/	< 15	N/mm²
Adhesive shear strength /DIN EN 1052-3/	-	N/mm²
Water absorption	-	mg
Water vapor diffusion equivalent air layer thickness	-	m
Thermal conductivity /DIN EN 1745/	0.87	W/(mK)
Tensile bond strength	-	N/mm²
Flexural strength	-	N/mm²
Sound absorption coefficient (as required)	-	%
Water vapour permeability- /DIN EN 1015-19/	15/35	-
Dry bulk density- /DIN EN 1015-10/	1300 - 1800	kg/m³
Capillary absorption- /DIN EN 1015-18/	n/a	kg/(m²min^0.5)

n/a = no requirements
No value specified (-): parameter not relevant

2.4 Delivery status

Mineral rendering mortars – normal/finishing renders are produced and supplied as pre-made dry mortars. Pre-made dry mortar is a mortar made from raw materials which are filled dry in the factory, delivered to the construction site and mixed there into ready-to-use mortar according to manufacturer instructions and conditions. Delivered in sacks up to 35 kg per sack or in silos up to 15 t per silo.

2.5 Base materials / Ancillary materials

Mineral building products such as mineral pre-made mortars and rendering mortars mainly consist of mineral raw materials.

Name	Value	Unit
Aggregate	55-70	M.-%
Fine aggregate	10-20	M.-%
Lightweight aggregate	-	M.-%
Artificial lightweight aggregate	-	M.-%
Cement	7-20	M.-%
Hydrated lime [Ca(OH)2]	< 17	M.-%

The permissible fluctuation range of the technical building data is enabled by the variety of proportions of base materials. In each case the composition of the rendering mortar is 100 M.-%.
The following processing aids and additives can be used as needed:

- Synthetic dispersion: < 0.50 M.-%
- Water retention agent: < 0.30 M.-%
- Air entraining admixture: < 0.03 M.-%
- Thickening agent: < 0.03 M.-%
- Mineral pigments: < 0.20 M.-%
- Hydrophobic agent: < 0.30 M.-%

Aggregate: Natural sands as natural raw materials, which contain natural minor and trace minerals along with the main minerals quartz (SiO2) or calcite (CaCo3).
Fine aggregate: Limestone dusts which arise as a result of the preparation of natural sand for the production of aggregates, as well as very fine sands.
Lightweight aggregate: Natural or artificial mineral lightweight aggregates for reducing the dry bulk weight. Natural lightweight aggregates are

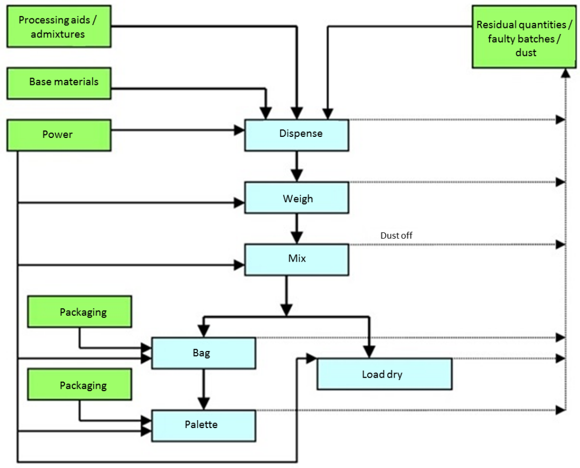
manufactured from natural raw materials via grinding (e.g. pumice or vermiculite). Artificial lightweight aggregates are manufactured by processing, melting, and swelling suitable natural raw materials (swelling clay, perlite) or sorted recycled glass (expanded glass).
Artificial lightweight aggregate: Organic, expanded polystyrene (EPS) produced by foaming in spherical or particle form (recycled) for reducing the dry bulk density.
Cement: As per /EN 197-1/; cement is used as a binder and is mainly made from limestone marl or a mixture of limestone and clay. The natural raw materials are baked and then ground.
Hydrated lime: As per /EN 459/; white hydrated lime is used as binder and is made by baking natural limestone followed by slaking.
Synthetic dispersion: Polymer powder for improving the adhesive bond, elasticity, mechanical properties, etc. in thin-bed mortar.
Water retention agent: Cellulose ether, made from cellulose, which prevents dehydration from occurring in the fresh mortar too quickly.
Air entraining admixture: Tensides for reducing the surface tension of water and producing air pores. These reduce the bulk density of fresh mortar, improve workability, and reduce the tendency of contraction and stress cracking.
Thickening agent: Cellulose or starch ether, made from cellulose or crystal starch, improves the resistance to flow, and thus has a thickening effect, but does not have any water-retaining properties.
Mineral pigments: Natural or synthetic powder-form colouring materials which are produced by mechanical processing of the relevant mineral substances such as chalk, clay, etc.
Hydrophobic agent: Water-soluble sodium oleate or zinc stearate for reducing the capillary absorption of the solid mortar.

2.6 Manufacture

Mineral rendering mortars are made in mixing plants in the following steps:

- Filling of the inventory or weighing containers
- Conveyance of ingredients and substances being mixed in the mixer
- Mixing
- Conveyance of finished products
- Packaging
- Loading and shipping of the finished product

The raw materials – sand, binder, lightweight aggregates, processing aids, admixtures, and additions (see base materials) – are stored at the manufacturing plant in silos. From the silos, the raw materials are gravimetrically dosed and intensely mixed according to the respective formulation. The mixture is then packaged and shipped dry as pre-made dry mortar in containers.



2.7 Environment and health during manufacturing

The current state of the art includes the 100-% return of dry waste in production. In all places where dust can arise during production in the factory, this waste is fed into a central filter system using the appropriate extraction systems, taking into account the occupational limit values. The very fine dust filtered out in these systems are then fed back into the manufacturing process. As part of the quality management systems introduced, any off-specification batches are detected immediately by the automated process monitoring system and are fed into circulation with the appropriate recovered-goods silos, i.e. they are fed back into the production process in very small quantities. This procedure is also applied for product residues which are transported back to the manufacturing plant in small quantities in silos or sacks.
Process exhaust air is dedusted until far below the statutory limiting values of the OEL values (Occupational exposure limits).

Noise:
Noise level measurements have shown that all values determined inside and outside the production sites are well below the required specifications of technical standard due to noise protection measures being taken.

2.8 Product processing/Installation

Mineral rendering mortars are normally processed by machine. They are extracted from the silo with a dry-materials conveying machine or from individual containers and mixed with a mixing pump before being conveyed and applied. Silo mixing pumps can also be used.
The rendering mortars are then levelled, and textured if necessary, on site with suitable tools.
The regulations of the workers' compensation insurers and the respective safety data sheets of the building apply.
With the cement and lime binders in mineral pre-made mortars, the fresh mortar mixed with water is strongly alkaline. Prolonged contact (e.g. knees in wet mortar) can cause serious skin damage owing to the alkalinity. Personal protective measures must therefore be taken (EU Health & Safety Data Sheet) to avoid any contact with eyes or skin.
No special measures are required for protection of the

environment. Unchecked dust emissions must be avoided.
Mineral pre-made mortars must not enter the sewer system, surface water, or ground water.

2.9 Packaging
Bagged cargo from a paper bag with a plastic insert, sacks stored on wooden pallets, pallets wrapped in plastic film, silo-based goods stored in steel silos.
Possibilities of reuse for the packaging of bagged cargo – separation if necessary. Unsoiled polyethylene films (correct sorting must be applied) and reusable wooden pallets are taken back by the building material dealer (reusable wooden pallets subject to reimbursement as per the deposit system), returned to the mortar plants by the dealer, and fed back into the production process. The films are forwarded to the film manufacturers for recycling.

2.10 Condition of use
The specified products are rot-resistant and ageing-resistant during normal use that conforms to the intended purpose of the products described.
Rendering mortars made from mineral pre-made mortars must be protected from long-term weather effects, e.g. by properly connecting the facade base /SAF 2004/.
The cracking resistance of rendering mortars made from mineral pre-made mortars can be increased with cracking reinforcement in the tension-stressed areas of the render /DIN V 18550/.

2.11 Environment and health during use
Due to the stable CSH compound (calcium silicate hydrate compound) and the firm structures achieved through curing on the substrate, emissions are rendered impossible. During normal use conforming to the intended purpose of the products described, any adverse health effects have been rendered impossible.
No hazards for water, air, and soil are known for use as per the intended application of the products.
The natural ionising radiation of the rendering mortars made from mineral pre-made mortars is extremely low and does not pose any health-related risks.

2.12 Reference service life
A reference service life (RSL) as per /ISO 15686-1, -2, -7, and -8/ is not declared. Provided they are used as intended and properly applied, the service life of pre-made mortars has been known to be 50 years or longer.

2.13 Extraordinary effects

Fire

Based on Commission Decision 94/611/EC, normal/finishing render must always be classified into fire protection class A1 “No contribution to fire” in accordance with /EN 13501-1/ because the proportion of finely distributed organic components is not greater than 1-%.
Regardless of the product group, it has been shown in the “hot” measurement (structural analysis with the resistance of the masonry reduced under the influence of fire temperatures) that rendering mortar made from mineral pre-made mortars has a beneficial effect on the required minimum wall thickness.
Depending on the product, additional labels will appear on containers with the CE mark or declaration of performance.

Fire protection

Name	Value
Building material class	A1
Burning droplets	-
Smoke gas development	-

Water

Mineral pre-made mortars as rendering mortars are structurally stable and are not subject to changes in shape as a result of water exposure and drying.

Mechanical destruction

No specifications required.

2.14 Re-use phase
The service life of masonry coated with normal/finishing render normally ends along with the service life of the simultaneously erected building.
Reuse and further use of masonry coated with render after demolition is not possible.
Elements of building construction made from mineral rendering mortars can normally be stripped down easily. During demolition of a building, these elements do not have to be treated as special waste, but the sorting during demolition must be as exact as possible.
Mineral rendering mortars can be recycled as building materials. They are normally reused in construction above and below ground in the form of recycled aggregates.

2.15 Disposal
Mortar is categorised as mineral construction waste.
78.4-% of construction waste is recycled. /German Building Materials Association/
The suitability of hardened mineral rendering mortars for landfill as per landfill class I is ensured according to the Technical Instruction on Municipal Waste /TASi/.
The /EWC waste code/ according to the waste reuse directory specifies 170101.

2.16 Further information
Further information is available online at www.sto.com.

3. LCA: Calculation rules

3.1 Declared Unit
This declaration refers to the production of one kilogram of typical rendering mortar of the normal/finishing render product group. Only dry mortars are taken into consideration.

Specification of declared unit

Name	Value	Unit
Declared unit	1	kg
Gross density	1300 - 1800	kg/m³
Spreading rate	0.70-0.85	l/kg

The product which demonstrated the highest environmental impact of the normal/finishing render product group was selected from that group for calculating the Life Cycle Assessment.

3.2 System boundary

The lifecycle analysis of the products being examined encompasses the production of the mortar incl. raw material extraction and the provision of energy sources up to the packaged, finished product (module A1-A3), the application of the product incl. transportation to the construction site (module A4-A5), the use phase (module B1), and disposal of the mortar (module C4). For silo-based goods, the proportionate applications for transportation and manufacturing of the silo are taken into account. Credit for packaging, including energy recovery (module D) is also incorporated into the Life Cycle Assessment.

3.3 Estimates and assumptions

For the individual formulation components of the formulations, these were assessed according to manufacturer specifications or literature in the event that no specific /GaBi/ processes were available.

3.4 Cut-off criteria

At the input side, all material flows that enter the system and are greater than 1-% of their total mass or contribute more than 1-% to primary energy demand are taken into consideration. The total amount of input flows not taken into consideration is maximum 5-% of the energy and mass in use.
The manufacturing of the machines, facilities, and other infrastructure required for the production of the relevant products was not taken into consideration for the Life Cycle Assessments.

3.5 Background data

The software system /GaBi 6/ was used for modelling the life cycle for the production of mortar products. All of the background records relevant to accounting have been retrieved from the GaBi database, with the exception of the FEFCO and pumice (ROTOCELL) record.

3.6 Data quality

Representative products were used for this sample EPD – the product with the greatest environmental impact was declared to be representative of a group in order to calculate the Life Cycle Assessment results. Corresponding background records were available in the GaBi database for all relevant pre-products used. The requirements in terms of data quality and background data correspond to the specifications of PCR Part A.
The technological background of the data collected reflects the physical reality for the declared product group.
The records are complete and fulfil the system boundaries and criteria for the exclusion of inputs and outputs.
The last audit of the data used was less than 7 years ago.

3.7 Period under review

The period under review is one year of production based on the year 2011. The reference area of the Life Cycle Assessments was limited to Germany. The result is that, besides production processes under these marginal conditions, the precursors also relevant for Germany, such as electricity and energy provision, were used.

3.8 Allocation

Specific information on the allocations within the background records can be found in the documentation of the GaBi records. The material and energy consumption for the declared product were allocated by the member companies of IWM. The data made available consists of internal key figures which have not been published. A multi-input allocation is used as per a simple credit method with a credit for power and thermal energy when burning packaging and production waste as well as the landfilling of production waste. The credit from the disposal of packaging is credited in module D.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account. The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

The following technical information is necessary for the declared modules or can be used for the development of specific scenarios in the context of building assessment if modules have not been declared (MND).

Transportation to the construction site (A4)

Name	Value	Unit
Litres of fuel	0.001573	l/100km
Transport distance	300	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1300 - 1800	kg/m³

Installation into the building (A5)

Name	Value	Unit
Auxiliary	0	kg
Water consumption	0.0003	m³
Other resources	0	kg
Electricity consumption	0.000124	kWh
Other energy carriers	0	MJ
Material loss	0	kg
Output substances following waste treatment on site	0	kg
Dust in the air	0	kg
VOC in the air	0	kg

For use (B1) see Chapter 2.12 on use

In the use stage, the carbon dioxide absorbed by means of carbonation is taken into consideration. The carbon dioxide released during the neutralisation of limestone (CaCO3) in the production of lime and cement is reabsorbed when reacting with the lime and cement binders, thus leading to an increase in strength. Only the cement content of the mortar is taken into consideration in the Life Cycle Assessment of the pre-made mortar because there are no binding specifications on the absorption of carbon dioxide for lime /Life Cycle Assessment/.

Reference service life

Name	Value	Unit
Reference service life (minimum)	50	a

End of life cycle (C1-C4)

Name	Value	Unit
Collected separately waste type	0	kg
Collected as mixed construction waste	0	kg
Reuse	0	kg
Recycling	0	kg
Energy recovery	0	kg
Landfilling	1.04	kg

Re-utilisation, recovery, and recycling potential (D); relevant scenario specifications

Name	Value	Unit
Recycling silo- (packaging)	100	%
Burning of wooden pallets- (packaging)	100	%
Burning of paper- (packaging)	100	%
Burning of polyethylene film- (packaging)	100	%

5. LCA: Results

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

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

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg rendering mortar – normal/finishing render

Parameter	Unit	A1-A3	A4	A5	B1	C4	D
Global warming potential	[kg CO_2-Eq.]	2.42E-1	2.16E-2	4.17E-2	-8.80E-4	1.45E-2	-1.83E-2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.24E-10	4.51E-13	3.73E-13	0.00E+0	1.11E-11	-5.30E-12
Acidification potential of land and water	[kg SO_2-Eq.]	3.59E-4	9.75E-5	4.73E-6	0.00E+0	8.84E-5	-2.61E-5
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	8.51E-5	2.36E-5	9.69E-7	0.00E+0	1.21E-5	-2.90E-6
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	3.04E-6	-3.34E-5	4.56E-7	0.00E+0	9.25E-6	-2.49E-6
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.20E-6	9.97E-10	5.57E-10	0.00E+0	5.21E-9	-3.76E-8
Abiotic depletion potential for fossil resources	[MJ]	1.89E+0	2.96E-1	1.07E-2	0.00E+0	1.94E-1	-2.42E-1

RESULTS OF THE LCA - RESOURCE USE: 1 kg rendering mortar – normal/finishing render

Parameter	Unit	A1-A3	A4	A5	B1	C4	D
Renewable primary energy as energy carrier	[MJ]	4.16E-1	IND	IND	IND	IND	IND
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	IND	IND	IND	IND	IND
Total use of renewable primary energy resources	[MJ]	4.16E-1	1.76E-2	1.13E-3	0.00E+0	1.51E-2	-2.56E-2
Non-renewable primary energy as energy carrier	[MJ]	2.01E+0	IND	IND	IND	IND	IND
Non-renewable primary energy as material utilization	[MJ]	6.00E-2	IND	IND	IND	IND	IND
Total use of non-renewable primary energy resources	[MJ]	2.07E+0	2.97E-1	1.24E-2	0.00E+0	2.03E-1	-2.79E-1
Use of secondary material	[kg]	0.00E+0	IND	IND	IND	IND	IND
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	IND	IND	IND	IND	IND	IND

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg rendering mortar – normal/finishing render

Parameter	Unit	A1-A3	A4	A5	B1	C4	D
Hazardous waste disposed	[kg]	IND	IND	IND	IND	IND	IND
Non-hazardous waste disposed	[kg]	IND	IND	IND	IND	IND	IND
Radioactive waste disposed	[kg]	IND	IND	IND	IND	IND	IND
Components for re-use	[kg]	IND	IND	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	5.31E-2	IND	IND	IND
Exported thermal energy	[MJ]	IND	IND	1.29E-1	IND	IND	IND

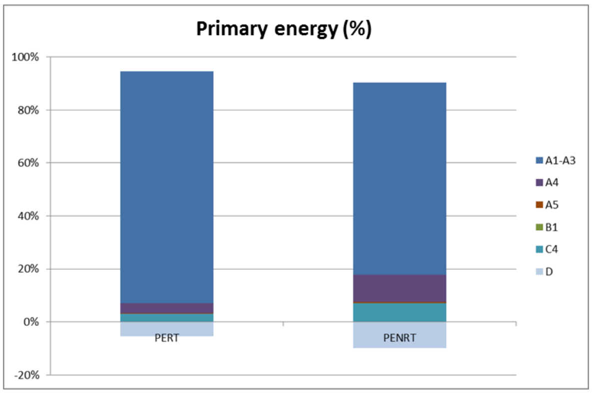
Relevant: Use of freshwater resources, hazardous waste for landfill disposal, disposed-of non-hazardous waste, disposed-of radioactive waste – not all of the data inventories used for calculating the Life Cycle Assessment support the methodical approach for declaration of the water and waste indicators. The amounts of material mapped out by these data inventories contribute 0.5-% to product manufacturing. The statistical significance of these data inventories has been tested using a sensitivity analysis and is defined as high. The indicators therefore cannot be disclosed (as per the decision of SVA from 7 January 2013)
Relevant: Non-renewable primary energy as material utilisation – based on expert analysis: dispersion powder calorific value: 12 MJ/kg based on the assumption that plastic products have average calorific values between 30 and 40 MJ/kg and dispersion powders normally have between 50 and 60-% proportion of filler which does not affect the calorific value (proportion in formulation: 0.5-%)
Relevant: Global warming potential B1 – carbon dioxide absorption depending on cement content and based on one year.

6. LCA: Interpretation

Primary energy renewable total (PERT) and non-renewable total (PENRT)

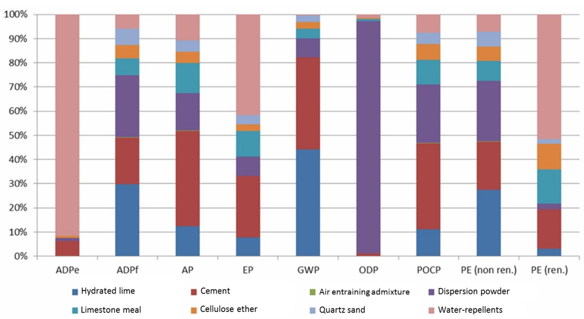
The main part of **renewable primary energy demand** (PERT) is caused by the production of the mortar, to which the manufacturing of packaging (wooden pallets in particular) contributes. This is explained by the fact that when wood grows solar energy is required for photosynthesis, and is therefore counted here as a renewable source of primary energy. The manufacturing of hydrophobic materials plays a significant role in the production stage, which is mainly a result of upstream supply chains of these pre-products.

The main part of the **non-renewable primary energy demand** (PENRT) can also be traced to the manufacturing of pre-products. The main energy sources used are coal, oil, and natural gas.



Distribution of primary energy for rendering mortar – normal/finishing render

During the manufacturing process, it is mainly the consumption of power and thermal energy as well as the production of packaging materials (polyethylene film, paper, wooden pallets, and steel) which affects non-renewable primary energy demand. The significant transportation distances of the dispersion powder in the module A2 are responsible for approx. 13-% of PERNT, to which the power and thermal-energy demand, as well as the production of packaging, also contributes at 15-%.
A credit (module D) is issued when packaging materials are burned (module A5).
However, the most significant factor on the renewable primary energy demand is the hydrophobic material, with dispersion powder with white hydrated lime for the non-renewable primary energy demand.



Effect of pre-products (module A1) on the impact categories and primary energy demand of rendering mortar – normal/finishing render

The **global warming potential** (GWP) is dominated by the manufacturing of pre-products (module A1), particularly the production of cement, but also white hydrated lime. During installation (module A5), the packaging (paper, polyethylene film, and wooden pallets) is burned. The resulting emissions (when burning the wood in particular) contribute to GWP. The credit (module D) which results from the power and heat produced in waste incineration units and steel recovery reduces the GWP. The absorption of carbon dioxide as a result of carbonation in the use stage (module B1) also reduces the GWP.
The power consumption on the construction site and the handling of packaging waste (module A5) contributes approx. 13-% and landfill disposal of the mortar contributes approx. 4-% to GWP.
The main cause of global warming potential is carbon dioxide emissions.

In terms of the **ozone depletion potential** (ODP), it is clear that the influencing factors are almost exclusively caused by modules A1 to A3, which can mainly be traced back to the upstream supply chain of the dispersion powder (approx. 96-%). The emissions of coolants (halogenated hydrocarbons) when generating the power used in the production of pre-products play a significant role. When disposing of the mortar by landfill, the surface and the waterproofing of the substrate are of particular significance. The expense required for these impermeable materials (e.g. swelling clay, mineral coatings, polyethylene film) and the diesel oil for the compressors are taken into consideration in the model.

Acidification potential (AP) is caused mainly by nitrogen oxides and sulphur dioxide, which again mainly occur as a result of landfill disposal (due to the production of impermeable materials and diesel oil for the compressors) and the production of pre-products, in particular for cement, limestone dust, white hydrated lime, and dispersion powder. In module A3, this is caused mainly by the power consumption and production of packaging. Because of the long distances, transportation to the construction site contributes approx. 17-% to the total acidification potential.

Nitrogen oxide emissions into the air are approx. 35-% responsible for the **eutrophication potential (EP)**, yet emissions into water also contribute approx. 20-%. The pre-products in the manufacturing process are responsible for approx. 58-% of the eutrophication potential, wherein cement, dispersion powder, and hydrophobic materials play the most significant role, while the manufacturing process itself (e.g. energy consumption) contributes approx. 15-%. In addition, because of the long distances, transportation to the construction site is responsible for approx. 19-% of the eutrophication potential.

Photochemical ozone creation potential (POCP) is caused mainly by the landfill disposal of mortar, the manufacturing of pre-products, and transportation to the construction site. Nitrogen monoxide emissions that are generated during transportation have a negative impact on POCP, which leads to a credit in all transport processes. The primary cause of the POCP is emissions of non-methane volatile organic compounds (NMVOCs) and methane from landfill disposal sites.

Abiotic depletion potential for non-fossil resources (ADPE) is almost exclusively driven by the manufacturing of pre-products (primarily hydrophobic materials), particularly because of the use of zinc in the upstream supply chain.

The interpretation of **abiotic depletion potential for fossil resources (ADPF)** follows that for non-renewable primary energy use. The greatest influencing factors on the impact category are the pre-products, particularly the manufacturing of dispersion powder, white hydrated lime, and cement, as well as the power consumption.

7. Requisite evidence

7.1. VOC emissions:
Measuring location: Fraunhofer Institute for Building Physics (IBP), Holzkirchen Branch, D-83626 Valley
Measuring procedure: Determination of volatile organic compounds from building products and fixtures in accordance with /ISO 16000-9 and -11/ in a 0.2 m3 test chamber (t0 = 7 days) and evaluation as per the schema of the Committee for Health-related Evaluation of Building Products /Committee for Health-related Evaluation of Building Products/. Measurement of different products intended for both interior use and outdoors.
Test report: Results log 005/2008/281 from 20 March 2008.
Results:

Sample identifier	Normal render	
Committee for Health-related Evaluation of Building Products result overview	3 days [µg/m³] Measured values	28 days [µg/m³] Measured values
[A] TVOC (C6-C16)	< 400	< 100
[B] ∑ SVOC (C16-C22)	< 5	< 2
[C] R (dimensionless)	< 1.5	< 0.2
[D] ∑ VOC without LCI	< 100	< 10
[E] ∑ carcinogens	< 2	< 1
[F] VVOC (<C6)	< 60	< 40

7.2 Radioactivity:
Measuring location: Fraunhofer Institute for Building Physics (IBP), Holzkirchen Branch, D-83626 Valley
Measuring procedure: Test of content for the radioactive nuclides radium-226, thorium-232, and potassium-40 by measuring the activity concentrations CNuklid through alpha spectrometry (delayed coincidence methods via LSC) or gamma spectrometry.
Test report: Inspection report from 12 December 2006 on the radioactivity of building products.
Result: The activity concentration indices (I) calculated from the measured activity concentrations CNuklid were below the recommended limiting value of I = 2 for all specified products. Moreover, at no point was the recommended limiting value I = 0.5 either reached or exceeded for building products used in large quantities. Where I correlated with the dose criterion in accordance with the /Radiation Protection 112/ guidelines from the European Commission, all specified products remained below the recommended limiting value of the annual radiation dose of 0.3 mSv/a.

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