Environmental Product Declaration

in accordance with ISO 14025

Exterior plaster (organic)

Sto Aktiengesellschaft

Declaration number

EPD-STO-2011331-E

Institut Bauen und Umwelt e.V.

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Abbreviated version

Environmental Product Declaration

Institut Bauen und Umwelt e.V. **www.bau-umwelt.com**	**Programme holder**
Sto Aktiengesellschaft Ehrenbachstrasse 1 D-79780 Stühlingen	**Declaration holder**
EPD-STO-2011331-E	**Declaration number**
Exterior plaster: Stolit, StoSilco, StoSil, StoLotusan This declaration is an environmental product declaration in accordance with ISO 14025 and describes the environmental performance of the building products named here. It is intended to promote the development of environmentally friendly and healthful construction. All relevant environmental data are disclosed in this validated declaration. The declaration is based on the PCR document "Coatings with organic binders", base year 2010-04.	**Declared building products**
This validated declaration entitles us to carry the mark of Institut Bauen und Umwelt e.V. It is applicable only for the named products for three years from the date of issue. The declaration holder is liable for the underlying statements and documentation.	**Validity**
The **declaration** is complete and contains in detailed form: - product definition and structural specifications - specifications on basic materials and their origin - descriptions of how the products are manufactured - notes on product application - statements on the condition of use, extraordinary effects and stage after use - results of the life cycle assessment - documentation and tests	**Contents of the declaration**
26 February 2011	**Date of issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of the IBU)	**Signatures**
This declaration and the underlying norms have been examined in accordance with ISO 14025 by the independent Expert Committee.	**Audit of the declaration**
Prof. Dr.-Ing. Hans-Wolf Reinhardt (chair of the Expert Committee) Dr. Eva Schmincke (Examiner appointed by the Expert Committee)	**Signatures**

Abbreviated version

Environmental Product Declaration

Product description

Exterior plasters according to DIN EN 15824 are factory-manufactured, paste-form mixtures made of one or more water-based polymer dispersions, possibly combined with silicon- or silicate-based binders, mineral bulking agents, water and additives. Hardening is through drying and film formation of the polymer binders into coatings with plaster-like appearance. As a rule, they are preserved for the duration of storage against bacteria, yeast or fungus. They can also be equipped with additives to protect their own coat and surface against algae and fungus during the utilisation phase.

Field of application

As finish plaster for mineral and organic substrates, including wood and metal surfaces.

Framework of the life cycle assessment

The **Life Cycle Assessment (LCA)** was performed in accordance with /DIN EN ISO 14040/ and /DIN EN ISO 14044/, the requirements of the IBU guideline on Type III declarations and the product-group-specific norms for "Coatings with organic binders". The LCA covers raw materials and energy production, raw materials transportation, actual manufacture, use and disposal. The long version (see chapter 8) also contains information on transportation, stage of use and disposal of exterior plaster.

Scope of the life cycle assessment

Raw material provision, production up to the factory gates

Evaluation dimension	Unit per kg			
	Stolit	StoSilco	StoSil	StoLotusan
Primary energy requirement, non-renewable [MJ]	7,41E+00	8,21E+00	5,10E+00	1,05E+01
Primary energy requirement, renewable [MJ]	1,33E+00	1,22E+00	4,46E-01	2,31E+00
Abiotic depletion potential (ADP) [kg Sb equiv.]	3,01E-03	3,33E-03	2,08E-03	4,10E-03
Global warming potential (GWP 100) [kg carbon	2,35E-01	2,65E-01	1,89E-01	3,79E-01
Ozone depletion potential (ODP) [kg R11 equiv.]	3,76E-07	3,43E-07	1,64E-07	5,05E-07
Acidification potential (AP) [kg SO2 equiv.]	1,47E-03	1,61E-03	1,31E-03	2,39E-03
Eutrophication potential (EP) [kg PO4 equiv.]	7,99E-04	8,06E-04	9,44E-04	1,22E-03
Photochemical ozone creation potential (POCP)	2,55E-04	2,60E-04	1,75E-04	2,93E-04

Raw material provision, production, utilisation and disposal

Evaluation dimension	Unit per kg			
	Stolit	StoSilco	StoSil	StoLotusan
Primary energy requirement, non-renewable [MJ]	7,79E+00	8,59E+00	5,48E+00	1,08E+01
Primary energy requirement, renewable [MJ]	1,33E+00	1,22E+00	4,46E-01	2,31E+00
Abiotic depletion potential (ADP) [kg Sb equiv.]	3,18E-03	3,50E-03	2,25E-03	4,28E-03
Global warming potential (GWP 100) [kg carbon	2,63E-01	2,93E-01	2,17E-01	4,07E-01
Ozone depletion potential (ODP) [kg R11 equiv.]	3,76E-07	3,43E-07	1,64E-07	5,05E-07
Acidification potential (AP) [kg SO2 equiv.]	1,78E-03	1,92E-03	1,62E-03	2,71E-03
Eutrophication potential (EP) [kg PO4 equiv.]	8,38E-04	8,45E-04	9,83E-04	1,26E-03
Photochemical ozone creation potential (POCP)	2,88E-04	2,93E-04	2,08E-04	3,26E-04

* For a building life cycle assessment, the material requirement per surface is decisive; see also table in 8.2.2.

Documents and tests

In addition, the following documents and tests are depicted in the environmental declaration:

Radioactivity: Determination of the radionuclides in accordance with gamma spectroscopic analysis by the Fraunhofer-Institut für Bauphysik, Stuttgart-Holzkirchen, Prof. Dr. Klaus Sedlbauer

VOC emissions: Emission investigations in accordance with DIN EN ISO 16000-9/11 /ISO 16000/ and evaluation in accordance with Committee for Health-related Evaluation of Building Products (AgBB) plan /AgBB/ by the Fraunhofer-Institut für Bauphysik, Stuttgart-Holzkirchen, Prof. Dr. Klaus Sedlbauer

Washing out of substances: The method for washing out components from exterior coatings is currently being developed in the TC 139 WG 10.

Product group:	Coatings with organic binders	Issued on
Declaration holder:	Sto AG, Ehrenbachstrasse 1, D-79780 Stühlingen, Germany	26-02-2011
Declaration number:	EPD-STO-2011331-E	

Area of application

This environmental declaration refers to exterior plaster with organic binders from the Sto factory in Weizen

1 Product definition

Product definition

Exterior plasters with organic binders according to DIN EN 15824 are factory-manufactured, paste-form mixtures of one or more water-based polymer dispersions, possibly combined with silicon- or silicate-based binders, mineral bulking agents, water and additives. Hardening is through drying and film formation of the polymer binders into coatings with plaster-like appearance.

Application

As finish plaster for mineral and organic substrates, including exterior wood and metal surfaces. Direct contact with groundwater is not intended.

Placing on the market / rules for use

DIN EN 15824

Quality assurance

CE-conformity marking

Internal and external supervision in accordance with the above standard.
Quality management system in accordance with DIN EN ISO 9001.
Environmental management system in accordance with EMAS or DIN EN ISO 14001,
certification number: 003651 QM, 003651 UM

Conformity with Biocidal Products Directive 98/8/EC

Properties as supplied

Exterior plasters with organic binders are produced in the factory as paste-form products and filled into plastic containers, drums, big bags, or wet silos, possibly tinted and temporarily stored, and delivered to the construction site.

After application, they are textured during the workable time with suitable tools. After drying and hardening, the result is weather-resistant (possibly tinted) surface layers with high flexibility, impact resistance and crack bridging and with good adhesion to practically all substrates.

Structural data

Criterion	Standard	Stolit	StoSilco	StoSil	StoLotusan	Unit
Density	DIN 53217	1.4 - 1.45	1.7 - 1.9	1.8 - 2	1.7 - 1.8	g/cm³
Water vapour diffusion mass flow density V	EN ISO 7783-2	43 - 54	73 - 81	400,0	200 - 250	g/m²*d
pH value	DIN ISO 10390	8 - 9.5	8 - 9.5	10 - 11.5	8 - 9.5	pH
Solids content	DIN 18556 DIN 53189	76 - 84	76 - 84	80 - 88	76 - 84	%
Water permeability rate W	EN 1062-3	0,0	< 0.05	0.1 - 0.2	< 0.05	kg/m² *√h

Degree of whiteness and lightness are not relevant for exterior plaster.

Sound protection

Sound-protection requirements are not placed on exterior plaster with organic binders.

Biocidal characteristics

Exterior plasters with organic binders are normally preserved for the duration of storage against bacteria, yeast or fungus. They can also be equipped with biocides to protect their own coat and surface against algae and fungus during the utilisation stage.

2 Base materials

Primary product base materials

Basic materials	Mass %
Polymer dispersion 50%	9 - 13
Aggregates	50 - 75
Pigments	0 - 2
Hydrophobic agent	0.2 - 5
Sodium silicate	4 - 6
Filler material	2.5 - 20
Water	6 - 13

Materials / additives

Materials / Additives	Mass %
Thickening agent	0.05 - 0.25
Water retention agent	0.1 - 0.7
Anti-foaming agent	0.2 - 0.4
Dispersing agent	0.1 - 1.0
Film forming agent	0.2 - 1.0
Container / film conservation	0.4 - 1.2
Fibre	0.1 - 0.7

Explanation of materials

Polymer dispersions: Water-based dispersions based on copolymers (acrylate, styrolacrylate, terpolymers, etc.)

Rock flour: Powder made of natural materials, such as quartz (SiO_2) or calcite ($CaCO_3$). They can contain minor and trace minerals.

Pigments: Mineral pigments, mostly titanium dioxide

Bulking agents: Synthetic bulking agents, such as precipitated $CaCO_3$, $BaSO_4$, $Al(OH)_3$, etc.

Thickening agents: Cellulose or starch ethers, polyacrylate and polyurethane products.

Water retention agents: Special cellulose ethers to achieve longer working times.

Anti-foaming agents: Surface-active substances for avoiding foam formation during manufacture and application

Dispersing agents: Surface-active substances for fast distribution of bulking agents and pigments.

Film-forming agents: Organic solvents for reducing the film-formation temperature in case of low outside temperature.
Packaging preservative: Preservative for stabilising the products during the storage phase (mostly on isothiazolinone basis).
Hydrophobing agents: Substances from the silane/siloxane/silicon group
Film conservation: Substances to protect the plaster film against algae and fungi.

Raw materials extraction and origin

Sand and limestone powders are extracted from natural deposits in near-surface layers by means of grinding and selection processes. The extracted mineral raw materials come from within a radius of maximum 300 kilometres from the plant.

Water-based polymer dispersions are produced through polymerisation of suitable monomers, mostly with 50% solids content at chemical companies and delivered in silo wagons. The transport distances are max. 400 kilometres.

Additives are manufactured by chemical companies and delivered in sacks, drums or silos. Transport distances can be up to 600 kilometres.

Availability of raw materials

Many organic components are dependent on fossil raw materials (oil, natural gas, coal), which are considered to be scarce. Some of the organic products, such as cellulose derivatives, fatty acids, alcohols, etc. are gained from renewable raw materials.
Inorganic components consist of mineral raw materials which are not scarce.

3 Product manufacture

Product manufacture

The formulations used are optimised according to market requirements within the percentage spectrum specified under section 2, Base Materials. Other materials are not included.

Product group:	Coatings with organic binders	Issued on
Declaration holder:	Sto AG, Ehrenbachstrasse 1, D-79780 Stühlingen, Germany	26-02-2011
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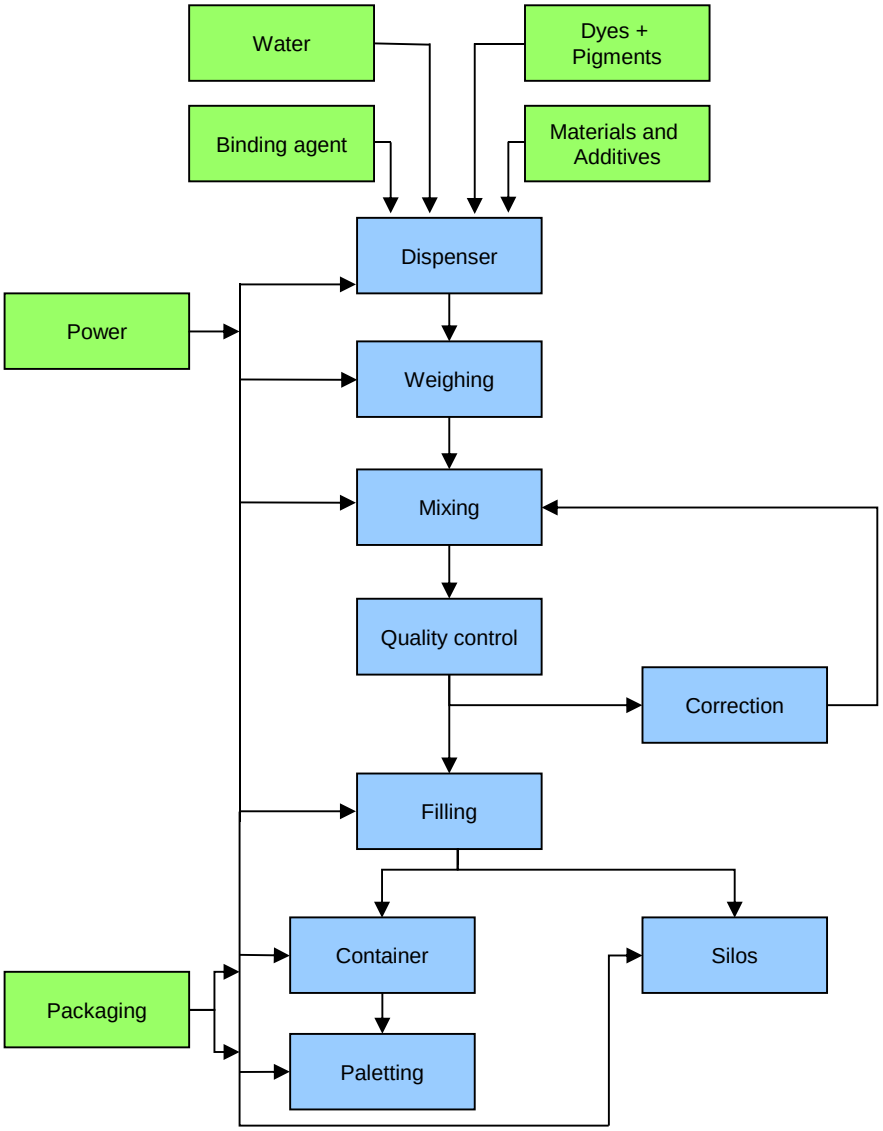

Exterior plasters with organic binders are manufactured in mixing plants in the following work steps:

1. Filling of the inventory or weighing containers
2. Conveyance of the ingredients into the mixer
3. Dispersing and mixing
4. Quality control, adjustment of the consistency, if necessary
5. Filling of the products into storage and transport packaging
6. Loading and delivery

The raw materials are stored in the production factory in silos, big bags, or sacks. According to the respective formulation, they are gravimetrically dosed and intensely mixed. After filling and packaging, they are temporarily stored or delivered directly. At the construction site, the products' consistency can be adjusted with water to meet the application and weather conditions.

Health protection manufacturing

In the chemical industry, safety glasses and gloves and possibly protective helmets are required in the plant. Modern mixing plants have automatic dosing of raw materials, so employees have practically no contact with raw materials. For solvents and preservatives, the manufacturer's safety instructions are followed.

Environmental protection manufacturing

Water
If the product remains the same, cleaning water is used as mixing water for the subsequent lot. Otherwise, all production wastewater is cleaned in our own wastewater treatment plant and then sent on to the municipal wastewater treatment plant. Dry waste (dust) is worked in.

Liquids
Storage and production are protected through safety measures against undesired leakage of liquid components (double-walled silos or collecting vats).

Noise
Noise level measurements have shown that all values determined inside and outside the production sites are well below the required specifications.

Waste
Types of waste include foils, paper bags, wood, paper, waste oil, metal scrap and residual commercial waste. These waste types are separated, stored and recycled.

4 Product application

Application recommendations

Organically bound plasters can be applied manually or by machine. After the products are applied to the intended surfaces, they are levelled and textured with an appropriate tool.

Specific information on application and other actions with these products are described in detail in the technical data sheet.

Occupational safety environmental protection

The regulations of the workers' compensation insurers and the respective safety data sheets of the products apply.

When working with organic solvents, ammonia, preservatives and sodium silicate, the instructions and safety measures of Gisbau or the applicable national safety information agency as well as EC safety data sheets shall be followed.

Direct contact with the eyes and skin must be avoided through personal protective measures.

During application and drying of the plaster mass, film forming agents (solvents) are released into the atmosphere. No other negative influences on the environment are currently known.

Plaster mass must not reach the sewer system, surface water or groundwater. That also applies to the cleaning water for tools and machines. The wastewater is collected and disposed of through suitable cleaning systems.

Residual material

Due to the value of these products, the residual material is kept and used at the next construction site.

Packaging

Packaging, such as foils, plastic buckets and paper, is collected separately and given to the waste management contractor for recycling.

The reusable wood pallets are given back to the manufacturer, who repays the deposit, and returned to the production process.

5 Usage conditions

Ingredients

As depicted under point 3 Product Manufacture, mostly natural aggregate and water-based polymer dispersions are used in the production of exterior plasters with organic binders. The additives for improvement of application and storage characteristics are added in small amounts.

Effects on environment and health

After drying, the unique matrix of aggregate, rock flour and water-based polymer dispersion results in firm, long-lasting, elastic and crack-resistant layers, which adhere to practically all substrates. They are impact-resistant, tough and crack-bridging.

Plaster on the outside of buildings without roof projections can sometimes be damaged by rain. Small amounts of water-soluble components can be washed out.

Possible effects of algicide/fungicide washout from rain cannot currently be specified. But the Biocidal Products Directive 98/8/EC is complied with. Other hazards are not expected if the products are used as intended.

Useful lives Organically bound plaster is largely weather- and crack-resistant and, with appropriate care, such as when covered with facade paint, can last as long as the building.

6 Extraordinary influences

Fire The exterior products correspond to fire classification B1 in accordance with DIN 4201-1. But in practice, they are always tested in a system or with the corresponding building element in accordance with DIN EN 13501-1 and fulfil fire classification B-s1, d0.

Water If subject to the action of water for a long time, the products can soften temporarily. After drying, the original firmness is restored. Small amounts of water-soluble substances can be washed out.

7 Reuse phase

Reuse and further use After the end of the usage phase but before the end of the building element's useful life, exterior plaster can be painted and used further.

Reuse and further use Exterior plaster is not reused or further used.

Disposal Due to its organic component, exterior plaster has an inherent energy content (feedstock energy), which can be regained in incinerators. But exterior plaster is seldom separated, due to its thin layers, but disposed of together with the substrate. Hardened exterior plaster can be disposed of safely in landfills.

The waste code is 170107 or 170904.

8 Life cycle assessment

8.1 Information on system definition and modelling of the lifecycle

Declared unit The declaration refers to 1 kilogramme of plaster mass in a ready-for-use, paste-form condition (with mixing water). The impact data for practical application and ecological considerations are specified per square metre (kg/m²).

System limits The lifecycle analysis of the examined products covers production, including raw materials extraction and energy provision up to the finished, packed product at the factory gate, transport to the construction site, as well as disposal or recycling of the packaging, which is included in the LCA of production. No balance-relevant processes run in the use stage of the exterior plaster.

Assumptions and estimates For examination of the use and disposal stage, a total of 400 km was used for transport paths from the ramp to the construction site and for disposal of the construction waste. This was determined by a rough estimate.

The distribution of electricity consumption per batch was converted to kg of product. Water consumption was calculated per kg of product; cleaning water was estimated.

Cut-off criterion	Processes whose total contribution to the final result, according to mass and in all impact categories looked at, is less than 1% can be ignored. The total of ignored processes does not exceed 5% of the impact categories looked at. Investment goods for the manufacturing processes (machines, buildings, etc.) were not considered.
Transport	All transportation of the raw materials and additives used as well as distribution transportation has been considered in the balance, taking distance and capacity utilisation into account.
Period under review	The data for manufacture of the examined products refer to the year 2009. The life cycle assessments were prepared for Germany as reference area. The result is that, besides production processes under these marginal conditions, the precursors relevant for Germany, such as electricity and energy provision, were used.
Background data	The data for the background processes come from the GaBi 4 database, specific, averaged data records of the German Paint Industry Association and from the corresponding EPD data records of Plastics Europe for the copolymers.
Data quality	The age of the data used is under 5 years. The data records used for the plastic dispersions were mostly updated based on the PCR document for plastics from Plastics Europe. Value was placed on completeness of the environmentally relevant lifecycle inventory analysis, both on the input side and on the output side.
Allocation	Allocation refers to assignment of the input and output flows of a LCA module to the examined product system and other product systems /ISO 14040/. Relevant allocations (i.e. the assignment of environmental burdens of a process to several products) did not have to be made for the examined products in this life cycle assessment.
Thermal recovery of waste and packaging	Plastic packaging, plaster packaging are partially thermally recovered. The energy gained thereby is credited to the manufacturing lifecycle segment with a standard process for electricity or thermal energy from natural gas with reference to Germany.
Notes on the use stage	No observations on the use stage of exterior plaster were performed.
Information on the disposal stage	Exterior plaster is a thin-layer coating that adheres firmly to the substrate. It is disposed of in landfills together with the demolished substrate.

8.2 Depiction of the balances and evaluation

8.2.1 Depiction of the balances and evaluation per 1 kg of exterior plaster

The following chapters show the lifecycle inventory analysis of the plaster with regard to primary energy needs, water needs and waste.

This environmental product declaration refers to exterior plasters with organic binders.

Primary energy	Illustration 1 shows the primary energy requirement (renewable and non-renewable), subdivided into raw materials provision, production and packaging of 1 kg Stolit, StoSilco, StoSil and StoLotusan.

Product group: Coatings with organic binders
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Issued on 26-02-2011

	Stolit	StoSilco	StoSil	StoLotusan
Raw materials	8,5900	9,2800	5,3920	12,5800
Production and packaging	0,1534	0,1534	0,1534	0,1815
Total	8,7434	9,4334	5,5454	12,7615

Table 1: Primary energy use for raw materials for 1 kg of exterior plaster with organic binder.

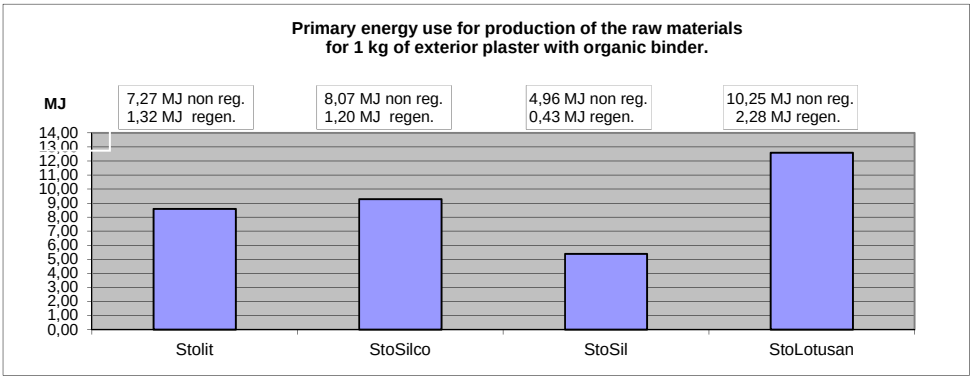

Illustration 1: Primary energy use for production of the raw materials for 1 kg of exterior plaster with organic binder.

The different total values in MJ for primary energy are due to the different raw materials (binder).

Further evaluation of the non-renewable energy sources used for production of 1 kg of exterior plaster with organic binder does not show any significant differences.

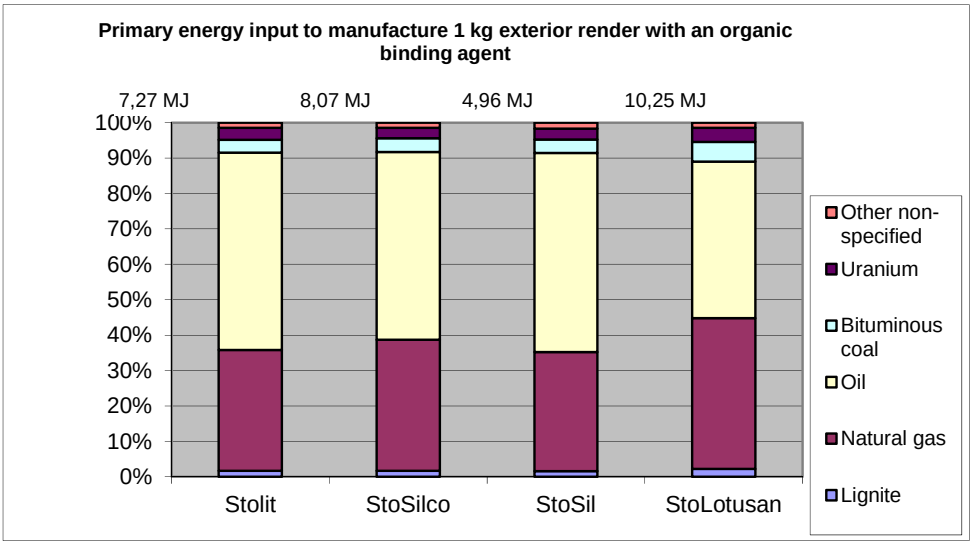

Illustration 2: Type and distribution of non-renewable energy sources for production of the raw materials for 1 kg of exterior plaster with organic binder.

Table 2 shows the type and distribution of renewable energy sources.

renewable energy carriers in %	Stolit	StoSilco	StoSil	StoLotusan
Timber	0,01	0,03	0,03	0,03
Biomass	23,88	23,36	21,96	22,87
Geothermal energy	0,01	0,01	0,01	0,01
Solar energy	0,00	0,00	0,00	0,00
Hydropower	75,88	76,37	77,74	76,87
Wind	0,20	0,19	0,18	0,19
Other non-specified	0,03	0,04	0,07	0,04
Total	100,00	100,00	100,00	100,00

Table 2: Type and distribution of renewable energy sources for production of 1 kg of exterior plaster with organic binder.

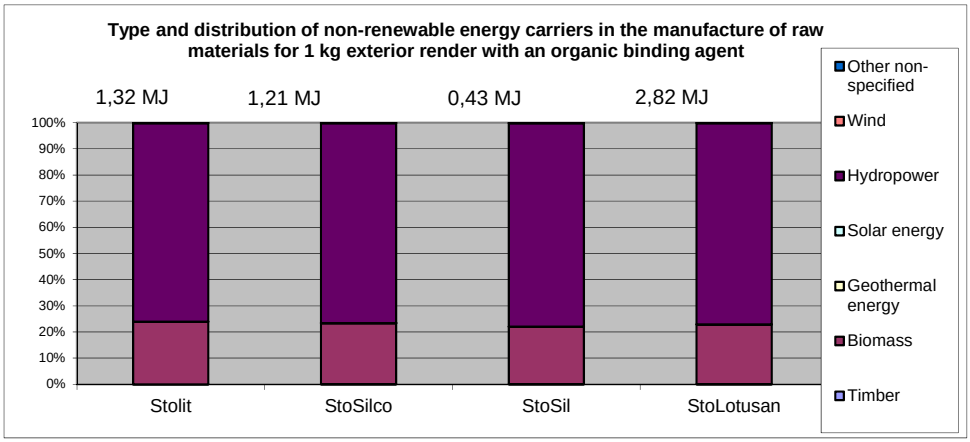

Illustration 3: Type and distribution of renewable energy sources for production of the raw materials for 1 kg of exterior plaster with organic binder.

Table 2 shows that the distribution of renewable energy sources is dominated especially by hydroelectric power and biomass. Other energy sources are well below 1% and cannot be depicted in illustration 3.

Production and packaging

For production, only electricity from hydroelectric power is used, of which 5% of requirements are covered by our own water turbines.

The relevant energy values and environmental impacts are depicted in the following table.

For 1 kg		Stolit, StoSilco, StoSil	StoLotusan
Primary energy non-renewable	MJ	1,39E-01	1,50E-01
Primary energy renewable	MJ	1,44E-02	3,15E-02
Abiotic Resource requirements (CML	kg Sb equiv.	5,74E-05	6,14E-05
Global warming potential	kg carbon dioxid	5,14E-03	5,86E-03
Ozone depletion potential	kg CFC11 equiv.	3,10E-08	3,10E-08
Acidification potential	kg SO2 equiv.	2,75E-05	3,25E-05
Eutrophication potential (CML)	kg PO4 equiv.	1,78E-06	1,98E-06
Photochemical ozone creation pote	kg ethene equiv.	7,55E-07	8,52E-07

Table 3: Primary energy use and environmental impacts for production and packaging of 1 kg of exterior plaster with organic binders.

This value is somewhat higher for StoLotusan due to the manufacturing process and equals 0.1815 MJ (renewable 0.0315 MJ and non-renewable 0.150 MJ).

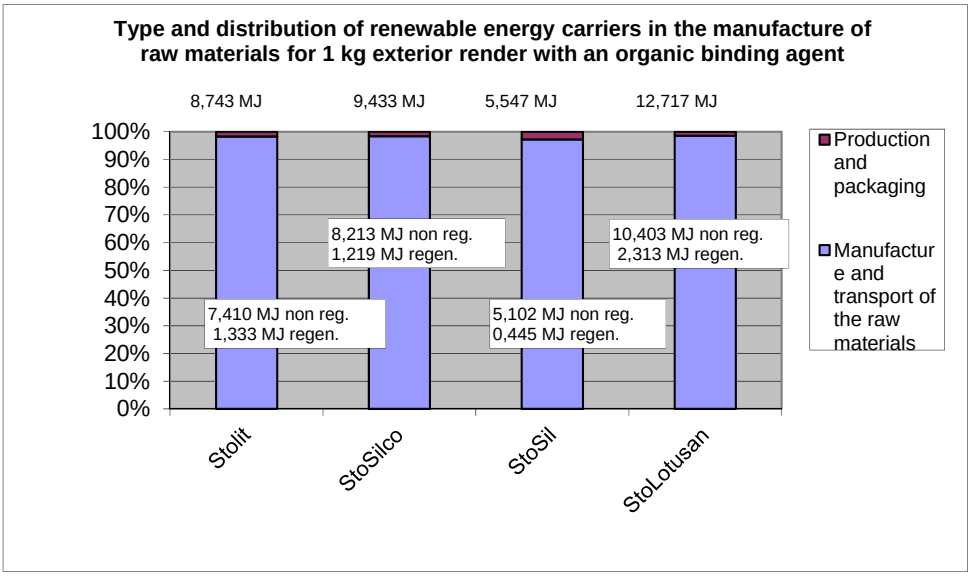

Illustration 4: Relative primary energy use for production and transport of raw materials, production and packaging of 1 kg of exterior plaster with organic binder.

Water use

Water is a formulation component of paste-form exterior plaster. The portion by weight is approx. 14%, depending on the product.

Cleaning water is cleaned in our own wastewater treatment plant and then sent on to the municipal wastewater treatment plant.

Waste

The evaluation of waste generated in production of 1 kg of exterior plaster with organic binder is separated into three sections – excavation / mining waste, non-hazardous waste (municipal waste) and hazardous waste, including radioactive waste.

Waste	Stolit	StoSilco	StoSil	StoLotusan
Mining waste material kg	1,36E-01	1,50E-01	8,62E-02	2,60E-01
Non-hazardous waste kg	4,53E-03	4,58E-03	4,63E-03	7,85E-03
Hazardous waste kg	2,18E-03	2,21E-03	1,19E-03	2,25E-03
Radio active waste kg	1,00E-04	9,96E-05	7,34E-05	1,56E-04
Special waste kg	2,08E-03	2,11E-03	1,12E-03	2,09E-03

Table 4: Waste in the production and transport of raw materials, production and packaging of 1 kg of exterior plaster

The graphic depiction of the waste in the production and transport of raw materials, production and packaging of 1 kg of exterior plaster

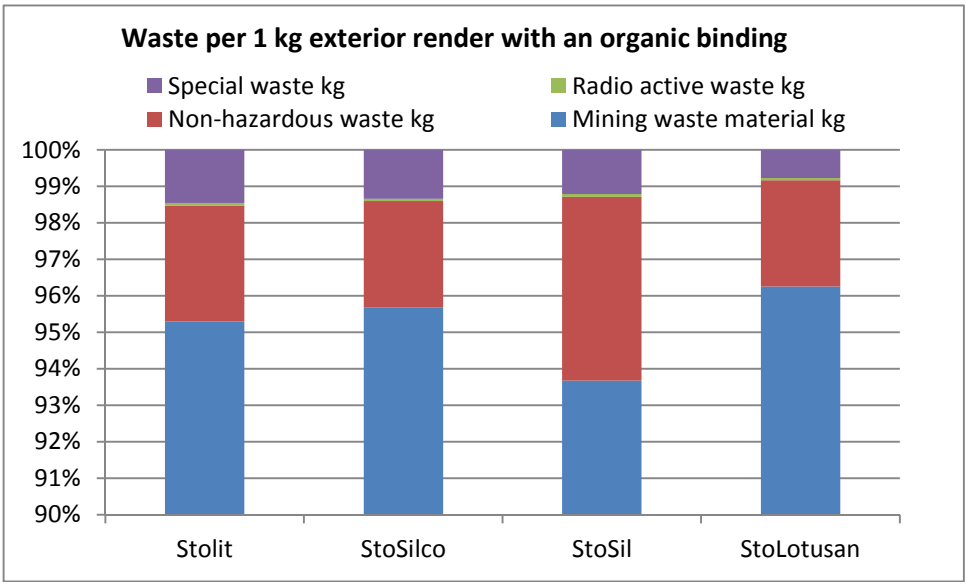

Illustration 5: Waste per 1 kg of exterior plaster.

For **excavation and mining waste**, excavation represents the greatest amount. Excavation applies especially in the precursor chain for obtaining rock flour and electricity (coal production).

Waste in the category **non-hazardous waste** includes municipal waste, commercial waste similar to residential waste, organic waste, internal chemicals, and the like. Fundamentally, all disposal processes up to final disposal are modelled "to the end". Therefore, the amount of non-hazardous waste is usually small. The situation is different for radioactive waste, for which no scenario for final storage has yet been established. For that reason, it appears in the category of hazardous waste.

Hazardous waste is mainly waste from the precursor chains, including generation of electricity. Besides radioactive waste for nuclear power generation, this includes slag from filter systems and sewage sludge from wastewater treatment.

Estimate of impact

The potential environmental factors from plaster manufacturing are presented in the following.

Table 5: Environmental impact of the manufacture and transport of raw materials, production and packaging of 1 kg of exterior plaster with organic binder.

	Unit per kg					
Evaluation dimension	Stolit	StoSilco	StoSil	StoLotusan	Production and packaging Stolit, StoSilco, StoSil	Production and packaging StoLotusan
Primary energy requirement, non-renewable [MJ]	7,27E+00	8,07E+00	4,96E+00	1,03E+01	1,39E-01	1,50E-01
Primary energy requirement, renewable [MJ]	1,32E+00	1,21E+00	4,32E-01	2,28E+00	1,44E-02	3,15E-02
Abiotic depletion potential (ADP) [kg Sb equiv.]	2,95E-03	3,27E-03	2,02E-03	4,04E-03	5,74E-05	6,14E-05
Global warming potential (GWP 100) [kg carbon	2,30E-01	2,60E-01	1,84E-01	3,73E-01	5,14E-03	5,86E-03
Ozone depletion potential (ODP) [kg R11 equiv.]	3,45E-07	3,12E-07	1,33E-07	4,74E-07	3,10E-08	3,10E-08
Acidification potential (AP) [kg SO2 equiv.]	1,44E-03	1,58E-03	1,28E-03	2,36E-03	2,75E-05	3,25E-05
Eutrophication potential (EP) [kg PO4 equiv.]	7,97E-04	8,04E-04	9,42E-04	1,22E-03	1,78E-06	1,98E-06
Photochemical ozone creation potential (POCP)	2,54E-04	2,59E-04	1,74E-04	2,92E-04	7,55E-07	8,52E-07

The following illustrations 6a to 6d show the contributions of raw materials procurement and production including packaging of 1 kg of the various external plaster types on the impact categories of abiotic depletion potential (ADP), global warming potential (GWP), ozone depletion potential (ODP), acidification potential (AP), eutrophication potential (EP) and photochemical ozone creation potential (POCP).

The relative contributions of the production processes and packaging on the environmental impact per 1 kg of exterior plaster are shown in the illustrations 6a to 6d

Raw material procurement causes the largest share of environmental impact in all impact categories. This result correlates with the primary energy requirements. The contribution of production and packaging is relatively low

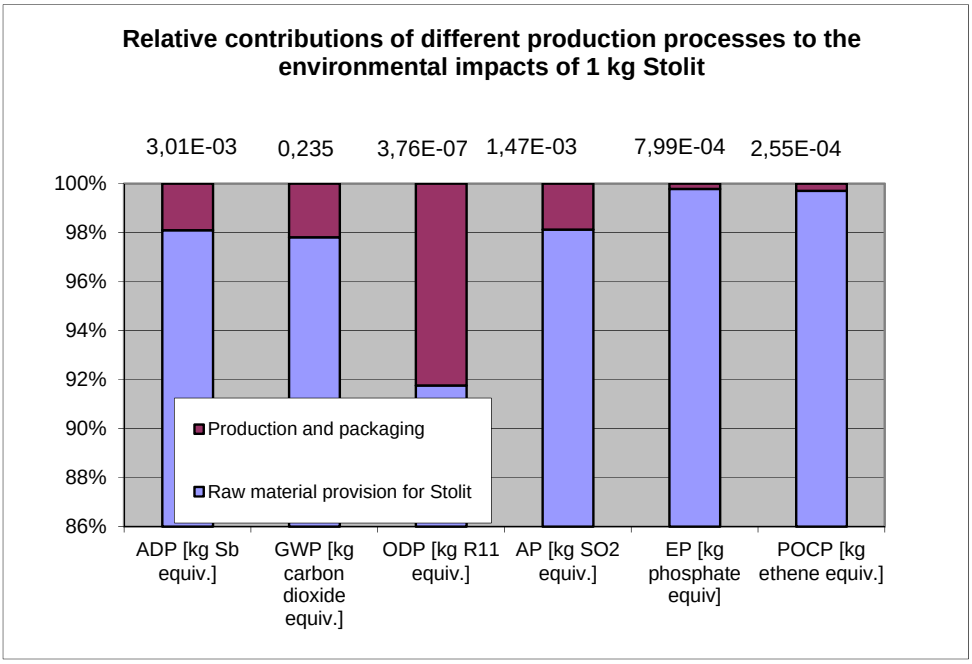

Illustration 6a: Relative contributions of various production processes to the environmental impact of 1 kg of Stolit

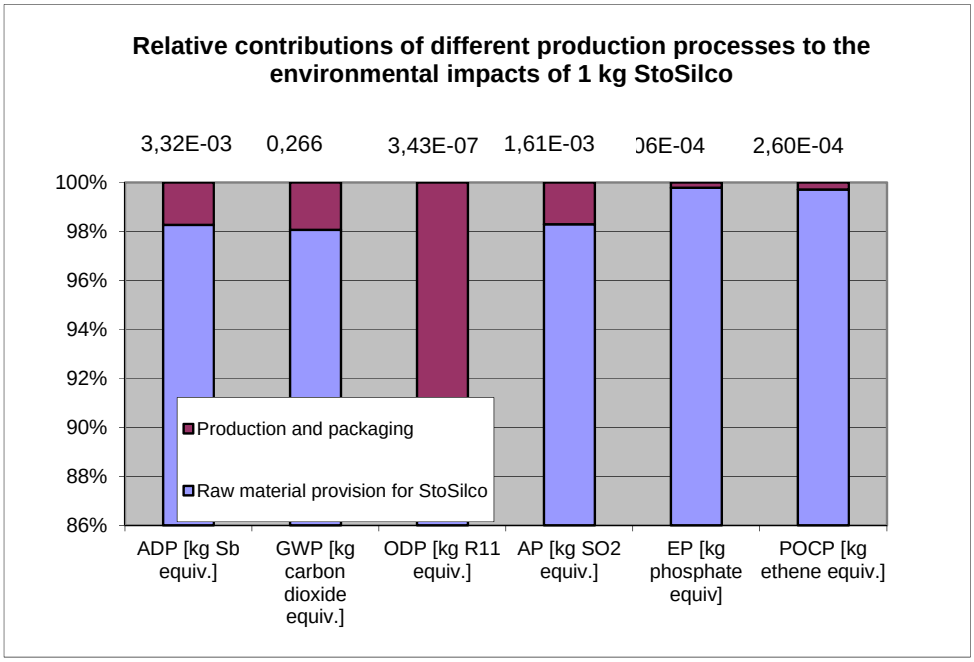

Illustration 6b: Relative contributions of various production processes to the environmental impact of 1 kg of StoSilco

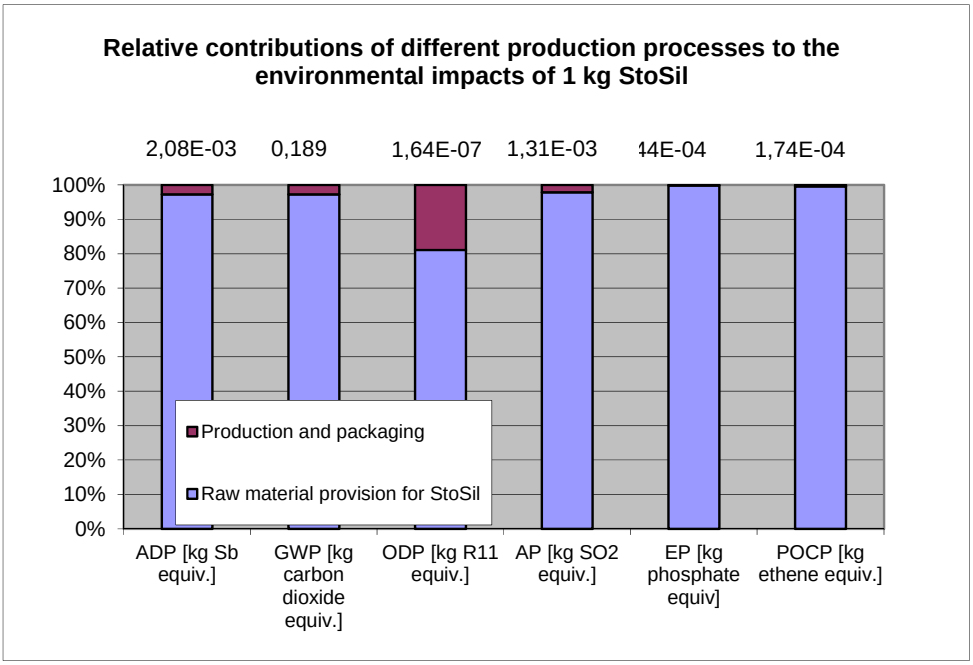

Illustration 6c: Relative contributions of various production processes to the environmental impact of 1 kg of StoSil

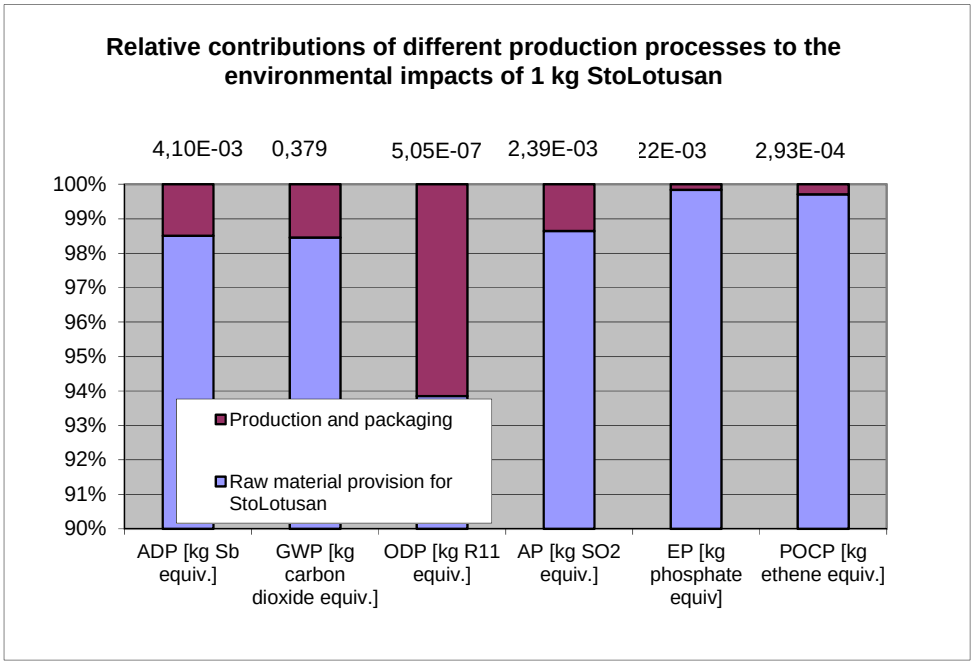

Illustration 6d: Relative contributions of various production processes to the environmental impact of 1 kg of StoLotusan

Transport during the building, use and disposal stages

Estimate of impact

For examination of the building, use and disposal stages, a total of 400 km per 1 kg was used for transportation from the ramp to the construction site and for disposal of the construction waste.

Table 6 shows the environmental impact of transportation during use and disposal.

		Transport 1 kg 400 km
Primary energy non-regenerative	MJ	3,80E-01
Primary energy regenerative	MJ	0,00E+00
Abiotic Resource requirements (CML)	kg Sb equiv.	1,75E-04
Global warming potential	kg carbon dioxid	2,81E-02
Ozone depletion potential	kg CFC11 equiv.	1,10E-11
Acidification potential	kg SO2 equiv.	3,17E-04
Eutrophication potential (CML)	kg PO4 equiv.	3,94E-05
Photochemical ozone creation potentia	kg ethene equiv.	3,32E-05

Table 6: Environmental impact of transport of the building, use and disposal stages of 1 kg of exterior plaster with organic binder.

Non-renewable energy Resources	**MJ**	**%**
Lignite	0,00	0,54
Natural gas	0,01	3,46
Oil	0,35	92,76
Bituminous coal	0,01	2,60
Uranium	0,00	0,62
Other non-specified	0,00	0,02
Total	0,37	100,00

Table 7 shows the type and distribution of non-renewable energy sources during transport to the construction site and for disposal.

Renewable energy Resources	**MJ**	**%**
Timber	0,00	0,00
Biomass	0,00	7,67
Geothermal energy	0,00	0,00
Solar energy	0,00	0,00
Hydropower	0,00	88,49
Wind		
Other non-specified	0,00	3,84
Total	0,00	100,00

Table 8 shows the type and distribution of renewable energy sources during transport to the construction site and for disposal.

Use stage Exterior plaster with organic binders is subject to different weathering depending on the climate, construction type (roof projection) and the wind orientation. With appropriate care (cleaning or painting), the useful life can equal the life of the building element. Use of exterior plaster does not contribute to the lifecycle inventory analysis.

Disposal stage Disposal takes place with the building element / system, normally as building rubble.

8.2.2 Depiction of the balances and evaluation per m² of exterior plaster

To simplify use of the data, the lifecycle inventory analysis values and environmental impacts of the finishing plaster are also used for the average consumption of product per m², which is documented in the technical data sheet. Possible variations in consumption can be caused by an uneven substrate.

The impact balance in impact/m² is depicted in tables 9 and 10, taking into account the respective consumption values that are documented in the corresponding technical data sheets.

Raw material provision, production up to the factory gates	Unit per m²			
Evaluation dimension	Stolit K 2	StoSilco K 2	StoSil K 2	StoLotusan K 2
Consumption: in kg/m²	3,0	3,2	3,0	3,2
Primary energy requirement, non-renewable [MJ]	2,22E+01	2,63E+01	1,53E+01	3,34E+01
Primary energy requirement, renewable [MJ]	4,00E+00	3,92E+00	1,34E+00	7,40E+00
Abiotic depletion potential (ADP) [kg Sb equiv.]	9,02E-03	1,06E-02	6,23E-03	1,31E-02
Global warming potential (GWP 100) [kg carbon	7,05E-01	8,48E-01	5,67E-01	1,21E+00
Ozone depletion potential (ODP) [kg R11 equiv.]	1,13E-06	1,10E-06	4,92E-07	1,62E-06
Acidification potential (AP) [kg SO2 equiv.]	4,40E-03	5,14E-03	3,92E-03	7,66E-03
Eutrophication potential (EP) [kg PO4 equiv.]	2,40E-03	2,58E-03	2,83E-03	3,91E-03
Photochemical ozone creation potential (POCP)	7,64E-04	8,31E-04	5,24E-04	9,37E-04

Table 9: Estimated impact of exterior plaster with organic binder with production and packaging per m²

Raw material provision, production, utilisation and disposal	Unit per m²			
Evaluation dimension	Stolit K 2	StoSilco K 2	StoSil K 2	StoLotusan K 2
Consumption: in kg/m²	3,0	3,2	3,0	3,2
Primary energy requirement, non-renewable [MJ]	2,34E+01	2,75E+01	1,64E+01	3,47E+01
Primary energy requirement, renewable [MJ]	4,00E+00	3,92E+00	1,34E+00	7,40E+00
Abiotic depletion potential (ADP) [kg Sb equiv.]	9,55E-03	1,05E-02	6,76E-03	1,28E-02
Global warming potential (GWP 100) [kg carbon	7,90E-01	8,80E-01	6,52E-01	1,22E+00
Ozone depletion potential (ODP) [kg R11 equiv.]	1,13E-06	1,03E-06	4,92E-07	1,52E-06
Acidification potential (AP) [kg SO2 equiv.]	5,35E-03	5,77E-03	4,87E-03	8,13E-03
Eutrophication potential (EP) [kg PO4 equiv.]	2,51E-03	2,54E-03	2,95E-03	3,78E-03
Photochemical ozone creation potential (POCP)	8,64E-04	8,79E-04	6,24E-04	9,78E-04

Tabelle 10 Estimated impact per m² for manufacture of the raw materials, production and packaging as well as use and disposal

9 Verification

9.1 VOC

Exterior plaster with organic binder in accordance with EN DIN 15824 contains so-called film forming agents (aromatic-free). The maximum amounts are below 2% by weight. These additives are necessary to secure functioning of these products in outside weather conditions. A VOC (AgBB) test for exterior products is not intended.

9.2 Leaching behaviour

Washing out of substances into the soil, surface water and groundwater are currently standardised horizontally in TC 351 WG 1. A vertical test standard for washing out from coatings with organic binders is currently being developed in TC 139, WG 10. The focus is on possible washing out of biocides from rain.

Use of algicides and fungicides as film protection is governed by the Directive 98/8 EC.

But a uniform recording and evaluation of the relevant amounts and their environmental impact is not currently possible.

10 PCR document and checking

This declaration is based on the PCR document "Coatings with organic binders", 2010-04.

Review of the PCR document by the Expert Committee. Chairman of the Expert Committee: Prof. Dr.-Ing. Hans-Wolf Reinhardt (Stuttgart University, IWB)
Independent audit of the declaration in accordance with ISO 14025: ☐ internal ☒ external
Validation of the declaration: Dr. Eva Schmincke

11 Literature

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DIN EN 15824	Specifications for external renders and internal plasters based on organic binders

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