Environmental Product Declaration

in accordance with ISO 14025

Primers and facade paints (organic)

Sto Aktiengesellschaft

Declaration number

EPD-STO-2011321-E

Institute Construction and Environment (IBU) e.V.

www.bau-umwelt.com

Institut Bauen und Umwelt e.V.

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-2011321-E	**Declaration number**
Primers and facade paints: **StoPrep Miral, Sto-Primer, StoColor Jumbosil, StoColor Crylan,** **StoColor Maxicryl, StoSilco Color, StoSil Color, Lotusan, StoPhotosan NOX** 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

Facade paints according to DIN EN 1062 and primers are factory-manufactured, fluid mixtures made of one or more water-based polymer dispersions, possibly combined with silicon- or silicate-based binders, mineral bulking agents, pigments, water and additives. Hardening is through drying and film formation of the polymer binders. 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

For use as exterior coatings and primers for mineral substrates, and possibly also organic substrates, as well as 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/, following the requirements of the Product Category Rules (PCR) 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 facade paints and primers.

Scope of the life cycle assessment

Raw material provision, production up to the factory gates	Unit per kg		Unit per litre						
Evaluation dimension	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Primary energy requirement, non-renewable [MJ]	1,27E+01	1,21E+01	2,18E+01	2,58E+01	2,92E+01	1,68E+01	2,96E+01	2,60E+01	3,79E+01
Primary energy requirement, renewable [MJ]	1,62E-01	6,64E-02	1,15E-01	1,27E-01	1,36E-01	4,73E-01	3,78E-01	3,39E-01	4,68E-01
Abiotic depletion potential (ADP) [kg Sb equiv.]	4,97E-03	5,03E-03	9,06E-03	1,07E-02	1,21E-02	6,67E-03	1,15E-02	1,02E-02	1,48E-02
Global warming potential (GWP 100) [kg carbon	7,56E-01	3,90E-01	7,27E-01	8,86E-01	9,91E-01	7,04E-01	1,76E+00	1,26E+00	1,84E+00
Ozone depletion potential (ODP) [kg R11 equiv.]	5,85E-07	8,00E-07	1,38E-06	1,55E-06	1,64E-06	1,37E-06	1,36E-06	1,91E-06	2,28E-06
Acidification potential (AP) [kg SO2 equiv.]	7,47E-03	2,31E-03	4,40E-03	5,57E-03	5,95E-03	5,31E-03	1,77E-02	1,17E-02	1,78E-02
Eutrophication potential (EP) [kg PO4 equiv.]	9,58E-04	2,23E-03	4,16E-03	4,92E-03	5,92E-03	1,96E-03	2,39E-03	2,33E-03	2,61E-03
Photochemical ozone creation potential (POCP)	2,68E-04	3,74E-04	6,94E-04	8,26E-04	9,72E-04	4,48E-04	7,00E-04	7,25E-04	1,04E-03

Raw material provision, production, utilisation and disposal	Unit per kg		Unit per litre						
Evaluation dimension	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Primary energy requirement, non-renewable [MJ]	1,31E+01	1,24E+01	2,24E+01	2,63E+01	2,97E+01	1,74E+01	3,02E+01	2,66E+01	3,85E+01
Primary energy requirement, renewable [MJ]	1,62E-01	6,64E-02	1,15E-01	1,27E-01	1,36E-01	4,73E-01	3,78E-01	3,39E-01	4,68E-01
Abiotic depletion potential (ADP) [kg Sb equiv.]	5,14E-03	5,21E-03	9,33E-03	1,09E-02	1,23E-02	6,93E-03	1,18E-02	1,04E-02	1,51E-02
Global warming potential (GWP 100) [kg carbon	7,85E-01	4,19E-01	7,70E-01	9,26E-01	1,03E+00	7,46E-01	1,80E+00	1,30E+00	1,88E+00
Ozone depletion potential (ODP) [kg R11 equiv.]	5,85E-07	8,00E-07	1,38E-06	1,55E-06	1,64E-06	1,37E-06	1,36E-06	1,91E-06	2,28E-06
Acidification potential (AP) [kg SO2 equiv.]	7,78E-03	2,63E-03	4,89E-03	6,02E-03	6,41E-03	5,79E-03	1,82E-02	1,21E-02	1,83E-02
Eutrophication potential (EP) [kg PO4 equiv.]	9,98E-04	2,27E-03	4,22E-03	4,98E-03	5,98E-03	2,02E-03	2,45E-03	2,39E-03	2,67E-03
Photochemical ozone creation potential (POCP)	3,01E-04	4,07E-04	7,45E-04	8,72E-04	1,02E-03	4,98E-04	7,51E-04	7,75E-04	1,09E-03

* 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-2011321-E	

Area of application

This environmental declaration refers to facade paints and primers with organic binders from the Sto factory in Weizen

1 Product definition

Product definition

Facade paints and primers with organic binders according to DIN EN 1062 are factory-manufactured, fluid mixtures made of one or more water-based polymer dispersions, possibly combined with silicon- or silicate-based binders, mineral bulking agents, pigments, water and additives. Hardening is through drying and film formation of the polymer binders.

Application

For use outdoors as coatings and primers for mineral substrates, and possibly also organic substrates, as well as wood and metal surfaces.

Direct contact with groundwater is not intended.

Placing on the market / rules for use

DIN EN 1062

Quality assurance

Internal and external supervision in accordance with the above standards.
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

Properties as supplied

Facade paints and primers with organic binders are produced in the factory as fluid products and filled into plastic containers, drums or wet silos, possibly tinted and temporarily stored, and delivered to the construction site.
They are applied manually with suitable tools or by spraying. After drying and hardening, the result is weather-resistant (possibly tinted) coatings with good flexibility, impact resistance and possibly crack bridging and with good adhesion to practically all substrates.

Building technology data

Criterion	Standard	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX	Unit
Density	DIN 53217	1,50	1,50	1,55	1,40	1,45	1,50	1,55	1,50	1,50	g/ml
pH value	DIN ISO 10390	10 - 11.5	8 - 9	8 - 9	8.5 - 9.5	8 - 9	8.5 - 9.5	10 - 11.5	8 - 9	8 - 10.5	pH
Water vapour diffusion flow density V	EN ISO 7783-2	> 2100	65 - 98	89 - 95	13 - 16	15 - 18	200 - 400	> 2000	2100,0	> 400	g/(m²*d)
Water permeability rate W	EN 1062-3	0,043	0,05	< 0.05	< 0.05	< 0.05	0,1	< 0.1	0,05	0,1	kg/m² *Vh
Solids content	DIN 18556 DIN 53189	69 - 74	58 - 64	66.5 - 67.5	60 - 61	60 - 64	63.5 - 64.5	59 - 60	64 - 65	59 - 65	pH

Lightness and degree of whiteness are not relevant for facade paints and primers.

Sound protection

Sound-protection requirements are not placed on facade paints and primers with organic binders.

Biocidal characteristics

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

2 Base materials

Base materials primary products

Basic materials	Mass %
Polymer dispersion 50%	6 - 28
Stone dust	28 - 61
Pigments	2 - 20
Hydrophobic agent	0.9 - 5
Sodium silicate	13 - 20
Water	14 - 26

Materials / additives

The following materials and additives can be used as needed:

Materials / Additives	Mass %
Thickening agent	0 - 0.7
Water retention agent	0.1 - 0.4
Anti-foaming agent	0.1 - 0.3
Dispersing agent	0.1 - 2.0
Film forming agent	0.5 - 2.7
Container / film conservation	0.2 - 1.0
Fibre	0 - 8.5
Caustic potash solvent 50%	0 - 0.1

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 film against algae and fungi.

Potassium hydroxide solution: Solution comprising KOH in water

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.

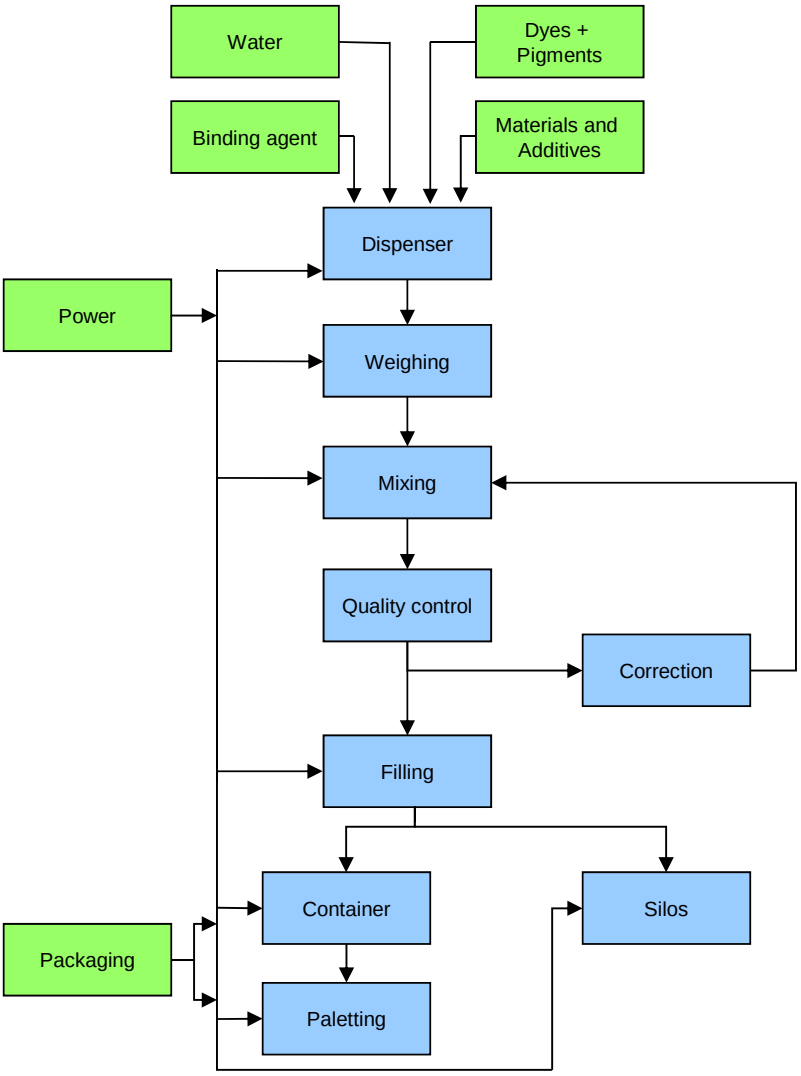
Availability of raw materials

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.
Mineral 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.



Facade paints and primers 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, drums 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 fluid 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 facade paints and primers can be applied manually or by machine. After the products are applied to the intended surfaces (one or two coats), they are evened out 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 facade paints and primers, film forming agents (solvents) are released into the atmosphere. No other negative influences on the environment are currently known.
Fluid facade paints and primers 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 rock flour, pigments and water-based polymer dispersions are used in the production of facade paints and primers with organic binders. The additives for improvement of application and storage characteristics are added only in small amounts.

Effects on environment and health

After drying, the unique matrix of rock flour and water-based polymer dispersion results in firm, long-lasting, elastic and crack-resistant films, which adhere to practically all substrates. Fresh paint on the facade of buildings without roof projections can sometimes be damaged by rain. Small amounts of water-soluble components can be extracted.

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 facade paints are largely weather- and crack-resistant and, with appropriate care, such as through cleaning or possibly repainting, can last as long as the building.

6 Extraordinary influences

Fire The products correspond to Class B1 in accordance with DIN 4102-1. 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, facade pants and primers can be used further. Facade paints can also be repainted.

Reuse and further use Facade paints and primers are not reused or further used.

Disposal Paints and primers are thin-layer coatings that are permanently bonded to the corresponding building element. Separation from the substrate is not possible.
Due to their organic component, facade paints and primers have an inherent energy content (feedstock energy), which can be regained in incinerators.
Due to their thin layers, facade paints and primers are seldom separated, but disposed of together with the substrate. Hardened facade paints and primers 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 of primers refers to 1 kilogramme of coating in a ready-for-use, fluid condition (with mixing water). The impact data for practical application and ecological considerations are specified per square metre (kg/m²).
Facade paints are sold in the EU in the volume unit of litres. For that reason, the ecological data are converted from 1 kg to 1 litre (for densities, see the table on page 5).

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 ecobalance of production. No balance-relevant processes run in the use stage of the facade paints and primers.

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 cicle 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, packaging of facade paints and primers, 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 the facade paints and primers were performed.
Information on the disposal stage	Facade paints and primers are thin-layer coatings that adhere firmly to the substrate. They are 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 primer and 1 litre of facade paint

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

In the EU countries, the facade paint is ordered and sold in litres and the primers in kg.
This environmental product declaration refers to facade paint and primers with organic binders.

Primary energy	Table 1 shows the primary energy used (renewable and non-renewable), subdivided into raw materials provision, production and packaging of 1 kg of primers and 1 litre of paint.

	Unit per kg		Unit per litre						
	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Raw materials	11,08	10,36	19,18	23,45	26,76	14,62	27,27	23,69	35,77
Production and packaging	1,77	1,77	2,74	2,47	2,56	2,65	2,74	2,65	2,65
Total	12,84	12,12	21,92	25,93	29,32	17,27	30,00	26,34	38,41

Table 1: Primary energy use for raw materials for 1 kg of primers and 1 litre of facade paints

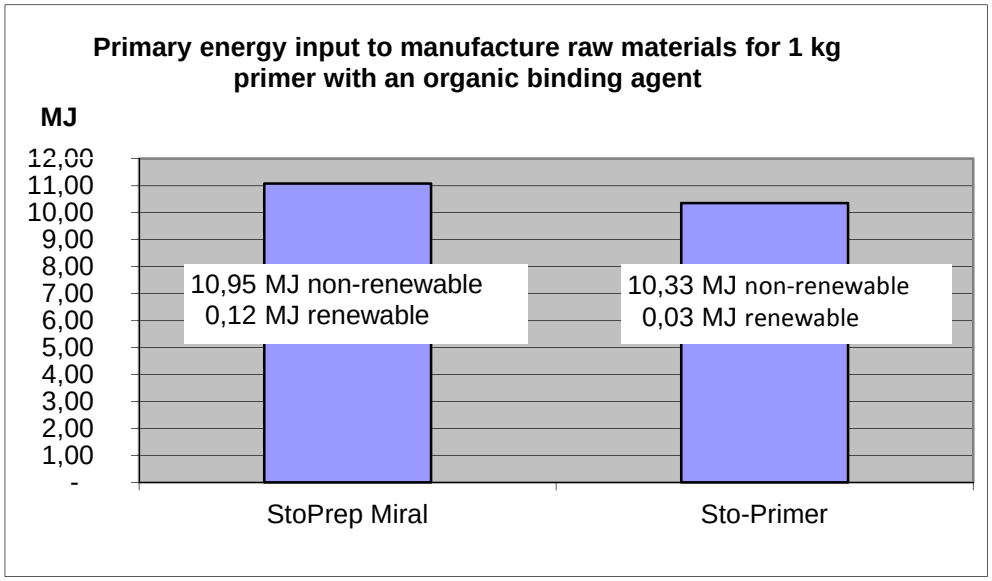


Illustration 1: Primary energy use for production of the raw materials for 1 kg of primer with organic binder

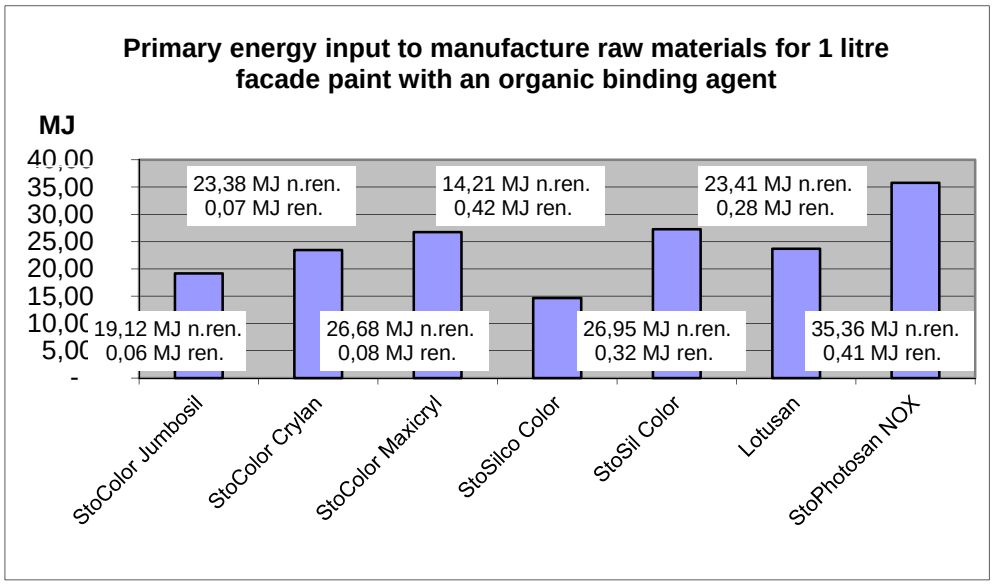


Illustration 2: Primary energy use for production of the raw materials for 1 litre of facade paint with organic binder

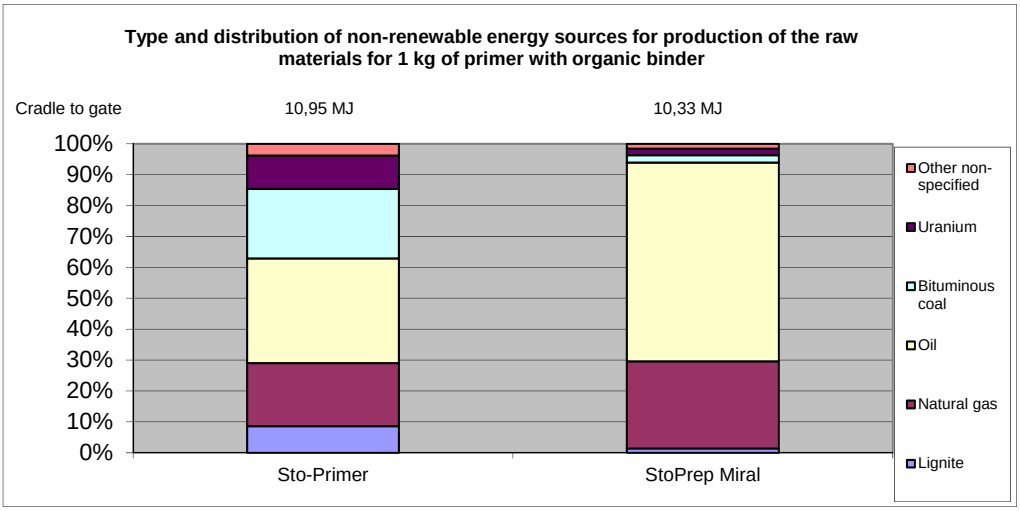


Illustration 3: Type and distribution of non-renewable energy sources for production of the raw materials for 1 kg of primer with organic binder

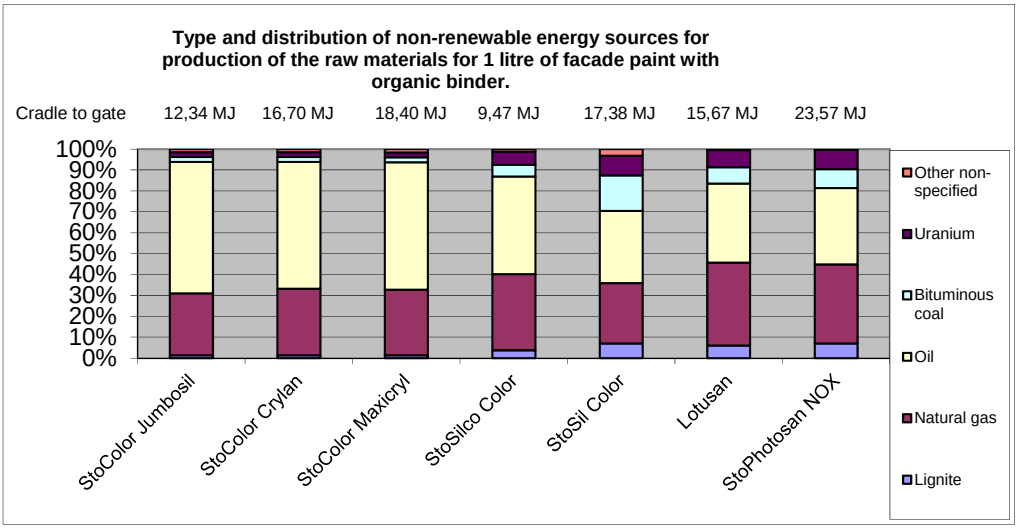


Illustration 4: Type and distribution of non-renewable energy sources for production of the raw materials for 1 litre of facade paint with organic binder.

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.

Product group:	Building coatings with organic binders	issued on
Declaration holder:	Sto AG, Ehrenbachstrasse 1, D-79780 Stühlingen, Germany	26-02-2011
Declaration number:	EPD-2011321-E	

		for 1 kg	for 1 litre						
		StoPrep Miral / Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Primary energy non-regenerative	MJ	1,73E+00	2,68E+00	2,42E+00	2,51E+00	2,59E+00	2,68E+00	2,59E+00	2,59E+00
Primary energy regenerative	MJ	3,80E-02	5,89E-02	5,32E-02	5,51E-02	5,70E-02	5,89E-02	5,70E-02	5,70E-02
Abiotic Resource requirements (CM	kg Sb equiv.	7,10E-04	1,10E-03	9,94E-04	1,03E-03	1,07E-03	1,10E-03	1,07E-03	1,07E-03
Global warming potential	kg carbon dioxi	5,30E-02	8,21E-02	7,41E-02	7,68E-02	7,94E-02	8,21E-02	7,94E-02	7,94E-02
Ozone depletion potential	kg CFC11 equiv	5,06E-07	7,84E-07	7,08E-07	7,34E-07	7,59E-07	7,84E-07	7,59E-07	7,59E-07
Acidification potential	kg SO2 equiv.	2,04E-04	3,16E-04	2,86E-04	2,96E-04	3,06E-04	3,16E-04	3,06E-04	3,06E-04
Eutrophication potential (CML)	kg PO4 equiv.	1,87E-05	2,90E-05	2,62E-05	2,72E-05	2,81E-05	2,90E-05	2,81E-05	2,81E-05
Photochemical ozone creation pote	kg ethene equiv	3,52E-06	5,46E-06	4,93E-06	5,11E-06	5,28E-06	5,46E-06	5,28E-06	5,28E-06

Table 2: Primary energy use and environmental impacts for production and packaging of 1 kg of primer and 1 litre of facade paint with organic binders.

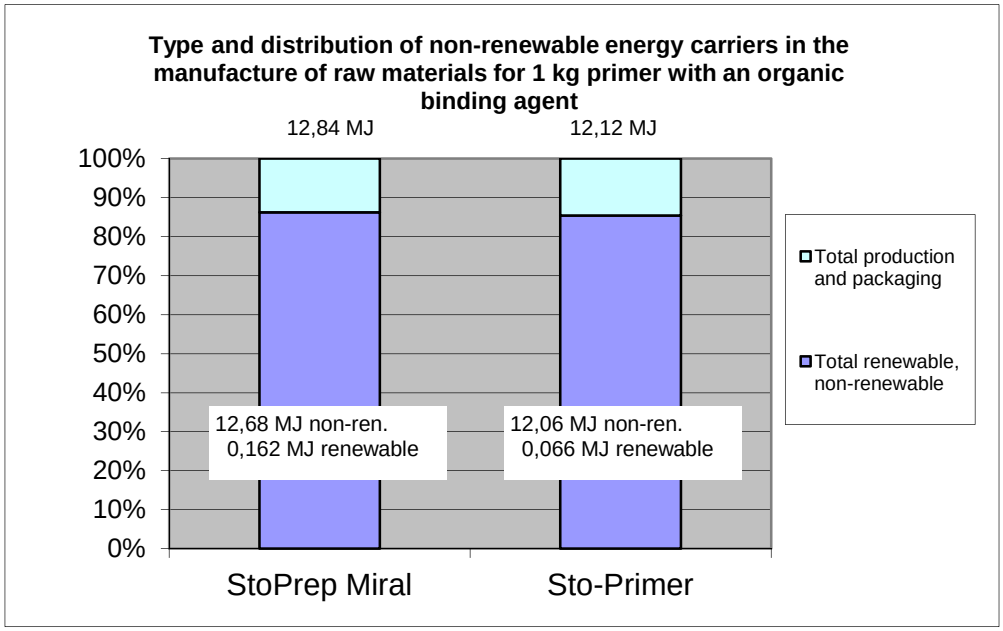


Illustration 5: Relative primary energy use for manufacture, production and packaging of 1 kg of primer with organic binder.

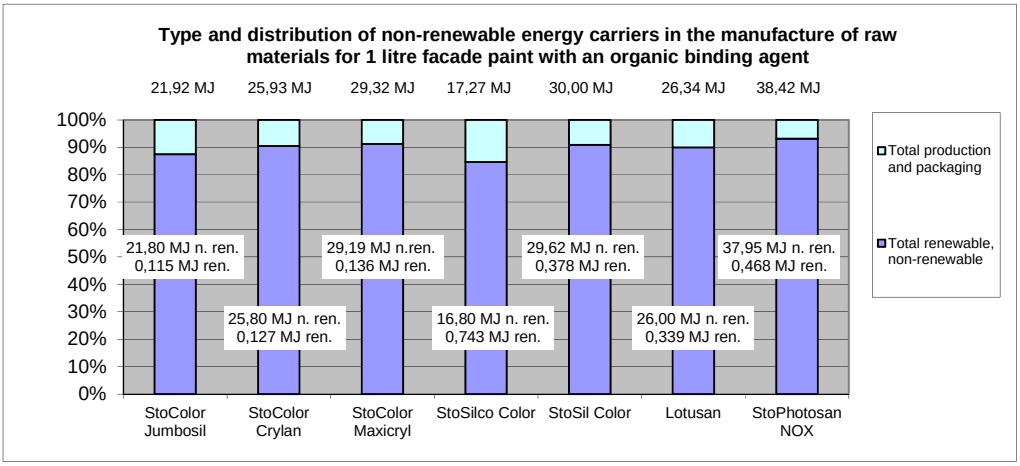


Illustration 6: Relative primary energy use for manufacture, production and packaging of 1 litre of facade paint with organic binder.

Water use

Water is a formulation component of facade paints and primers. 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 facade paints and primer with organic binder is separated into three sections – excavation / mining waste, non-hazardous waste (municipal waste) and hazardous waste, including radioactive waste.

Table 3: Waste in the production and transport of raw materials, production and packaging of 1 kg of facade paint and primer

Waste	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Mining waste material kg	1,07E-01	1,14E-01	1,46E-01	2,10E-01	2,10E-01	2,40E-01	3,48E-01	7,02E-01	1,11E+00
Non-hazardous waste kg	1,13E-02	1,00E-02	1,21E-02	1,56E-02	1,83E-02	6,95E-03	1,48E-02	1,18E-02	1,75E-02
Hazardous waste kg	3,54E-03	2,89E-03	3,11E-03	4,04E-03	4,41E-03	2,45E-03	4,48E-03	3,15E-03	4,10E-03
Radio active waste kg	3,99E-04	7,69E-05	9,56E-05	1,33E-04	1,44E-04	2,04E-04	5,53E-04	4,32E-04	7,31E-04
Special waste kg	3,15E-03	2,81E-03	3,01E-03	3,91E-03	4,27E-03	2,25E-03	3,92E-03	2,71E-03	3,37E-03

The graphic depiction of the waste in the production and transport of raw materials, production and packaging of 1 kg of facade paint and primer

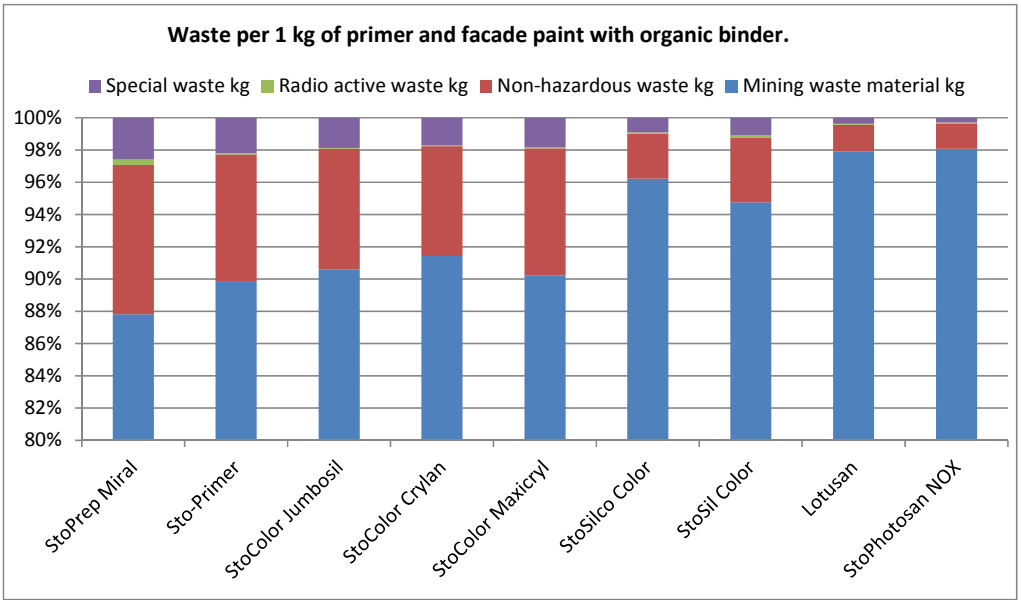


Illustration 7: Waste per 1 kg of primer and facade paint with organic binder.

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 of the category **non-hazardous waste** comprises municipal waste, commercial waste similar to household waste, organic waste, internal chemicals, and the like. All disposal processes are modelled "to the end", up to final disposal in the landfill. For that reason, the amount of non-hazardous waste is usually low. The situation is different for radioactive waste, for which no scenario for final storage has yet been established. Therefore, they appear 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 the production of facade paints and primers are presented in the following.

Table 4: Environmental impact of the manufacture and transport of raw materials, production and packaging of 1 kg of primer with organic binder.

	Unit per kg		
Evaluation dimension	StoPrepMiral	StoPrimer	Production and packaging
Primary energy requirement, non-renewable [MJ]	1,10E+01	1,03E+01	1,73E+00
Primary energy requirement, renewable [MJ]	1,24E-01	2,84E-02	3,80E-02
Abiotic depletion potential (ADP) [kg Sb equiv.]	4,26E-03	4,32E-03	7,10E-04
Global warming potential (GWP 100) [kg carbon	7,03E-01	3,37E-01	5,30E-02
Ozone depletion potential (ODP) [kg R11 equiv.]	7,90E-08	2,94E-07	5,06E-07
Acidification potential (AP) [kg SO2 equiv.]	7,26E-03	2,11E-03	2,04E-04
Eutrophication potential (EP) [kg PO4 equiv.]	9,40E-04	2,21E-03	1,87E-05
Photochemical ozone creation potential (POCP)	2,65E-04	3,70E-04	3,52E-06

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

Evaluation dimension	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX	Production and packaging
Density g/mL	1,55	1,4	1,45	1,5	1,55	1,5	1,5	
Primary energy requirement, non-renewable [MJ]	1,23E+01	1,67E+01	1,84E+01	9,47E+00	1,74E+01	1,56E+01	2,36E+01	1,73E+00
Primary energy requirement, renewable [MJ]	3,60E-02	5,25E-02	5,58E-02	2,77E-01	2,06E-01	1,88E-01	2,74E-01	3,80E-02
Abiotic depletion potential (ADP) [kg Sb equiv.]	5,14E-03	6,90E-03	7,61E-03	3,74E-03	6,70E-03	6,07E-03	9,17E-03	7,10E-04
Global warming potential (GWP 100) [kg carbon	4,16E-01	5,80E-01	6,30E-01	4,16E-01	1,08E+00	7,84E-01	1,17E+00	5,30E-02
Ozone depletion potential (ODP) [kg R11 equiv.]	3,83E-07	6,03E-07	6,24E-07	4,08E-07	3,69E-07	7,66E-07	1,02E-06	5,06E-07
Acidification potential (AP) [kg SO2 equiv.]	2,64E-03	3,78E-03	3,90E-03	3,34E-03	1,12E-02	7,57E-03	1,17E-02	2,04E-04
Eutrophication potential (EP) [kg PO4 equiv.]	2,67E-03	3,50E-03	4,07E-03	1,29E-03	1,52E-03	1,53E-03	1,72E-03	1,87E-05
Photochemical ozone creation potential (POCP)	4,44E-04	5,86E-04	6,67E-04	2,95E-04	4,48E-04	4,80E-04	6,92E-04	3,52E-06

The following illustrations 8a to 8i show the contributions of raw materials procurement and production including packaging of 1 kg of facade paint and primer 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 primer and facade paint are shown in the illustrations 8a to 8i

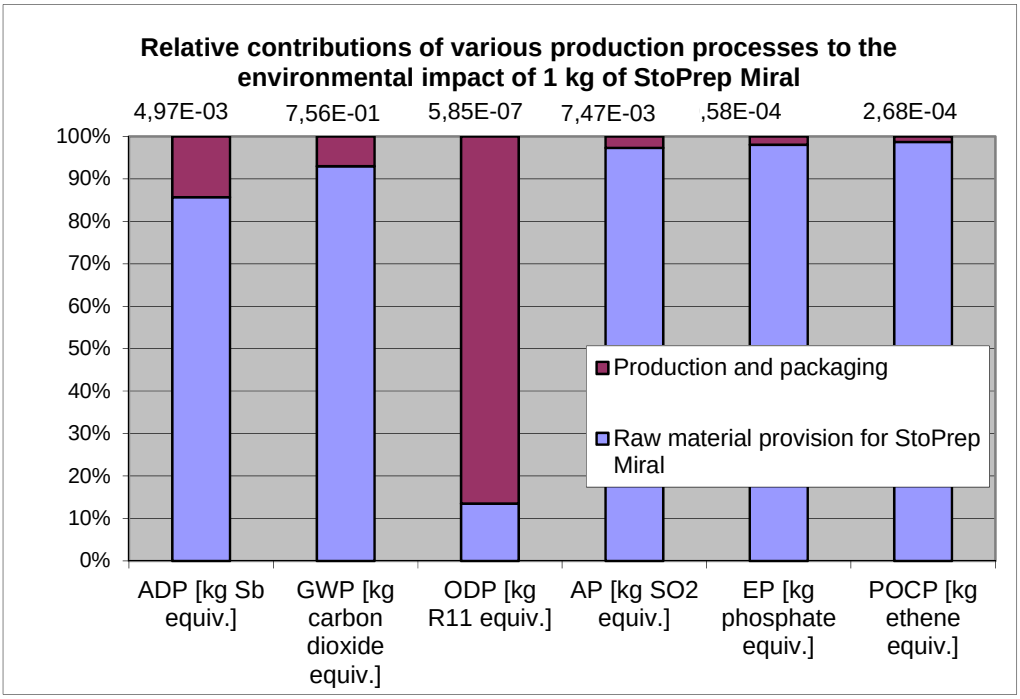


Illustration 8a: Relative contributions of various production processes to the environmental impact of 1 kg of StoPrep Miral

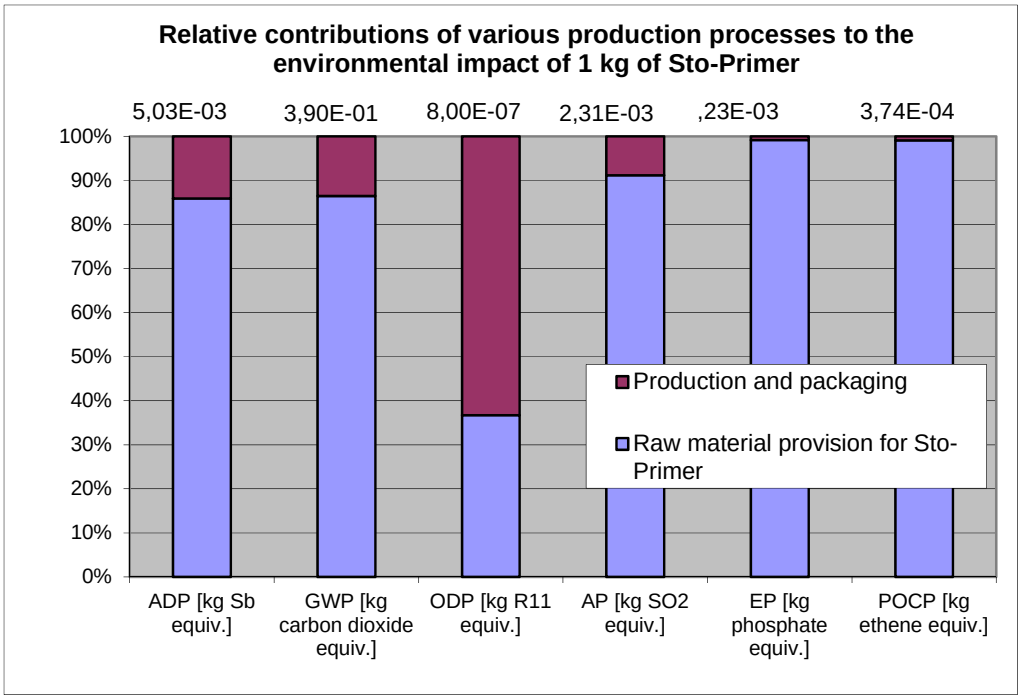


Illustration 8b: Relative contributions of various production processes to the environmental impact of 1 kg of Sto-Primer

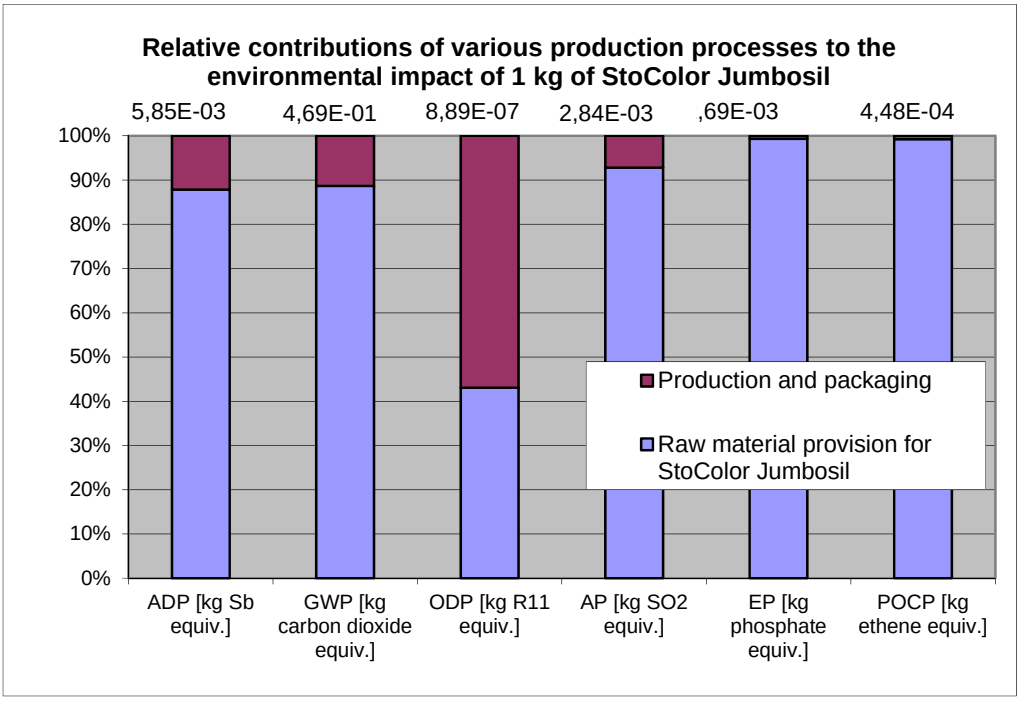


Illustration 8c: Relative contributions of various production processes to the environmental impact of 1 kg of StoColor Jumbosil

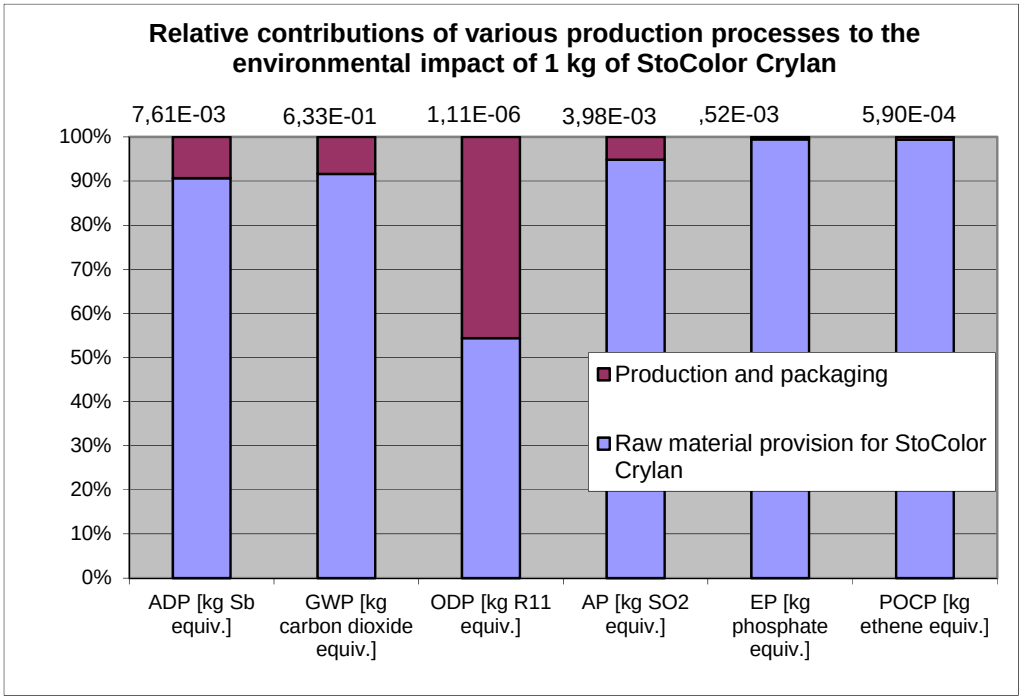


Illustration 8d: Relative contributions of various production processes to the environmental impact of 1 kg of StoColor Crylan

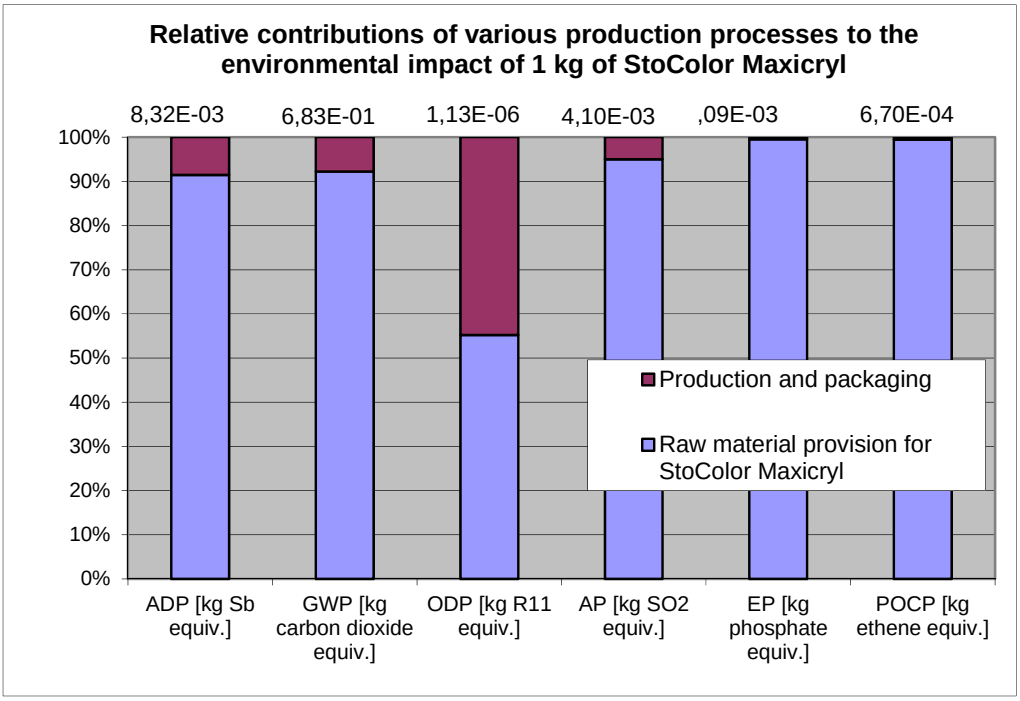


Illustration 8e: Relative contributions of various production processes to the environmental impact of 1 kg of StoColor Maxicryl

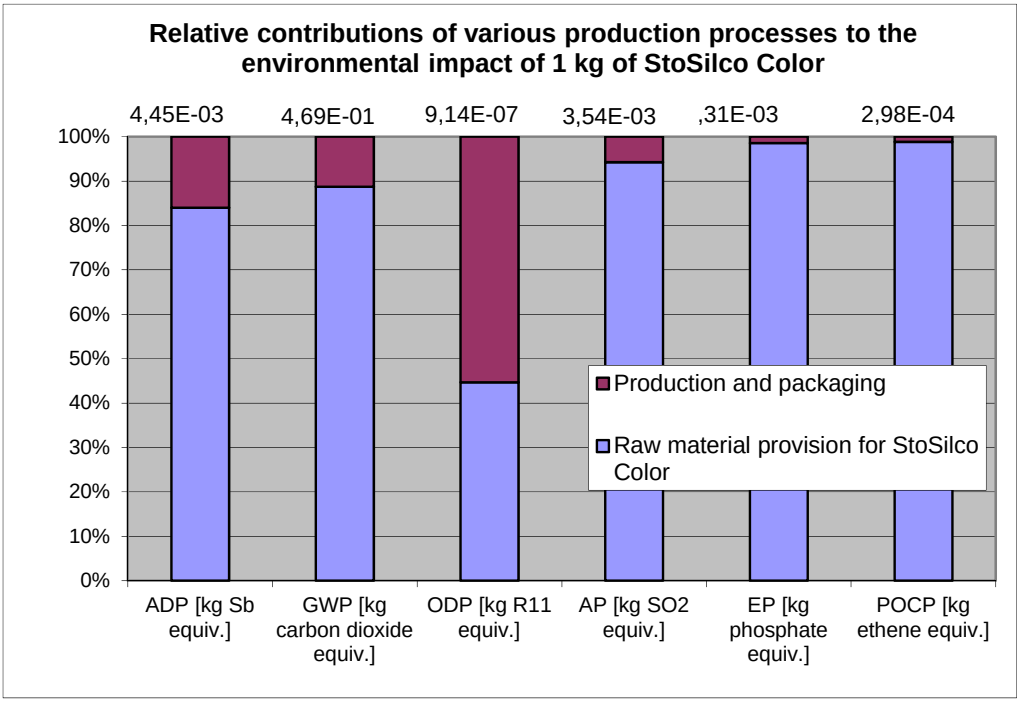


Illustration 8f: Relative contributions of various production processes to the environmental impact of 1 kg of StoSilco Color

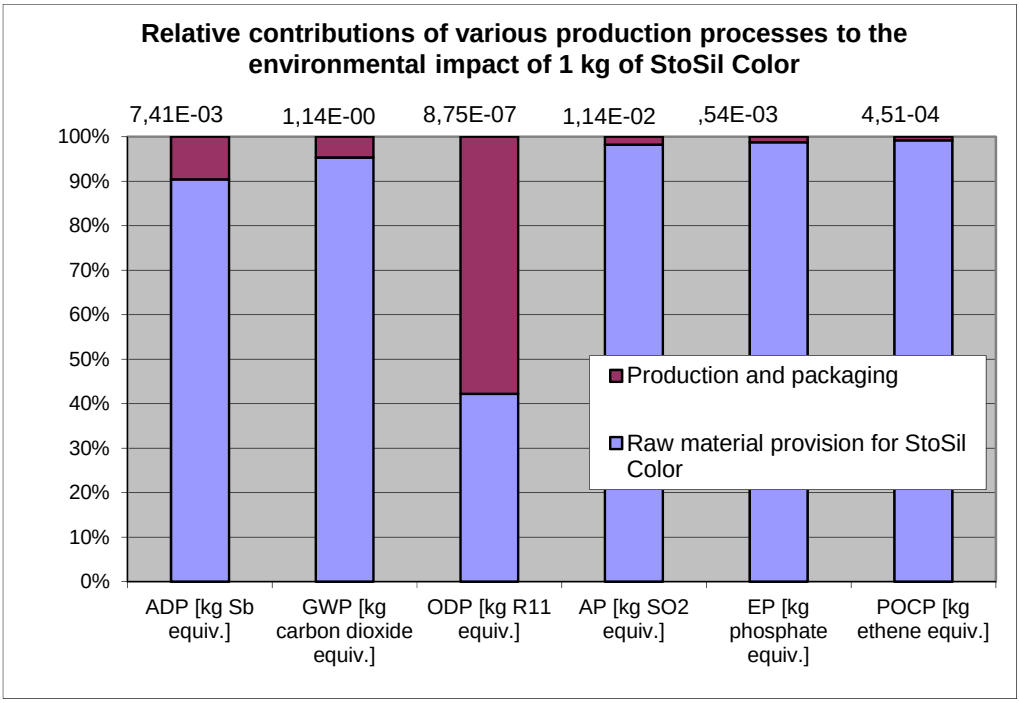


Illustration 8g: Relative contributions of various production processes to the environmental impact of 1 kg of StoSil Color

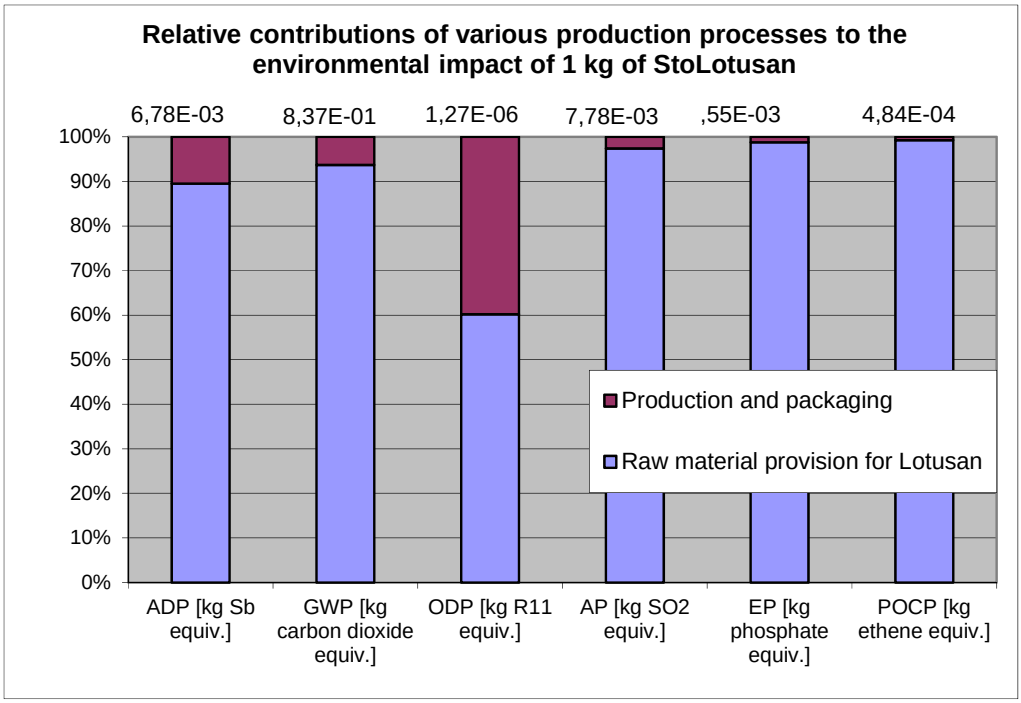


Illustration 8h: Relative contributions of various production processes to the environmental impact of 1 kg of StoLotusan

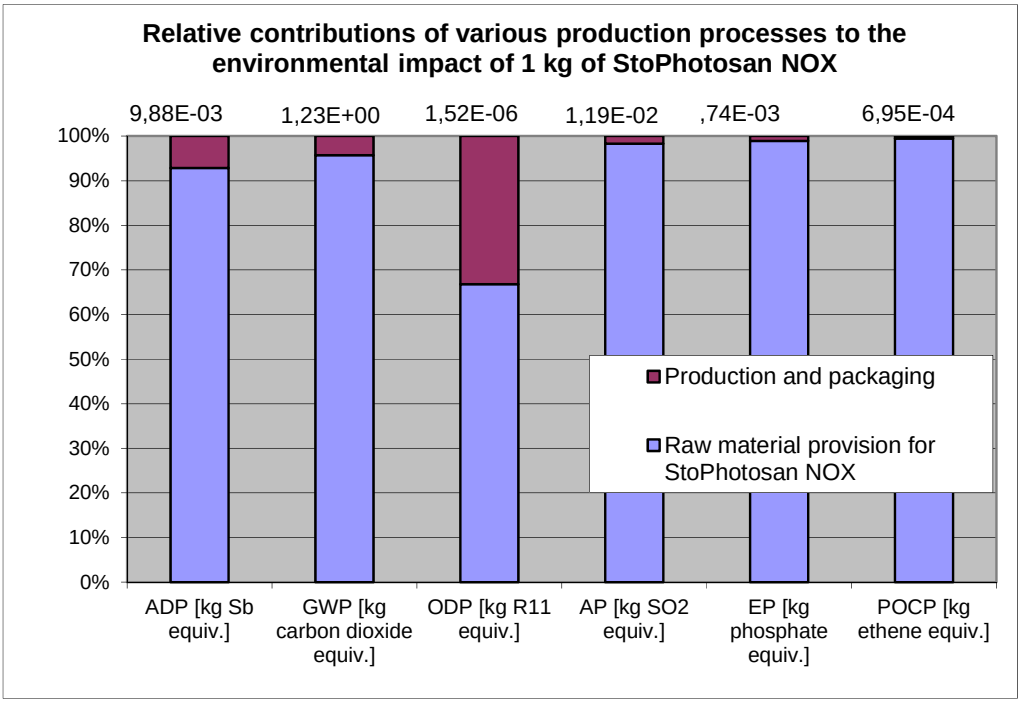


Illustration 8i: Relative contributions of various production processes to the environmental impact of 1 kg of StoPhotosan NOX

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.

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 primer and facade paint 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 Facade paints with organic binders are 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 facade paints and primers does not contribute to the lifecycle inventory analysis.

The elasticity ensures high flexibility and the absence of cracks.

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 primer and facade paint

To simplify use of the data, the lifecycle inventory analysis values and environmental impacts of the facade paints and primers 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 kg/m²		Unit per litre/m²						
Evaluation dimension	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Average consumption pro m²	0,3	0,3	0,2	0,15	0,15	0,18	0,15	0,18	0,15
Primary energy requirement, non-renewable [MJ]	3,80E+00	3,62E+00	4,36E+00	3,87E+00	4,38E+00	2,52E+00	4,44E+00	4,68E+00	5,69E+00
Primary energy requirement, renewable [MJ]	4,85E-02	1,99E-02	2,29E-02	1,90E-02	2,04E-02	7,09E-02	5,66E-02	6,10E-02	7,03E-02
Abiotic depletion potential (ADP) [kg Sb equiv.]	1,49E-03	1,51E-03	1,81E-03	1,60E-03	1,81E-03	1,00E-03	1,72E-03	1,83E-03	2,22E-03
Global warming potential (GWP 100) [kg carbon	2,27E-01	1,17E-01	1,45E-01	1,33E-01	1,49E-01	1,06E-01	2,64E-01	2,26E-01	2,76E-01
Ozone depletion potential (ODP) [kg R11 equiv.]	1,75E-07	2,40E-07	2,76E-07	2,33E-07	2,46E-07	2,06E-07	2,03E-07	3,43E-07	3,42E-07
Acidification potential (AP) [kg SO2 equiv.]	2,24E-03	6,93E-04	8,81E-04	8,36E-04	8,92E-04	7,97E-04	2,66E-03	2,10E-03	2,67E-03
Eutrophication potential (EP) [kg PO4 equiv.]	2,88E-04	6,68E-04	8,33E-04	7,39E-04	8,89E-04	2,94E-04	3,58E-04	4,19E-04	3,92E-04
Photochemical ozone creation potential (POCP)	8,04E-05	1,12E-04	1,39E-04	1,24E-04	1,46E-04	6,72E-05	1,05E-04	1,31E-04	1,56E-04

Table 9: Estimated impact of primers and facade paints with organic binder with production and packaging per m²

Raw material provision, production, utilisation and disposal	Unit kg/m²		Unit per litre/m²						
Evaluation dimension	StoPrep Miral	Sto-Primer	StoColor Jumbosil	StoColor Crylan	StoColor Maxicryl	StoSilco Color	StoSil Color	Lotusan	StoPhotosan NOX
Average consumption pro m²	0,3	0,3	0,2	0,15	0,15	0,18	0,15	0,18	0,15
Primary energy requirement, non-renewable [MJ]	3,92E+00	3,73E+00	4,48E+00	3,95E+00	4,46E+00	3,13E+00	4,53E+00	4,78E+00	5,78E+00
Primary energy requirement, renewable [MJ]	4,85E-02	1,99E-02	2,29E-02	1,90E-02	2,04E-02	8,51E-02	5,66E-02	6,10E-02	7,03E-02
Abiotic depletion potential (ADP) [kg Sb equiv.]	1,54E-03	1,56E-03	1,87E-03	1,64E-03	1,85E-03	1,25E-03	1,76E-03	1,88E-03	2,26E-03
Global warming potential (GWP 100) [kg carbon	2,35E-01	1,26E-01	1,54E-01	1,39E-01	1,55E-01	1,34E-01	2,70E-01	2,34E-01	2,82E-01
Ozone depletion potential (ODP) [kg R11 equiv.]	1,75E-07	2,40E-07	2,76E-07	2,33E-07	2,46E-07	2,47E-07	2,03E-07	3,43E-07	3,42E-07
Acidification potential (AP) [kg SO2 equiv.]	2,34E-03	7,88E-04	9,79E-04	9,02E-04	9,61E-04	1,04E-03	2,73E-03	2,18E-03	2,74E-03
Eutrophication potential (EP) [kg PO4 equiv.]	2,99E-04	6,80E-04	8,45E-04	7,47E-04	8,97E-04	3,64E-04	3,67E-04	4,29E-04	4,00E-04
Photochemical ozone creation potential (POCP)	9,04E-05	1,22E-04	1,49E-04	1,31E-04	1,53E-04	8,96E-05	1,13E-04	1,40E-04	1,64E-04

Table 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

Facade paints and primers with organic binder in accordance with EN DIN 1602 contain 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 13823	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item.
DIN EN 15824	Specifications for external renders and internal plasters based on organic binders

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