



Building with conscience.

## EPD for StoQuik® Silver Drainscreen™ System

StoQuik® Silver Drain-Screen™ is a durable cement board stucco system with superior energy efficiency and improved water drainage.

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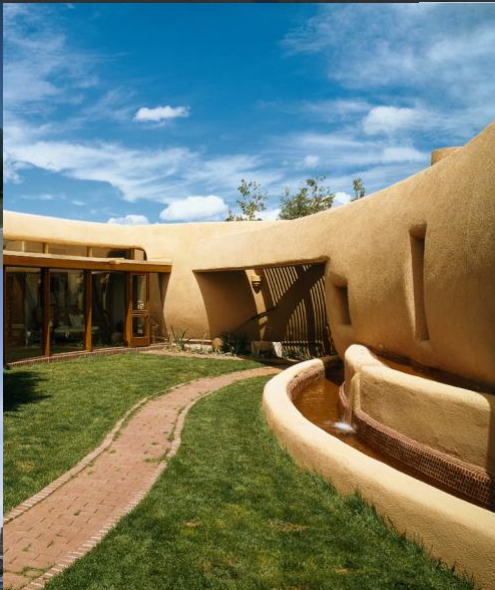


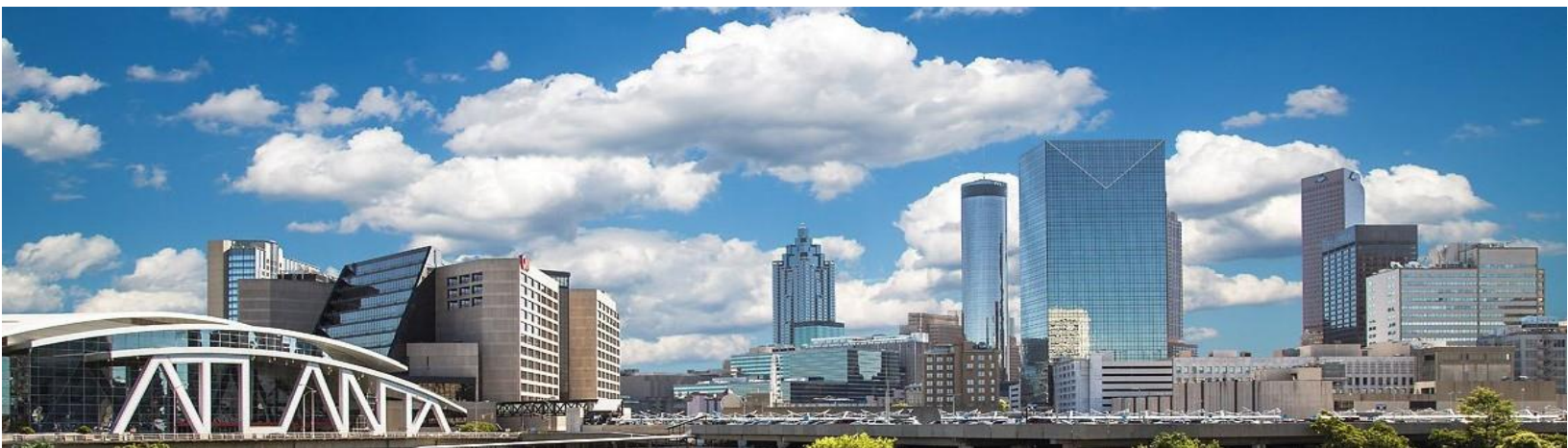
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#### EPD for Sto Gold Coat®

Sto Gold Coat® is a code recognized, vapor permeable fluid-applied membrane designed for application under ci wall systems. Sto Gold Coat® is a sheathing treatment which is part of the StoGuard® air barrier and moisture barrier family of products.





<b>PCR Identification</b>	<b>PCR for Architectural Coatings: NAICS 325510 on the basis of ISO 21930:2007, NSF International, 2017. Valid through June 23, 2022</b>
Compliance to ISO 14040/44, ISO 14025 and ISO 21930	Yes
Product Category	Exterior Coating
Manufacturer's name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120 Atlanta, GA 30331 <a href="http://www.stocorp.com">www.stocorp.com</a>   (800) 221-2397
EPD program operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 <a href="http://www.epstengroup.com">www.epstengroup.com</a>
Declaration Number	01-003
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered and protected substrate for 60 years
Market-base life used in assessment	10 Years
Design life used in assessment	N/A
Test method employed for determination of design life	N/A
Amount of colorant needed	See table 3
Overall Data Quality Assessment Score	Good
Site(s) in which the results of the LCA are representative	STO manufacturing sites in Atlanta, Georgia; Glendale, Arizona; and Rutland, Vermont
Information on where explanatory material can be obtained	See references at the end of this document.
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database Version 8.7, Service Pack 39
This declaration was independently verified in accordance with ISO 14025: 2006 and the reference PCR: PCR for Architectural Coatings: NAICS 325510 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14040/44 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

**Comparability**

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

## » Company

We believe in ‘**Building with conscience**’.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you’re always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That’s exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it’s new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That’s why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through [Sto Studio](#) or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Atlanta Plant

Glendale Plant

Rutland Plant

## » Performance Features

Waterproof Material	Structural and Durable	Low Temperature Application	Spray Applied with Airless Spray Equipment
Vapor Permeable	UV Durable	Build-in Freeze Protection	Water-base and Low VOC

## » Product Identification

Sto Gold Coat® is a fluid-applied vapor permeable air barrier offered in 5-gallon pails. There are no finish or color base options provided.

Table 1: Sto Gold Coat® Identification

Product Name	Product Number	Base Type	Finish Type
Sto Gold Coat®	81636	n/a	n/a

## » Product Description

Sto Gold Coat® is a fluid-applied vapor permeable air barrier and water-resistive barrier (WRB) with built-in anti-freeze properties. It is used over prepared vertical above grade concrete, concrete masonry, brick masonry, wood and glass mat gypsum sheathing behind StoTherm® ci and other wall claddings. Gold Coat® is treated in the study as a undercoater and it only utilizes the market-based lifetime (10 years for exterior undercoater).



## » Material Composition

The material composition of Sto Gold Coat® is listed below:

Table 2: Material composition for Gold Coat®

Ingredient	Gold Coat®
Additives	1-2%
Colorant	3-4%
Polymer	25-26%
Silica	41-42%
Silicate	0%
Surfactant	0-1%
Water	25-26%

## » Components related to Life Cycle Assessment

The functional unit for the LCA study was covering and protecting 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in the PCR. The market-based lifetime is 10 years. By default, Gold Coat® has a 5-year warranty. In case it is applied on Sto’s wall systems, the warranty is extended to 10 years. The reference flow required for one functional unit is provided in Table 3.

Table 3: Market-based lifetime and reference flow

	Functional Unit [1 m <sup>2</sup> ]	Reference Flow [kg]	Tint needed [kg]
Lifespan		Market-based Lifetime [10 years]	
Gold Coat® over plywood)	1	3.08	N/A
Gold Coat® over CMU	1	8.87	N/A

## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in the PCR.

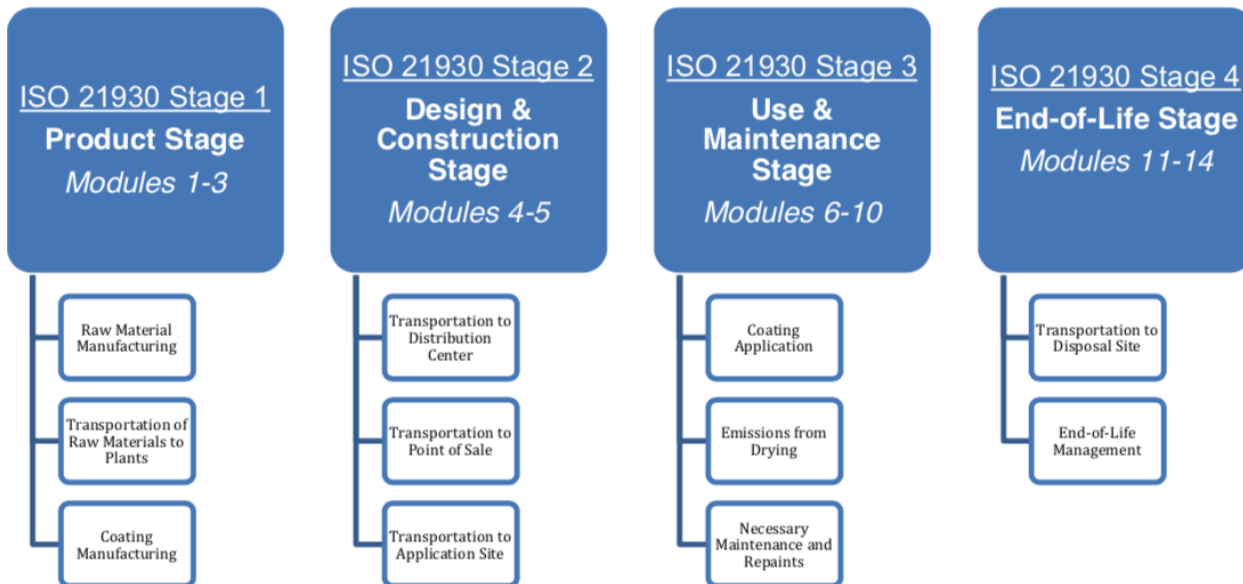


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from Sto's facilities in Atlanta, GA, Glendale, AZ and Rutland, VT for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V8.7 Database Service Pack 39. Overall, both primary and secondary data are considered good quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions were made in accordance with the PCR and include the transportation distances, the disposal of packaging material and the product at its end of life and use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis.

## » Product Stage

Sto Gold Coat is produced at Sto's Atlanta, GA, Glendale, AZ and Rutland, VT facilities. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by Sto. Sto Gold Coat is supplied in 5-gallon pails.

## » Design and Construction Stage

The design and construction process stage starts with the packaged product leaving the production site and ends with being delivered to the application site.

During this stage, the finished product is moved from a shipping dock for distribution. The end gate is the application site after the purchaser acquires the finished product and transports it to the application site.

## » Use and Maintenance Stage

The use stage begins when the user prepares the product before applying it to a substrate and ends with any leftover coating and discarded packaging entering the end-of-life stage. Detailed application instructions are provided online. The application procedure includes mixing and applying. As recommended, an electric drill/mixer and a spray pump are assumed to be used for mixing and application. The equipment is not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible, but electricity to power application tools has been included.

As prescribed in the PCR, 10% of the wet mass of Sto Gold Coat is assumed to be unused and properly disposed of.

## » End-of-Life Stage

Table 4: End-of-life Disposal Scenarios

Waste Flow	Recycling	Incineration	Landfilling
Paper Packaging	66.6%	6.01%	27.39%
Steel Packaging	33.3%	12.01%	54.69%
Plastic Packaging	9.1%	16.36%	74.54%
Unused Product	0%	0%	100%
Post-Consumer Product	0%	0%	100%

In this stage, the disposal of installation waste, packaging waste and product waste at its end of life is included. The disposal pathway of each waste stream is modeled based on the recommendation of PCR and US EPA's latest waste management fact sheet.

## » Life Cycle Assessment Results

As prescribed by the PCR, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 5 provides the acronym key of the impact indicators declared in this EPD.

Table 5: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
<b>Resource Use Parameters</b>		
RPR	Use of renewable primary energy	MJ, net calorific value (LHV)
RMR	Use of renewable Material Resources	kg
NRER	Depletion of Non-Renewable Energy Resources	MJ, net calorific value
NRMR	Depletion of Non-Renewable Material Resources	kg
FW	Consumption of Freshwater	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
<b>Biogenic Carbon Parameter</b>		
BC	Biogenic Carbon	kg CO <sub>2</sub> eq
<b>Energy Differentiation Parameters</b>		
HWP	Hydro/wind Power	MJ, net calorific value (LHV)
FE	Fossil Energy	MJ, net calorific value (LHV)
BE	Bio-energy	MJ, net calorific value (LHV)
NE	Nuclear Energy	MJ, net calorific value (LHV)
OE	Other Energy	MJ, net calorific value (LHV)

» Sto Gold Coat® over Plywood

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	2.88E-02	1.24E-03	2.39E-05	8.39E-04	
	EP [kg N eq]	9.37E-04	1.01E-04	1.00E-06	1.48E-04	
	GWP [kg CO <sub>2</sub> eq]	5.35E+00	2.42E-01	8.46E-03	1.79E-01	
	ODP [kg CFC 11 eq]	-1.42E-13	2.30E-17	2.81E-17	4.44E-16	
	POCP [kg O <sub>3</sub> eq]	2.04E-01	2.84E-02	3.14E-01	1.36E-02	
	RPRE [MJ]	5.79E+00	1.06E-01	1.86E-02	1.29E-01	
	NRPRE [MJ]	1.22E+02	3.43E+00	1.36E-01	1.96E+00	
	FW [m <sup>3</sup> ]	3.11E-02	4.09E-04	4.76E-05	2.61E-04	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	3.23E+00	0.00E+00	0.00E+00	0.00E+00	
	HWD [kg]	1.12E-07	2.78E-08	5.98E-11	8.47E-09	
	NHWD [kg]	2.21E-01	1.29E-04	4.28E-05	3.16E+00	
	BC [kg CO <sub>2</sub> eq]				3.81E-01	
	HWP [MJ]				1.98E-01	
	FE [MJ]				3.00E+00	
	BE [MJ]				9.76E-02	
	NE [MJ]				7.85E-01	
	OE [MJ]				7.88E-02	



» Sto Gold Coat® over CMU

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	8.29E-02	3.58E-03	6.86E-05	2.41E-03
	EP [kg N eq]	2.69E-03	2.92E-04	2.89E-06	4.26E-04
	GWP [kg CO <sub>2</sub> eq]	1.54E+01	6.96E-01	2.43E-02	5.16E-01
	ODP [kg CFC 11 eq]	-4.07E-13	6.61E-17	8.07E-17	1.28E-15
	POCP [kg O <sub>3</sub> eq]	5.87E-01	8.17E-02	9.04E-01	3.91E-02
	RPRE [MJ]	1.67E+01	3.05E-01	5.36E-02	3.70E-01
	NRPRE [MJ]	3.50E+02	9.87E+00	3.92E-01	5.63E+00
	FW [m3]	8.93E-02	1.18E-03	1.37E-04	7.52E-04
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	9.31E+00	0.00E+00	0.00E+00	0.00E+00
	HWD [kg]	3.22E-07	8.00E-08	1.72E-10	2.44E-08
	NHWD [kg]	6.36E-01	3.72E-04	1.23E-04	9.09E+00
	BC [kg CO <sub>2</sub> eq]			1.10E+00	
	HWP [MJ]			5.70E-01	
	FE [MJ]			8.63E+00	
	BE [MJ]			2.81E-01	
	NE [MJ]			2.26E+00	
	OE [MJ]			2.27E-01	

## » Interpretation

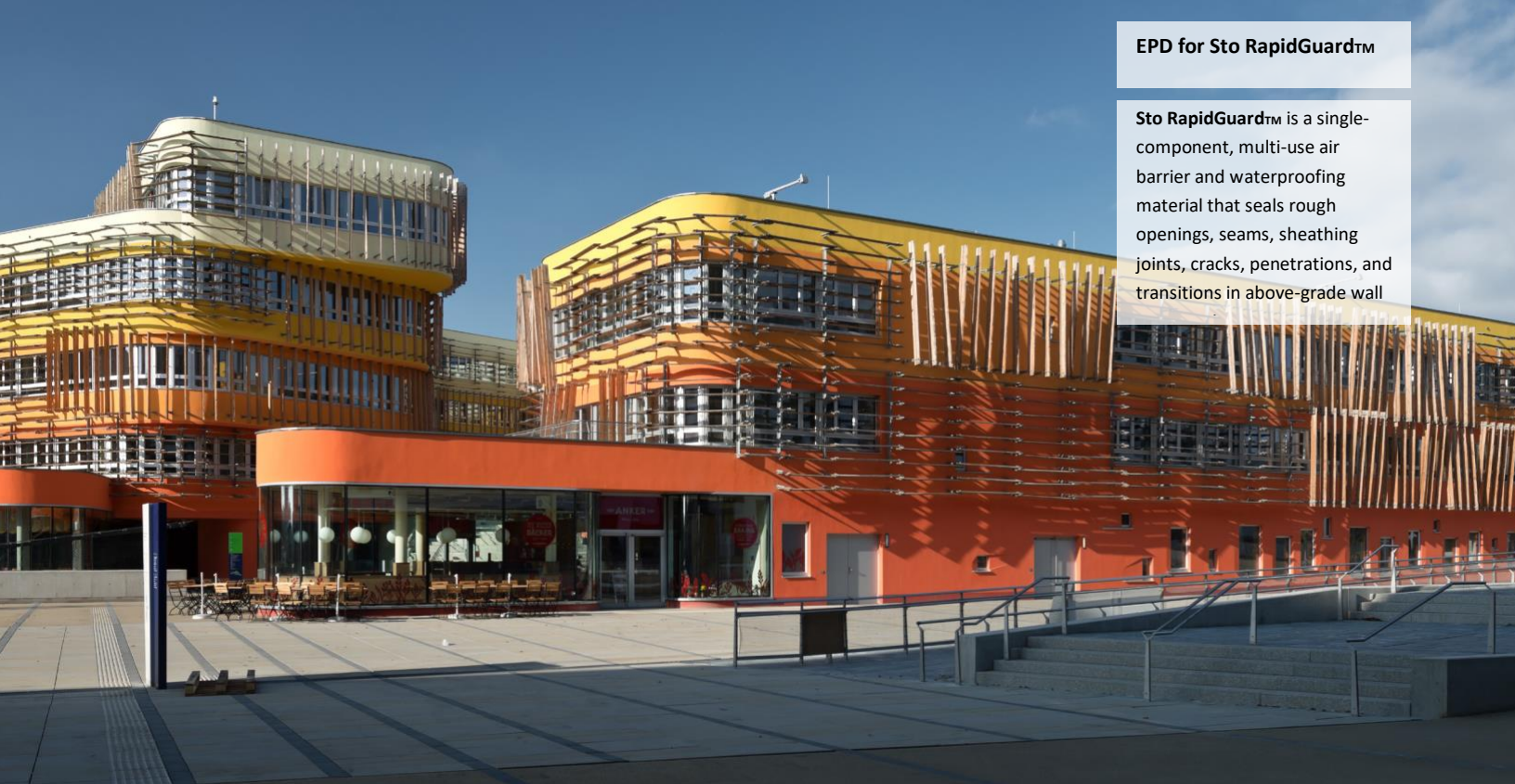
Overall, the Product Stage which includes raw material extraction delivery and product manufacturing are the highest contributors to all impact indicators except POCP where the contribution from application phase is more prominent because of VOC emission.

## » Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, September 2019
- PCR for Architectural Coatings: NAICS 325510. NSF International, 2017
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Advancing Sustainable Materials Management: 2015 Fact Sheet. US EPA. Available at [https://www.epa.gov/sites/production/files/2018-07/documents/2015\\_smm\\_msw\\_factsheet\\_07242018\\_fnl\\_508\\_002.pdf](https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf)
- Product Bulletin – Sto Gold Coat. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Products\\_TechService/Air%20Moisture%20Barriers/Product%20Bulletins/PB\\_81636\\_Sto\\_Gold%20Coat\\_EN.pdf](https://www.stocorp.com/wp-content/content/Products_TechService/Air%20Moisture%20Barriers/Product%20Bulletins/PB_81636_Sto_Gold%20Coat_EN.pdf)

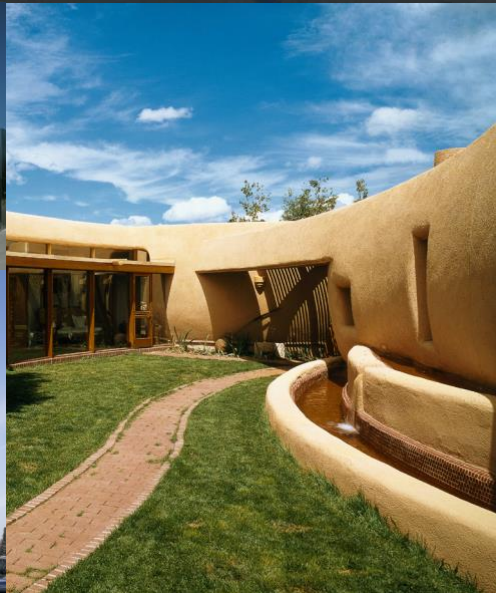


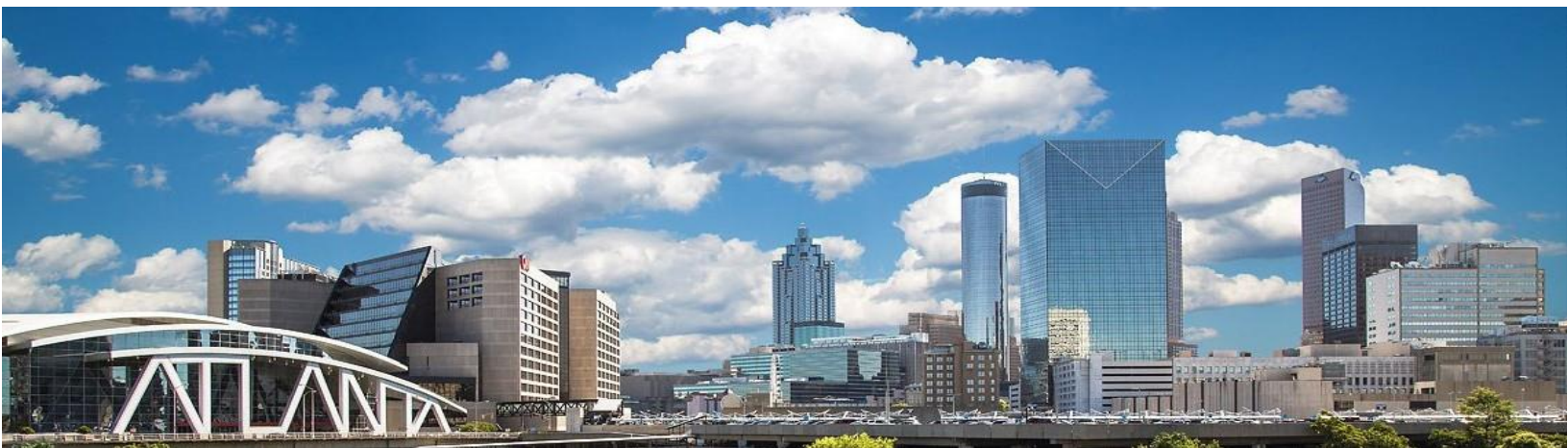
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**EPD for Sto RapidGuard™**

**Sto RapidGuard™** is a single-component, multi-use air barrier and waterproofing material that seals rough openings, seams, sheathing joints, cracks, penetrations, and transitions in above-grade wall





Manufacturer Name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120, Atlanta, GA 30331 www.stocorp.com   (800) 221-2397
EPD Program Operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 www.epstengroup.com
Compliance to ISO21930:2017	Yes
Product Name	Sto RapidGuard™
Product's Intended Application and Use	Air Barrier and Waterproofing Membrane
Declaration Number	01-006
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered substrate for 60 years
Reference Service Life used in assessment	10 Years
Overall Data Quality Assessment Score	Good
Manufacturing Location	Facility in Guelph, ON, Canada
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database, Service Pack 39
ISO 21930: 2017 serves as the core PCR Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> <i>Katherine McFeaters</i>
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## >> Company

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That’s exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it’s new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That’s why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through Sto Studio or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## >> Manufacturing Sites Covered in this EPD

Manufacturing location is Guelph, ON, Canada

## >> Performance Features

Waterproof Material  
Vapor Permeable

No mesh/fabric/tapes needed at rough  
openings and sheathing joints  
Fast Cure

Cures in wet weather and on damp  
substrates  
Gun Applied



## >> Product Identification

RapidGuard™ is offered in two packaging options. Table 1 lists the products declared in this EPD.

Table 1: List of RapidGuard™ Products

Product Name	Product Number
Sto RapidGuard™ Cartridge	81571-740
Sto RapidGuard™ Sausage	81571-741

## >> Product Description

Sto RapidGuard™ is a single-component, multi-use air barrier and waterproofing material that seals rough openings, seams, sheathing joints, cracks, penetrations, and transitions in above-grade wall construction.

## » Technical Details

Table 2 : Technical Data

Performance*	Test Method	Test Criteria	Result
Water Penetration Resistance	AATCC-127 (waster column)	Resist 21.6" (55 cm) water for 5 hours	No water penetration
Tensile Strength	ASTM D412	n/a	250 psi (1724 kPa)
Elongation at Break	ASTM D412	n/a	400%
Durometer Hardness	ASTM D2240	Shore A	40-45 points
Adhesion (psi)	ASTM D4541	>50 psi (345 kPa) or substrate failure: OSB, Plywood, Concrete, CMU, Vinyl, Galvanized Steel, and Gypsum Sheathing	> 50 psi (345 kPa) > 20 psi (138 kPa) to gypsum sheathing (substrate failure)
Water Vapor Permeability (@DFT)	ASTM E96 (wet cup method)	n/a	6.18 perms @ 20 mils (353 ng/s•m <sup>2</sup> •Pa) 5.37 perms @ 30 mils (307 ng/s•m <sup>2</sup> •Pa)
Air Leakage Resistance	ASTM E2178	Less than 0.02 L/s/m <sup>2</sup>	Pass
% Solids by Volume	n/a	n/a	98%
VOC Content	n/a	Compliant with EPA and South Coast AQMD requirements for Building Envelope Coatings	< 21 g/L
Building Code Compliance	Meets requirements of 2015 IBC, IRC, and IECC as an air barrier and joint treatment, ICC AC 212 and ASTM E 2570		

\*Results are based on lab testing under controlled conditions. Results can vary between labs or from field tests.

## » Material Composition

The material composition of RapidGuard™ is listed below:

Table 3: Material composition of RapidGuard™

Ingredient	Mass %
Calcium Carbonate	45-55%
Plasticizers	25-30%
Silane Polymer	17-24%
Colorant	2-3%
Wax	1-2%
Silica	1-2%
Other Additives	<1%

## » Components related to Life Cycle Assessment

The functional unit for the LCA study was covering 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in ISO 21930:2017. The reference service life of the product is 10 years which is the warranty of Sto's wall system. The reference flow required for one functional unit is provided in Table 4.

Table 4: Reference flow and Functional Unit

Product	Functional Unit [1 m <sup>2</sup> ]	Reference Flow [kg]
RapidGuard™	1	7.68

## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in ISO 21930:2017.

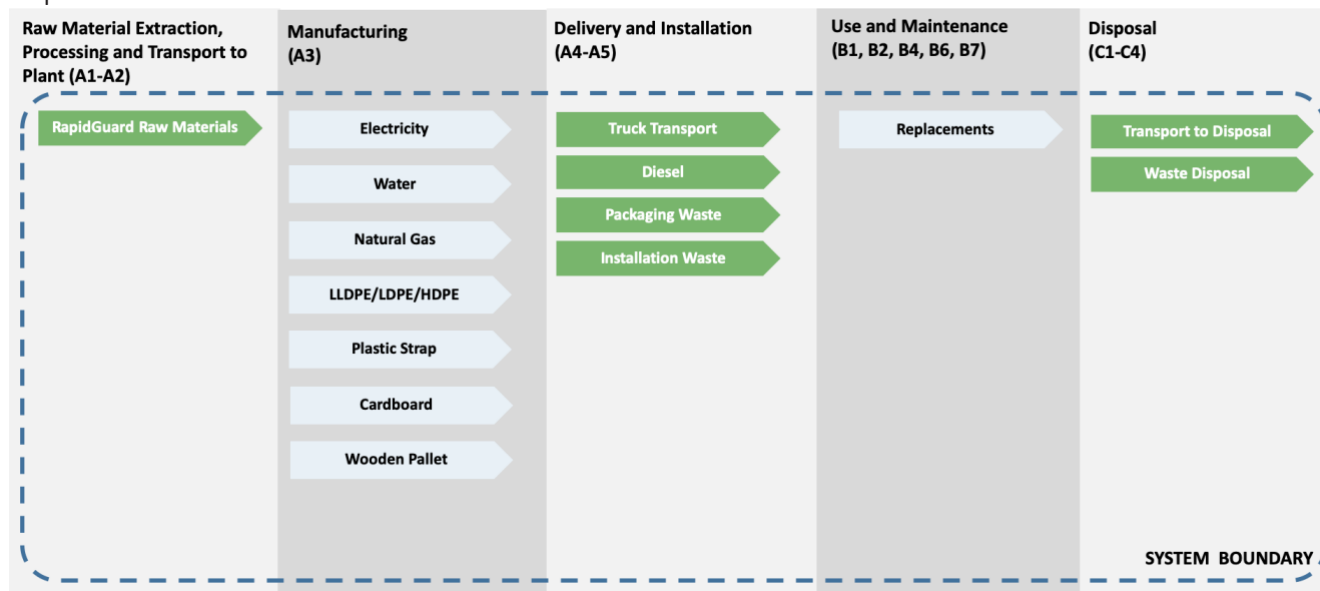


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from the manufacturing facility in Guelph, ON in Canada for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V9.2.0.58 Database Service Pack 39. Overall, both primary and secondary data are considered good quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions include the transportation distances, the disposal of packaging material and the product at its end of life and use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. To derive a per unit value for manufacturing inputs such as electricity, water, heating oil and natural gas, a series of allocation calculations were adopted. The facility level of utility data was allocated based on production values of different types of products in the same manufacturing facility. Then the data is further allocated among products of different packaging specifications based on the mass because it is believed the energy consumption and water consumption correlated better on a mass basis.

## » Production Stage (A1-A3)

RapidGuard™ is manufactured in Guelph, ON in Canada. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by the manufacturer. The raw materials used in the production manufacturing are sourced from the USA, Europe and China. After proper homogenization, the product is filled in 29-oz. (0.86-L) cartridges and 20-oz. (0.6-L) sausages, and then further packaged in cartons and shipped on wooden pallets from Canada to facilities in the US for distribution.

## » Transport to Construction Site (A4)

RapidGuard™ is assumed to be shipped from the manufacturing facility in Canada to distribution facilities in the US via truck. From the distribution facilities, the product is shipped to construction sites. Table 5 gives the transportation details including the distances and the truck dataset used in the model. Transport distances are calculated based on the locations of the manufacturing facility, the distribution facilities, and customers' zip codes retrieved from the sales records.

Table 5: Transport Details

Parameter	Details	Unit
Type of transport	Truck	-
Fuel type	Diesel	-
Liters of fuel	39.0625	l/100km
Vehicle type	Heavy duty diesel truck/ 45,000 lb payload	-
Transport distance from the manufacturing facility to distribution facilities	1724.17	km
Transport distance from the distribution facilities to construction sites	782.21	km

## » Installation (A5)

RapidGuard™ is a one-component product without the need for mixing. The product can be applied with a caulking gun and spread with a dry joint knife, trowel or spatula while material is still wet. Detailed installation instructions can be found at Sto's website.

The installation process is manual. Thus, no energy or no material input other than the product is required. The LCA study considered a 10% of product loss in the installation process. Together with the product loss, the waste derived from the packaging material coming with the product are disposed of properly. In addition, the VOC emission from the curing of applied RapidGuard™ was also taken into account.



Table 6: Installation (A5)

Parameter	Value	Unit
Product loss per functional unit	7.68E-01	kg/ESL
Waste materials at the construction site before waste processing, generated by product installation	2.21E+00	kg/ESL
Plastic material recycled	1.77E-01	kg/ESL
Plastic material landfilled	1.47E+00	kg/ESL
Plastic material incinerated	3.02E-01	kg/ESL
Cardboard recycled	1.19E-01	kg/ESL
Cardboard landfilled	4.79E-02	kg/ESL
Cardboard incinerated	1.16E-02	kg/ESL
GWP based in biogenic carbon content of cardboard packaging	6.30E-01	kg CO2e/ESL
Wood material recycled	1.40E-02	kg/ESL
Wood material landfilled	5.85E-02	kg/ESL
Wood material incinerated	1.36E-02	kg/ESL
GWP based in biogenic carbon content of wood packaging	1.55E-01	kg CO2e/ESL
Direct emissions to ambient air	9.43E-02	kg/ESL

## » Use Stage (B1-B5 & B6-B7)

Since the product is applied under a wall surface, there are no use phase inputs required to maintain the performance of the product other than the replacement needed through the estimated service life (ESL) of a whole building. The ESL in the study is assumed to be 60 years which is a standard established and used in many PCRs of similar product categories such as architectural coating. The RSL of the product is determined by the warranty of the product, which is ten years. Therefore, after initial installation on a building with a 60-year service life, there will be five replacements needed. Besides the emissions to the air disclosed in the above table, there are no other emissions to air, soil or water, including those of any regulated substances.

Table 7: Replacement (B4)

Parameter	Value	Unit
Reference Service Life (RSL)	10	Years
Estimated Service Life (ESL)	60	Years
Replacement cycle	5	(ESL/RSL)-1
Declared product properties	As per Product Identification section	-
Design application parameters	As per technical details in Table 2	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Industry Standard	-

## >> End-of-Life Stage (C1-C4)

In this stage, the product at its end of life is transported to the waste disposal facility and processed. Included in this stage are the following:

- Deconstruction – There are no impacts during this stage as the product is manually removed.
- Transportation to disposal – Estimated fuel requirements made based on weight of product and average distance to landfill.
- Waste processing for landfilling – This process is included in the landfilling process.
- Waste disposal – Due to the fact that all the products in study are installed as part of a wall system including the external coating/finish, and are not able to be dismantled based on their material type, it is reasonable to assume that the products at their end-of-life stage are landfilled.

Table 8: End-of-Life Parameters

	RapidGuard™	Unit
Collected with mixed construction waste	6.82	kg/ESL
Landfilling	100	%
Product for final deposition	6.82	kg/ESL

## » Life Cycle Assessment Results

As prescribed by ISO 21930:2017, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 9 provides the acronym key of the impact indicators declared in this EPD.

Table 9: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
ADP-Fossil Fuel	Abiotic depletion potential for fossil resources (An indicator derived from CML 2001-Jan 2016)	MJ, net calorific value
<b>Resource Use Parameters</b>		
RPR <sub>E</sub>	Renewable primary energy as energy carrier	MJ, net calorific value
RPR <sub>M</sub>	Renewable primary energy resources as material utilization	MJ, net calorific value
NRPR <sub>E</sub>	Non-renewable primary energy as energy carrier	MJ, net calorific value
NRPR <sub>M</sub>	Non-renewable primary energy as material utilization	MJ, net calorific value
SM	Use of secondary material	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value
RE	Recovered energy	MJ, net calorific value
FW	Use of fresh water	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste disposed	kg
ILLRW	Intermediate and low-level radioactive waste disposed	kg
<b>Carbon Removal and Emission Parameter</b>		
BCRP	Biogenic Carbon Removal from Product	kg CO <sub>2</sub> eq
BCEP	Biogenic Carbon Emission from Product	kg CO <sub>2</sub> eq
BCRK	Biogenic Carbon Removal from Packaging	kg CO <sub>2</sub> eq
BCEK	Biogenic Carbon Emission from Packaging	kg CO <sub>2</sub> eq
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO <sub>2</sub> eq
CCE	Calcination Carbon Emissions	kg CO <sub>2</sub> eq
CCR	Carbonation Carbon Removals	kg CO <sub>2</sub> eq
CWNR	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO <sub>2</sub> eq

## » Sto RapidGuard™ – Results

### TRACI Results and ADP-Fossil Fuel

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO <sub>2</sub> eq]	2.50E-02	1.45E-03	3.19E-04	0.00E+00	0.00E+00	0.00E+00	1.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.60E-06	0.00E+00	2.29E-04	MND
EP [kg N eq]	7.68E-04	1.20E-04	9.48E-05	0.00E+00	0.00E+00	0.00E+00	4.97E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.96E-07	0.00E+00	1.17E-05	MND
GWP [kg CO <sub>2</sub> eq]	4.49E+00	3.02E-01	1.64E-01	0.00E+00	0.00E+00	0.00E+00	2.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-03	0.00E+00	4.99E-02	MND
ODP [kg CFC 11 eq]	3.13E-13	-1.62E-15	-1.19E-15	0.00E+00	0.00E+00	0.00E+00	1.54E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.47E-17	0.00E+00	-2.62E-15	MND
POCP [kg O <sub>3</sub> eq]	1.94E-01	3.31E-02	2.61E-03	0.00E+00	0.00E+00	0.00E+00	1.17E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-04	0.00E+00	4.59E-03	MND
ADP-fossil fuel [MJ]	8.28E+01	4.26E+00	3.13E-01	0.00E+00	0.00E+00	0.00E+00	4.41E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E-02	0.00E+00	7.77E-01	MND

### Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR <sub>E</sub> [MJ]	1.80E+01	1.33E-01	2.14E-02	0.00E+00	0.00E+00	0.00E+00	9.11E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	0.00E+00	6.08E-02	MND
RPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR <sub>E</sub> [MJ]	8.96E+01	4.29E+00	3.22E-01	0.00E+00	0.00E+00	0.00E+00	4.75E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E-02	0.00E+00	7.97E-01	MND
NRPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	3.84E-02	5.14E-04	2.70E-04	0.00E+00	0.00E+00	0.00E+00	1.96E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E-06	0.00E+00	9.46E-05	MND

### Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	1.85E-07	3.47E-08	1.11E-09	0.00E+00	0.00E+00	0.00E+00	1.12E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E-10	0.00E+00	2.79E-09	MND
NHWD [kg]	4.63E-01	1.62E-04	3.48E-01	0.00E+00	0.00E+00	0.00E+00	9.75E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-06	0.00E+00	1.14E+00	MND
HLRW [kg]	3.62E-06	1.15E-08	4.38E-09	0.00E+00	0.00E+00	0.00E+00	1.82E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-10	0.00E+00	9.70E-09	MND
ILLRW [kg]	2.70E-03	9.49E-06	3.52E-06	0.00E+00	0.00E+00	0.00E+00	1.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.56E-08	0.00E+00	7.72E-06	MND

## Carbon Removal and Emission

Indicator	RapidGuard™
BCRP [kg CO2 eq]	7.80E-01
BCEP [kg CO2 eq]	7.85E-01
BCRK [kg CO2 eq]	1.36E-01
BCEK [kg CO2 eq]	6.26E-02
BCEW [kg CO2 eq]	0.00E+00
CCE [kg CO2 eq]	0.00E+00
CCR [kg CO2 eq]	0.00E+00
CWNR [kg CO2 eq]	0.00E+00

### >> Interpretation

In one reference service life of the product, the production stage, which includes raw material extraction, transportation from suppliers and manufacturing, is the highest contributor to all impact indicators. The impact from the remaining stages is negligible. From the perspective of a whole building lifespan, the vast majority of the impacts are derived from the number of replacements needed. This is directly related to the impacts associated with the manufacture of new products that are used to replace the original. Improving the relatively short lifespan of the product is essential to reducing the overall impact of the product.

### >> Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, October 2019
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Sto Studio. Sto Corp, 2019. Available at <https://www.stocorp.com/sto-studio-us/>
- Installation Guide, Sto RapidGuard. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Systems\\_TechService/Air%20and%20Moisture%20Barriers/Installation%20and%20Repair/IG\\_Sto%20RapidGuard%20Installation%20Guide\(HiRes\).pdf](https://www.stocorp.com/wp-content/content/Systems_TechService/Air%20and%20Moisture%20Barriers/Installation%20and%20Repair/IG_Sto%20RapidGuard%20Installation%20Guide(HiRes).pdf)

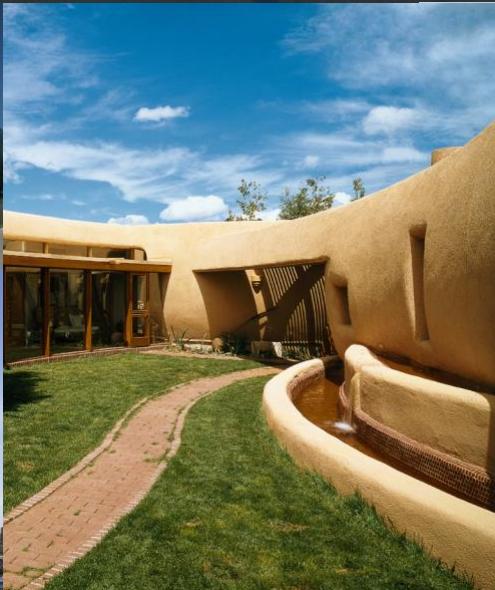


Building with conscience.





**EPD for StoGuard®  
Transition Membrane**

**StoGuard® Transition Membrane** is a flexible air barrier membrane for use on vertical above grade wall construction over properly prepared concrete, concrete masonry (CMU), glass mat gypsum sheathing and Exterior or Exposure I wood-based sheathing.





Manufacturer Name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120, Atlanta, GA 30331 www.stocorp.com   (800) 221-2397
EPD Program Operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 www.epstengroup.com
Compliance to ISO21930:2017	Yes
Product Name	StoGuard® Transition Membrane
Product's Intended Application and Use	Flexible air barrier membrane
Declaration Number	01-007
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered substrate for 60 years
Reference Service Life used in assessment	10 Years
Overall Data Quality Assessment Score	Good
Manufacturing Location	Wörschach, Austria
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database, Service Pack 39
ISO 21930: 2017 serves as the core PCR Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

### Comparability

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

## » Company

We believe in 'Building with conscience'.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you're always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That's exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it's new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That's why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through Sto Studio or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Manufacturing location is Wörschach, Austria.

## » Product Description

StoGuard® Transition Membrane is applicator-friendly and cost-saving:

- StoGuard® Transition Membrane can be easily applied without the use of special tools or applicator training.
- Thanks to the durability of StoGuard® Transition Membrane, it will not tear or lose effectiveness while in service.
- Because StoGuard® Transition Membrane is a fully adhered product, it will not peel or suffer loss of adhesion along edges.
- StoGuard® Transition Membrane will not stain surfaces due to adhesive leaching or streaking.
- StoGuard® Transition Membrane does not require the use of primers or terminations mastics for proper installation.
- Because StoGuard® Transition Membrane is a flexible material, it can be used in a wide range of applications for both static and dynamic joint conditions. One product solves multiple job site conditions.
- StoGuard® Transition Membrane is compatible with all StoGuard® vapor permeable or vapor impermeable membranes.



## » Product Identification

StoGuard® Transition Membrane is offered in five different width options. It is a flexible air barrier membrane for use on vertical above grade wall construction over properly prepared concrete, concrete masonry (CMU), glass mat gypsum sheathing and Exterior or Exposure I wood-based sheathing. Table 1 lists the products declared in this EPD.

Table 1: List of StoGuard® Transition Membrane Products

Product Name	Product #	Width
StoGuard® Transition Membrane	81272	120 mm (4.75")
	81342	152 mm (6")
	81343	228 mm (9")
	81344	304 mm (12")
	81349	457 mm (18")



## » Performance Features

Waterproof	Flexible	Fully adhered membrane	No adhesive leaching	Compatible with other StoGuard® products
Fast and easy to install	Durable	UV-resistant	Versatile	Sustainability

## » Technical Details

Table 2: Technical Data

Performance	Test Method	Test Criteria	Result
Elongation*	ASTM D412	Measure	260%
Tensile Strength*	ASTM D412	Measure	60 psi (.41 MPa)
Tear and Adhesion Properties at 25% Elongation	ASTM C1523	No tearing or loss of adhesion after conditioning	Pass after dry, wet, frozen, and heat aged conditioning
Water Vapor Permeance	ASTM E96		1.48 perms (85 ng/Pa•s•m2)
Air Leakage**	ASTM E2178	≤ 0.02 L/m2•s @ 75 Pa (≤ 0.004 cfm/ft2 @ 1.57 psf)	Passed
Water Column	AATCC 127 (modified)	No leakage for 5 hours minimum	Passed
Adhesion	ASTM D4541	≥ 60 psi (414 kPa)	Passed on plywood, OSB, concrete, and CMU substrates. Exceeded strength of glass mat facing attachment when adhered to glass mat gypsum sheathing
Cyclic Elongation	Lab Method	500 cycles at 0% to 50% elongation and return	No loss of continuity of membrane or loss of bond at joint

\*Elongation and Tensile strength measured in transverse direction (perpendicular to length of roll).

\*\* Based on extrapolation of similar E2178 test data.

## » Material Composition

The material composition of StoGuard® Transition Membrane is listed below:

Table 3: Material composition of StoGuard® Transition Membrane

Ingredient	Mass %
Polyester	20-25%
Thermoplastic Elastomer	75-80%
Colorant	0.04%

## » Components related to Life Cycle Assessment

The functional unit for the EPD was covering 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in ISO 21930:2017. The reference service life of the product is 10 years which is the warranty of Sto’s wall system. Because the impacts of the product applied on different substrates differ by more than 10%. The results will be reported separately for application on plywood and CMU, which is respectively the lower and upper band of the amount of installation material. The reference flow required for one functional unit is provided in Table 4.

Table 4: Reference flow and Functional Unit

Substrate	Functional Unit [1 m <sup>2</sup> ]	Product	Reference Flow of product [kg]	Installation Material	Reference Flow of installation material [kg]
Plywood	1	StoGuard®	2.4	Sto Gold Coat	5.6
CMU		Transition Membrane			12.06

## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in ISO 21930:2017.

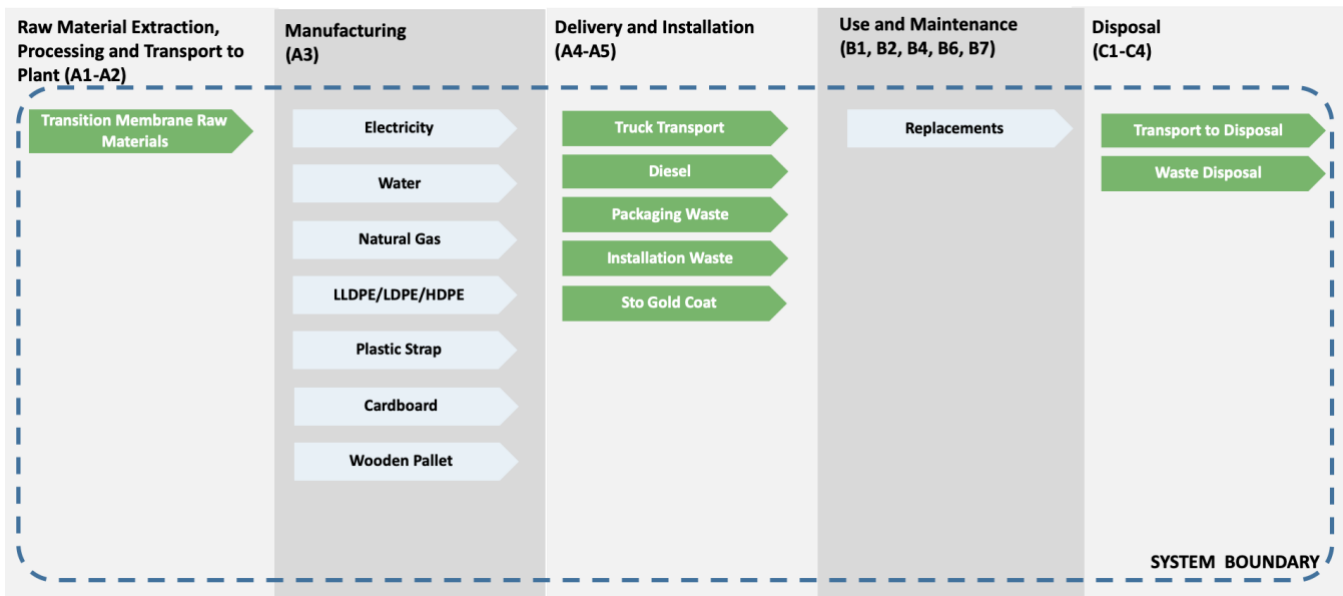


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from the manufacturing facility in Wörschach, Austria for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V9.2.0.58 Database Service Pack 39. Overall, both primary and secondary data are considered acceptable quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions include up stream and downstream transportation distances, the disposal of packaging material, the method in which the product is disposed of at its end of life and relevant use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. To derive a per unit value for manufacturing inputs such as electricity, water, and natural gas, a series of allocation calculations were adopted. The facility level of utility data was allocated based on production values of different types of products in the same manufacturing facility. Then the data is further allocated among products of different specifications based on the mass because it is believed the energy consumption and water consumption correlated better on a mass basis.

## » Production Stage (A1-A3)

StoGuard® Transition Membrane is manufactured in Wörschach, Austria. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by the manufacturer.

## » Transport to Construction Site (A4)

The product is assumed to be shipped from the manufacturing facility to distribution facilities in the US via truck and ocean freight transportation. From the distribution facilities, the product is shipped to construction sites by trucks. Table 5 gives the transportation details including the distances and the truck dataset used in the model. Transport distances are calculated based on the locations of the manufacturing facility, the distribution facilities, and customers' zip codes retrieved from the sales records.

Table 5: Transport Details

Parameter	Truck in US	Ocean Vessel	Truck in EU	Unit
Fuel type	Diesel	Heavy fuel oil	Diesel	-
Liters of fuel	39.0625	0.00023	33.1	l/100km
Vehicle type	Heavy duty diesel truck/ 50,000 lb payload	Container ship, 5,00 to 200,000 dwt payload capacity, ocean going	Truck-trailer, Euro 0-6 mix, 34 - 40t gross weight / 27t payload capacity	-
Transport distance from the manufacturing facility to the departure port	n/a	n/a	441	km
Transport from EU to the USA	n/a	14127.62	n/a	km
Transport from arrival port to distribution facilities	446.59	n/a	n/a	km
Transport distance from the distribution facilities to construction sites	636.45	n/a	n/a	km

## » Installation (A5)

StoGuard® Transition Membrane is installed with any of the StoGuard® fluid-applied air barrier products: Sto Gold Coat, Sto Emerald Coat, Sto AirSeal or Sto VaporSeal. It also may be installed using Sto Extra Seal cementitious air barrier material. In this EPD, Sto Gold Coat is used as the complementary installation material due to the availability of its LCA data. Detailed application instructions are provided online.

The installation process is manual. Thus no energy or additional material other than the product and Sto Gold Coat is required. The use amount of Sto Gold Coat is calculated based on the coverages on two substrates: plywood and CMU, which give a lower and upper band of the coverage area. The LCA study considered a 10% of product loss as waste in the installation process. Together with the product loss, the waste was also generated from the packaging material. In addition, VOC emissions from the curing of applied Sto Gold Coat was also taken into account.

Table 6: Installation (A5)

Parameter	Transition Membrane on Plywood	Transition Membrane on CMU	Unit
Product loss per functional unit		0.24	kg/ESL
Waste materials at the construction site before waste processing, generated by product installation	1.10E+00	2.07E+00	kg/ESL
Plastic material recycled	9.65E-02	1.82E-01	kg/ESL
Plastic material landfilled	7.99E-01	1.51E+00	kg/ESL
Plastic material incinerated	1.64E-01	3.10E-01	kg/ESL
Cardboard recycled		2.38E-03	kg/ESL
Cardboard landfilled		9.60E-04	kg/ESL
Cardboard incinerated		2.32E-04	kg/ESL
GWP based in biogenic carbon content of cardboard packaging		2.10E-4	kg CO <sub>2</sub> e/ESL
Wood material recycled		2.64E-03	kg/ESL
Wood material landfilled		1.10E-02	kg/ESL
Wood material incinerated		2.56E-03	kg/ESL
GWP based in biogenic carbon content of wood packaging		2.92E-02	kg CO <sub>2</sub> e/ESL
Steel material recycled	7.13E-03	1.54E-02	kg/ESL
Steel material landfilled	1.17E-02	2.53E-02	kg/ESL
Steel material incinerated	2.53E-03	5.44E-03	kg/ESL
Direct emissions to ambient air	2.04E-01	3.95E-01	kg/ESL

## » Use Stage (B1-B5 & B6-B7)

Since the product is applied under a wall surface, there are no use phase inputs required to maintain the performance of the product other than the replacement needed through the estimated service life (ESL) of a whole building. The ESL in the study is assumed to be 60 years which is a standard established and used in many PCRs of similar product categories such as architectural coating. The RSL of the product is determined by the warranty of the product, which is ten years. Therefore, after initial installation on a building with a 60-year service life, there will be five replacements needed. Besides the emissions to the air disclosed in the above table, there are no other emissions to air, soil or water, including those of any regulated substances.

Table 7: Replacement (B4)

Parameter	Value	Unit
Reference Service Life (RSL)	10	Years
Estimated Service Life (ESL)	60	Years
Replacement cycle	5	(ESL/RSL)-1
Declared product properties	As per Product Identification section	-
Design application parameters	As per technical details in Table 2	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Industry Standard	-

## » End-of-Life Stage (C1-C4)

In this stage, the product at its end of life is transported to the waste disposal facility and processed. Included in this stage are the following:

- Deconstruction – There are no impacts during this stage as the product is manually removed.
- Transportation to disposal – Estimated fuel requirements made based on weight of product and average distance to landfill.
- Waste processing for landfilling – This process is included in the landfilling process.
- Waste disposal – Due to the fact that all the products in study are installed as part of a wall system including the external coating/finish, and are not able to be dismantled based on their material type, it is reasonable to assume that the products at their end-of-life stage are landfilled.

Table 8: End-of-Life Parameters

Parameter	Transition Membrane on Plywood	Transition Membrane on CMU	Unit
Collected with mixed construction waste	6.98	12.6	kg/ESL
Landfilling	100	100	%
Product for final deposition	6.98	12.6	kg/ESL

## » Life Cycle Assessment Results

As prescribed by ISO 21930:2017, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 9 provides the acronym key of the impact indicators declared in this EPD.

Table 9: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
ADP-Fossil Fuel	Abiotic depletion potential for fossil resources (An indicator derived from CML 2001-Jan 2016)	MJ, net calorific value
<b>Resource Use Parameters</b>		
RPR <sub>E</sub>	Renewable primary energy as energy carrier	MJ, net calorific value
RPR <sub>M</sub>	Renewable primary energy resources as material utilization	MJ, net calorific value
NRPR <sub>E</sub>	Non-renewable primary energy as energy carrier	MJ, net calorific value
NRPR <sub>M</sub>	Non-renewable primary energy as material utilization	MJ, net calorific value
SM	Use of secondary material	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value
RE	Recovered energy	MJ, net calorific value
FW	Use of fresh water	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste disposed	kg
ILLRW	Intermediate and low-level radioactive waste disposed	kg
<b>Carbon Removal and Emission Parameter</b>		
BCRP	Biogenic Carbon Removal from Product	kg CO <sub>2</sub> eq
BCEP	Biogenic Carbon Emission from Product	kg CO <sub>2</sub> eq
BCRK	Biogenic Carbon Removal from Packaging	kg CO <sub>2</sub> eq
BCEK	Biogenic Carbon Emission from Packaging	kg CO <sub>2</sub> eq
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO <sub>2</sub> eq
CCE	Calcination Carbon Emissions	kg CO <sub>2</sub> eq
CCR	Carbonation Carbon Removals	kg CO <sub>2</sub> eq
CWNR	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO <sub>2</sub> eq

## » StoGuard® Transition Membrane on Plywood -- Results

### TRACI Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO <sub>2</sub> eq]	1.75E-03	1.69E-03	9.76E-03	0.00E+00	0.00E+00	0.00E+00	6.73E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.54E-06	0.00E+00	2.54E-04	MND
EP [kg N eq]	1.71E-04	6.90E-05	3.44E-04	0.00E+00	0.00E+00	0.00E+00	2.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.83E-07	0.00E+00	1.30E-05	MND
GWP [kg CO <sub>2</sub> eq]	1.17E+00	9.20E-02	1.96E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.02E-03	0.00E+00	5.53E-02	MND
ODP [kg CFC 11 eq]	-1.52E-13	-3.88E-16	1.74E-11	0.00E+00	0.00E+00	0.00E+00	8.62E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.63E-17	0.00E+00	-2.91E-15	MND
POCP [kg O <sub>3</sub> eq]	3.17E-02	3.38E-02	7.11E-02	0.00E+00	0.00E+00	0.00E+00	7.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-04	0.00E+00	5.09E-03	MND
ADP-fossil fuel [MJ]	3.18E+01	1.20E+00	3.81E+01	0.00E+00	0.00E+00	0.00E+00	3.60E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.27E-02	0.00E+00	8.62E-01	MND

### Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR <sub>E</sub> [MJ]	3.00E+00	2.55E-02	1.74E+00	0.00E+00	0.00E+00	0.00E+00	2.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-03	0.00E+00	6.74E-02	MND
RPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR <sub>E</sub> [MJ]	3.33E+01	1.21E+00	4.09E+01	0.00E+00	0.00E+00	0.00E+00	3.82E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.29E-02	0.00E+00	8.84E-01	MND
NRPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	4.74E-03	7.57E-05	1.06E-02	0.00E+00	0.00E+00	0.00E+00	7.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-06	0.00E+00	1.05E-04	MND

### Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	2.54E-08	1.22E-08	3.95E-08	0.00E+00	0.00E+00	0.00E+00	4.03E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E-10	0.00E+00	3.10E-09	MND
NHWD [kg]	1.18E-02	3.43E-05	2.61E-01	0.00E+00	0.00E+00	0.00E+00	7.68E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-06	0.00E+00	1.26E+00	MND
HLRW [kg]	7.91E-07	2.76E-09	1.30E-06	0.00E+00	0.00E+00	0.00E+00	1.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-10	0.00E+00	1.08E-08	MND
ILLRW [kg]	5.92E-04	2.06E-06	1.08E-03	0.00E+00	0.00E+00	0.00E+00	8.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-08	0.00E+00	8.56E-06	MND

## » StoGuard® Transition Membrane on CMU – Results

### TRACI Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO <sub>2</sub> eq]	1.75E-03	1.69E-03	1.89E-02	0.00E+00	0.00E+00	0.00E+00	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-05	0.00E+00	4.24E-04	MND
EP [kg N eq]	1.71E-04	6.90E-05	6.56E-04	0.00E+00	0.00E+00	0.00E+00	4.60E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-06	0.00E+00	2.16E-05	MND
GWP [kg CO <sub>2</sub> eq]	1.17E+00	9.20E-02	3.77E+00	0.00E+00	0.00E+00	0.00E+00	2.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.04E-03	0.00E+00	9.23E-02	MND
ODP [kg CFC 11 eq]	-1.52E-13	-3.88E-16	3.37E-11	0.00E+00	0.00E+00	0.00E+00	1.68E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.72E-17	0.00E+00	-4.85E-15	MND
POCP [kg O <sub>3</sub> eq]	3.17E-02	3.38E-02	1.37E-01	0.00E+00	0.00E+00	0.00E+00	1.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.57E-04	0.00E+00	8.49E-03	MND
ADP-fossil fuel [MJ]	3.18E+01	1.20E+00	7.38E+01	0.00E+00	0.00E+00	0.00E+00	5.42E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E-02	0.00E+00	1.44E+00	MND

### Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR <sub>E</sub> [MJ]	3.00E+00	2.55E-02	3.36E+00	0.00E+00	0.00E+00	0.00E+00	3.25E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-03	0.00E+00	1.13E-01	MND
RPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR <sub>E</sub> [MJ]	3.33E+01	1.21E+00	7.91E+01	0.00E+00	0.00E+00	0.00E+00	5.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.16E-02	0.00E+00	1.48E+00	MND
NRPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	4.74E-03	7.57E-05	2.04E-02	0.00E+00	0.00E+00	0.00E+00	1.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.59E-06	0.00E+00	1.75E-04	MND

### Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	2.54E-08	1.22E-08	7.64E-08	0.00E+00	0.00E+00	0.00E+00	5.99E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.81E-10	0.00E+00	5.17E-09	MND
NHWD [kg]	1.18E-02	3.43E-05	4.65E-01	0.00E+00	0.00E+00	0.00E+00	1.29E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-06	0.00E+00	2.11E+00	MND
HLRW [kg]	7.91E-07	2.76E-09	2.51E-06	0.00E+00	0.00E+00	0.00E+00	1.66E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-10	0.00E+00	1.80E-08	MND
ILLRW [kg]	5.92E-04	2.06E-06	2.10E-03	0.00E+00	0.00E+00	0.00E+00	1.35E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-07	0.00E+00	1.43E-05	MND



## Carbon removal and Emission

Indicator	Transition Membrane on plywood	Transition Membrane on CMU
BCRP [kg CO2 eq]	5.86E-02	6.10E-02
BCEP [kg CO2 eq]	5.95E-02	6.13E-02
BCRK [kg CO2 eq]	5.51E-03	5.96E-03
BCEK [kg CO2 eq]	2.05E-03	2.37E-03
BCEW [kg CO2 eq]	0.00E+00	0.00E+00
CCE [kg CO2 eq]	0.00E+00	0.00E+00
CCR [kg CO2 eq]	0.00E+00	0.00E+00
CWNR [kg CO2 eq]	0.00E+00	0.00E+00

### » Interpretation

In one reference service life of the product, the stage that contributes the most environmental impact is the installation stage. Unlike many products, the impact derived from the production of the declared product is exceeded by those from the installation of Sto Transition Membrane. This also explains the significant differences in impacts between substrate types. From the perspective of a whole building lifespan, the vast majority of the impacts are derived from the number of replacements needed. This is directly related to the impacts associated with the manufacture of new installation material and new products that are used to replace the original. Improving the relatively short lifespan of the products is essential to reducing the overall impact of the product.

### » Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, October 2019
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Sto Studio. Sto Corp, 2019. Available at <https://www.stocorp.com/sto-studio-us/>
- Product Bulletin – StoGuard Transition Membrane. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Products\\_TechService/Air%20Moisture%20Barriers/Product%20Bulletins/PB\\_81272\\_StoGuard\\_Transition\\_Membrane\\_EN.pdf](https://www.stocorp.com/wp-content/content/Products_TechService/Air%20Moisture%20Barriers/Product%20Bulletins/PB_81272_StoGuard_Transition_Membrane_EN.pdf)

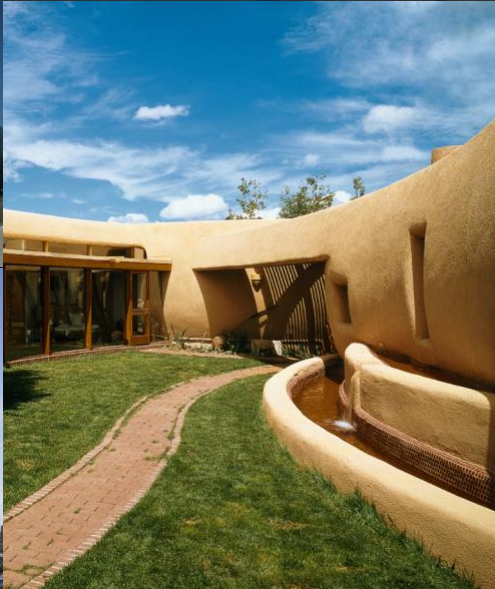


Building with conscience.

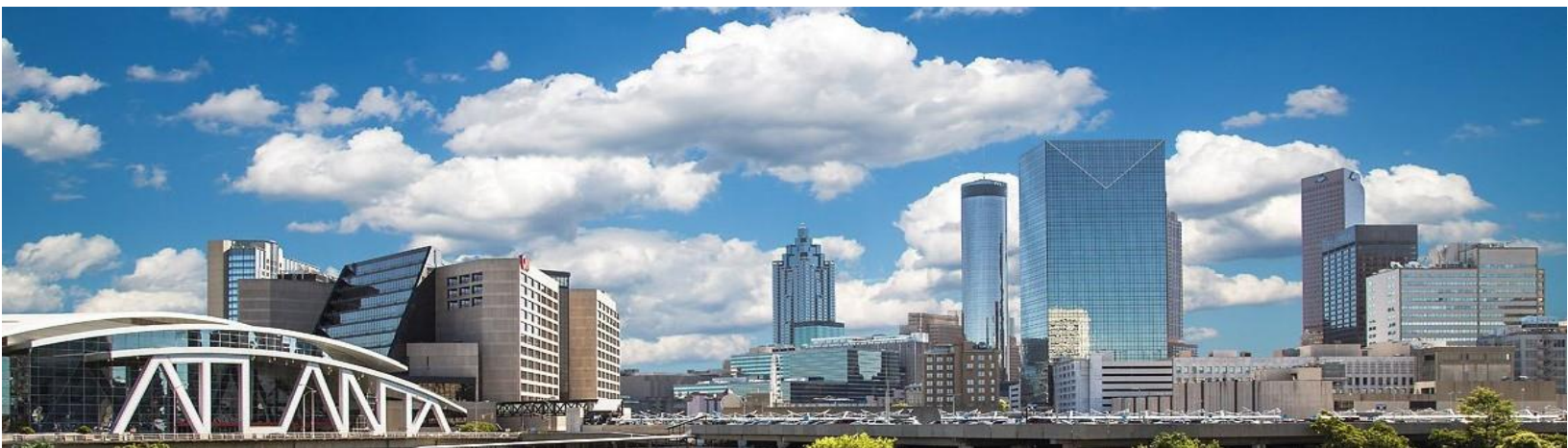




**EPD for BTS® Plus**

Sto BTS® Plus is a one-component, polymer-modified, cement based, dry powder material used as an adhesive and base coat in Sto Wall Claddings, including StoTherm ci Classic and StoTherm ci Lotusan Systems.



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Solutions for a Sustainable World



<b>PCR Identification</b>	<b>PCR for Architectural Coatings: NAICS 325510 on the basis of ISO 21930:2007, NSF International, 2017. Valid through June 23, 2022</b>
Compliance to ISO 14040/44, ISO 14025 and ISO 21930	Yes
Product Category	Exterior Coating
Manufacturer's name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120 Atlanta, GA 30331 <a href="http://www.stocorp.com">www.stocorp.com</a>   (800) 221-2397
EPD program operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 <a href="http://www.epstengroup.com">www.epstengroup.com</a>
Declaration Number	01-004
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered and protected substrate for 60 years
Market-base life used in assessment	10 Years
Design life used in assessment	N/A
Test method employed for determination of design life	N/A
Amount of colorant needed	See table 3
Overall Data Quality Assessment Score	Good
Site(s) in which the results of the LCA are representative	STO manufacturing sites in Atlanta, Georgia; and Glendale, Arizona.
Information on where explanatory material can be obtained	See references at the end of this document.
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database Version 8.7, Service Pack 39
This declaration was independently verified in accordance with ISO 14025: 2006 and the reference PCR: PCR for Architectural Coatings: NAICS 325510 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14040/44 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

#### Comparability

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

## » Company

We believe in ‘**Building with conscience**’.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you’re always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That’s exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it’s new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That’s why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through [Sto Studio](#) or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Atlanta Plant

Glendale Plant

## » Performance Features

One-component Polymer Modified	High Polymer/ Cement Ratio Creamy Smooth Consistency	Vapor Permeable High Build	Pre-blended Low Cement Ratio
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## » Product Identification

Sto BTS® Plus is offered in 47-lb bags and used as an undercoater. Thus, there are no finish or color base options provided.

Table 1: BTS® Plus Identification

Product Name	Product Number	Base Type	Finish Type
Sto BTS® Plus	80130	n/a	n/a



## » Product Description

Sto BTS® Plus is a one-component, polymer-modified, cement based, dry powder material used as an adhesive, skim coat and base coat in Sto Wall Claddings, including StoTherm ci Classic and StoTherm ci Lotusan Systems. According to the classification scheme developed by American Coating Association (ACA), BTS® Plus is treated in the study as an undercoater and as per PCR, it should only utilize the market-based lifetime (10 years for exterior undercoater).

## » Material Composition

The material compositions of BTS® Plus are listed below:

Table 2: Material composition for BTS® Plus

Ingredient	BTS® Plus
Additives	0-1%
Cement	40-45%
Colorant	0-1%
Polymer	2-3%
Silica	54-55%
Silicate	0-1%

## » Components related to Life Cycle Assessment

The functional unit for the LCA study was covering and protecting 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in the PCR. The market-based lifetime is 10 years. By default, BTS® Plus has a 5-year warranty. In case it is applied on Sto’s wall systems, the warranty is extended to 10 years. The reference flow required for one functional unit is provided in Table 3.

Table 3: Market-based lifetime and reference flow

	Functional Unit [1 m <sup>2</sup> ]	Reference Flow [kg]	Tint needed* [kg]
Lifespan			
Market-based Lifetime [10 years]			
BTS® Plus – Adhesive over Rough Masonry	1	40.39	N/A
BTS® Plus – Average		14.12	N/A

## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in the PCR.

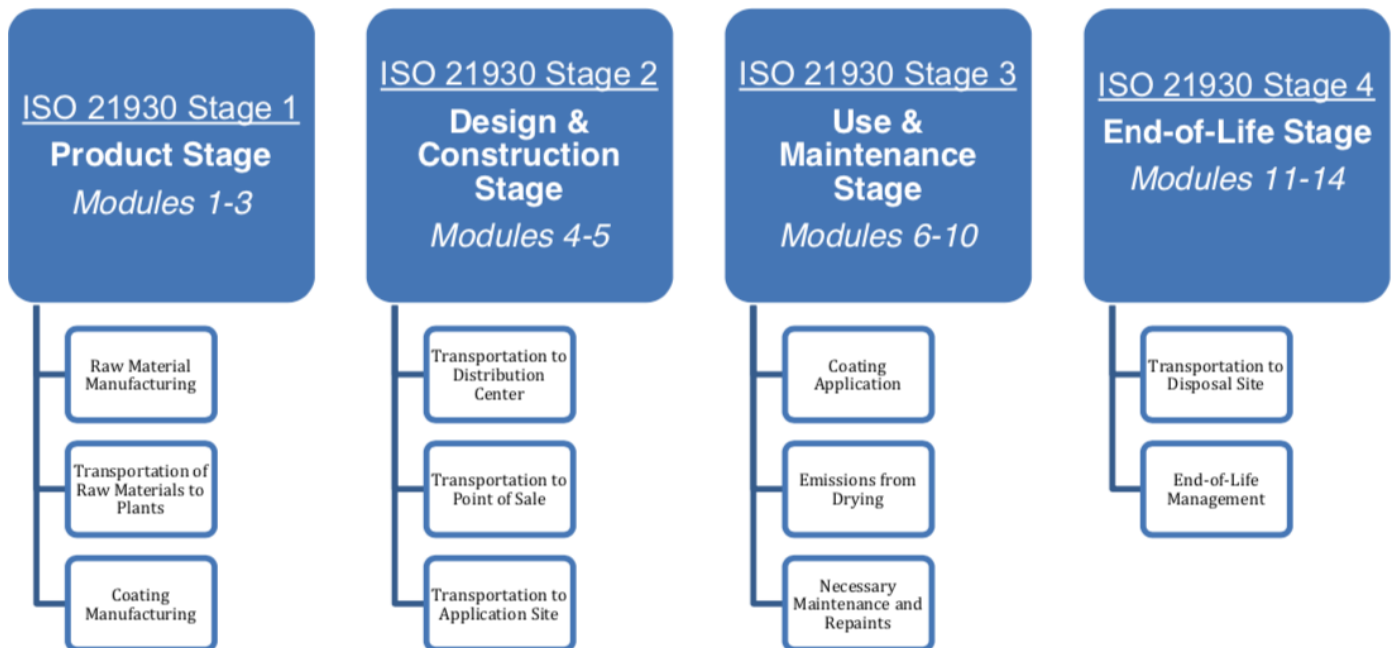


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from Sto's facilities in Atlanta, GA, and Glendale, AZ for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V8.7 Database Service Pack 39. Overall, both primary and secondary data are considered good quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions were made in accordance with the PCR and include the transportation distances, the disposal of packaging material and the product at its end of life and use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis.

## » Product Stage

BTS® Plus is a dry-powder product. It is manufactured in both the Atlanta, GA and Glendale, AZ facilities. The facility in Atlanta also supplies BTS® concentrate to Glendale facility, based on which BTS® Plus is produced. BTS® Plus is packaged in a paper bag at 47 pounds (21.3 kgs) per bag. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by Sto.

## » Design and Construction Stage

The design and construction process stage starts with the packaged product leaving the production site and ends with being delivered to the application site.

During this stage, the finished product is moved from a shipping dock for distribution. The end gate is the application site after the purchaser acquires the finished product and transports it to the application site.

## » Use and Maintenance Stage

The use stage begins when the user prepares the product before applying it to a substrate and ends with any leftover coating and discarded packaging entering the end-of-life stage. Detailed application instructions are provided online. The application procedure includes mixing and applying. In the mixing process, BTS® Plus requires the addition of water at an average rate of 5.45 kg of water per 21.3-kg bag. As recommended, an electric drill/mixer and a spray pump are assumed to be used for mixing and application. The equipment is not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible, but electricity to power application tools has been included.

As prescribed in the PCR, 10% of the wet mass of BTS® Plus is assumed to be unused and properly disposed of.

## » End-of-Life Stage

Table 4: End-of-life Disposal Scenarios

Waste Flow	Recycling	Incineration	Landfilling
Paper Packaging	66.6%	6.01%	27.39%
Unused Product	0%	0%	100%
Post-Consumer Product	0%	0%	100%

In this stage, the disposal of installation waste, packaging waste and product waste at its end of life is included. The disposal pathway of each waste stream is modeled based on the recommendation of PCR and US EPA's latest waste management fact sheet.

## » Life Cycle Assessment Results

As prescribed by the PCR, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 5 provides the acronym key of the impact indicators declared in this EPD.

Table 5: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
<b>Resource Use Parameters</b>		
RPR	Use of renewable primary energy	MJ, net calorific value (LHV)
RMR	Use of renewable Material Resources	kg
NRER	Depletion of Non-Renewable Energy Resources	MJ, net calorific value
NRMR	Depletion of Non-Renewable Material Resources	kg
FW	Consumption of Freshwater	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
<b>Biogenic Carbon Parameter</b>		
BC	Biogenic Carbon	kg CO <sub>2</sub> eq
<b>Energy Differentiation Parameters</b>		
HWP	Hydro/wind Power	MJ, net calorific value (LHV)
FE	Fossil Energy	MJ, net calorific value (LHV)
BE	Bio-energy	MJ, net calorific value (LHV)
NE	Nuclear Energy	MJ, net calorific value (LHV)
OE	Other Energy	MJ, net calorific value (LHV)

» BTS® Plus – Adhesive over Rough Masonry

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	8.90E-02	1.56E-02	6.73E-04	1.07E-02
	EP [kg N eq]	9.00E-03	1.27E-03	3.03E-05	1.52E-03
	GWP [kg CO <sub>2</sub> eq]	3.86E+01	3.04E+00	2.42E-01	1.94E+00
	ODP [kg CFC 11 eq]	3.82E-12	2.89E-16	8.03E-16	6.57E-15
	POCP [kg O <sub>3</sub> eq]	1.61E+00	3.57E-01	5.67E-03	1.79E-01
	RPRE [MJ]	4.35E+01	1.33E+00	5.23E-01	2.22E+00
	NRPRE [MJ]	4.64E+02	4.30E+01	3.85E+00	2.99E+01
	FW [m <sup>3</sup> ]	1.09E-01	5.13E-03	1.18E-02	3.47E-03
	RMR [kg]	2.05E-01	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	4.04E+01	0.00E+00	0.00E+00	0.00E+00
	HWD [kg]	7.01E-07	3.49E-07	1.73E-09	1.11E-07
	NHWD [kg]	4.33E+00	1.62E-03	3.30E-03	4.09E+01
	BC [kg CO <sub>2</sub> eq]			4.21E+00	
	HWP [MJ]			2.67E+00	
	FE [MJ]			3.97E+01	
	BE [MJ]			1.29E+00	
	NE [MJ]			1.04E+01	
	OE [MJ]			1.04E+00	



» BTS® Plus – Average Substrate

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	3.11E-02	5.46E-03	2.35E-04	3.73E-03
	EP [kg N eq]	3.15E-03	4.45E-04	1.06E-05	5.30E-04
	GWP [kg CO <sub>2</sub> eq]	1.35E+01	1.06E+00	8.44E-02	6.78E-01
	ODP [kg CFC 11 eq]	1.34E-12	1.01E-16	2.81E-16	2.30E-15
	POCP [kg O <sub>3</sub> eq]	5.62E-01	1.25E-01	1.98E-03	6.26E-02
	RPRE [MJ]	1.52E+01	4.66E-01	1.83E-01	7.74E-01
	NRPRE [MJ]	1.62E+02	1.51E+01	1.35E+00	1.04E+01
	FW [m <sup>3</sup> ]	3.82E-02	1.79E-03	4.12E-03	1.21E-03
	RMR [kg]	7.16E-02	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	1.41E+01	0.00E+00	0.00E+00	0.00E+00
	HWD [kg]	2.45E-07	1.22E-07	6.07E-10	3.88E-08
	NHWD [kg]	1.51E+00	5.68E-04	1.15E-03	1.43E+01
	BC [kg CO <sub>2</sub> eq]			1.47E+00	
	HWP [MJ]			9.34E-01	
	FE [MJ]			1.39E+01	
	BE [MJ]			4.51E-01	
	NE [MJ]			3.64E+00	
	OE [MJ]			3.65E-01	

## » Interpretation

Overall, the Product Stage is the major contributor to many impact categories including GWP. This is understandable as cement is a major ingredient of BTS® Plus and it is an energy-intensive material.

## » Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, September 2019
- PCR for Architectural Coatings: NAICS 325510. NSF International, 2017
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Advancing Sustainable Materials Management: 2015 Fact Sheet. US EPA. Available at [https://www.epa.gov/sites/production/files/2018-07/documents/2015\\_smm\\_msw\\_factsheet\\_07242018\\_fnl\\_508\\_002.pdf](https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf)
- Product Bulletin – Sto BTS® Plus. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Products\\_TechService/Base%20Coats%20and%20Adhesives/Product%20Bulletins/PB\\_80727\\_Sto\\_BTS\\_Plus\\_EN.pdf](https://www.stocorp.com/wp-content/content/Products_TechService/Base%20Coats%20and%20Adhesives/Product%20Bulletins/PB_80727_Sto_BTS_Plus_EN.pdf)

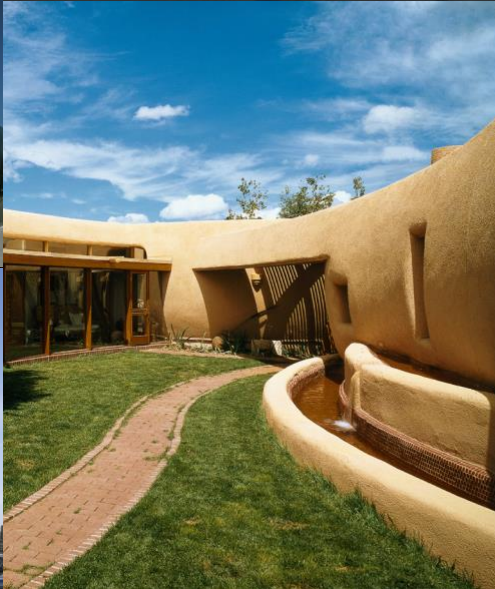


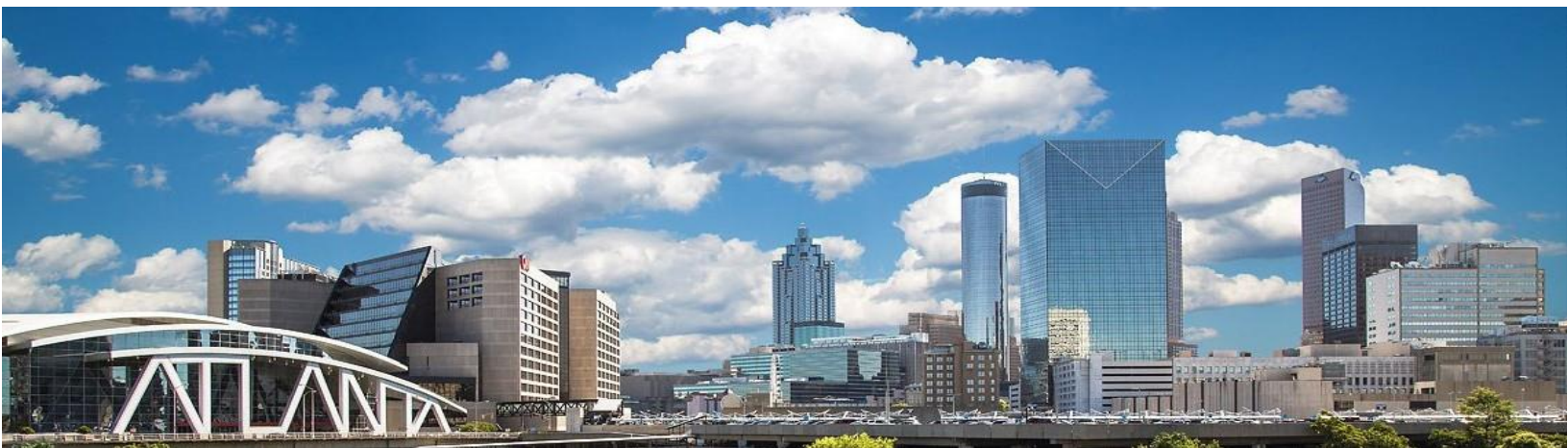
Building with conscience.





**EPD for Sto TurboStick®**

**Sto TurboStick®**  
Sto TurboStick® is a ready-to-use, single component polyurethane foam adhesive for installing Sto insulation boards in StoTherm® exterior wall claddings.  
Compared to cementitious adhesives, Sto TurboStick delivers unparalleled convenience and installation





Manufacturer Name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120, Atlanta, GA 30331 www.stocorp.com   (800) 221-2397
EPD Program Operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 www.epstengroup.com
Compliance to ISO21930:2017	Yes
Product Name	Sto TurboStick®
Product's Intended Application and Use	Foam adhesive for securing insulation boards
Declaration Number	01-008
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered substrate for 60 years
Reference Service Life used in assessment	10 Years
Overall Data Quality Assessment Score	Good
Manufacturing Location	Wilmington, IL, USA
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database, Service Pack 39
ISO 21930: 2017 serves as the core PCR Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

### Comparability

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

## » Company

We believe in 'Building with conscience'.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you're always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That's exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it's new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That's why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through Sto Studio or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Manufacturing location is Wilmington, IL, USA.

## » Product Identification

Sto TurboStick® is offered in a 31-lb gross weight pressurized cylinder. Sto TurboStick® is a ready-to-use, single component polyurethane foam adhesive for securing Sto EPS Insulation Boards in StoTherm exterior wall claddings including StoTherm® ci XPS.

Table 1: List of TurboStick® Products

Product Name	Product Number
Sto TurboStick®	81181



## » Product Description

The leader in innovation, Sto offers an entirely new PU-foam adhesive system that outperforms traditional adhesives across the board. Sto TurboStick® requires no mixing, goes on easier, cures in just one hour, and can even be used for other applications, such as filling voids between insulation boards. It is also lightweight, so it requires no heavy lifting to get it up the scaffolding like cementitious adhesives.

- Ready-to-apply: Go straight to the wall as there is no mixing required compared to traditional cementitious adhesives;
- Cures in one hour: Rasp, cut joints and apply basecoat and mesh the same day instead of waiting until the following day;
- Small packaging: Easier to handle the material on scaffolding. Requires less space on the ground for staging compared to bag material; and
- Lightweight: The product weighs significantly less than a bag of basecoat. In addition, its compact size makes it easier to carry and handle, for example on scaffolding.

## » Performance Features

Convenient and Ready-to-Use	Pre-pressurized Container	Minimal preparation time
Compact and Lightweight	Fast	VOC Compliant
High coverage rate		

## » Technical Details

Table 2: Technical Data\*

Performance	Test Method	Test Criteria	Result
Surface Burning	ASTM E-84-10	Flame Spread: ≤25	Flame Spread: 10
	(UL 723, UBC 8-1, NFPA 255)	Smoke Developed: ≤450	Smoke Developed: 5
Tensile Strength	ASTM C-297	Greater than 15 psi	> 15 psi; cohesive failure of EPS insulation board

VOC (g/L) This product contains no VOC's. Complies with US EPA (40 CFR 59) VOC emission standards for architectural coatings.

\*Results are based on lab testing under controlled conditions. Results can vary between labs or from field tests.

## » Material Composition

The material composition of TurboStick® is listed below:

Table 3: Material composition of TurboStick®

	TurboStick®
Polymethylenepolyphenyl polyisocyanate, polypropyleneglycol copolymer	30-60%
1,1,1,2-Tetrafluoroethane	10-30%
Diphenylmethane Diisocyanate, isomers and homologues	10-30%
4,4'-Diphenylmethane diisocyanate	7-13%
N,N'-Dimorpholinodiethylether	1-5%

## » Components related to Life Cycle Assessment

The functional unit for the EPD was covering 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in ISO 21930:2017. The reference service life of the product is 10 years which is the warranty of Sto's wall system. The reference flow required for one functional unit is provided in Table 4.

Table 4: Reference flow and Functional Unit

Product	Functional Unit [1 m <sup>2</sup> ]	Reference Flow [kg]
TurboStick®	1	0.81

## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in ISO 21930:2017.

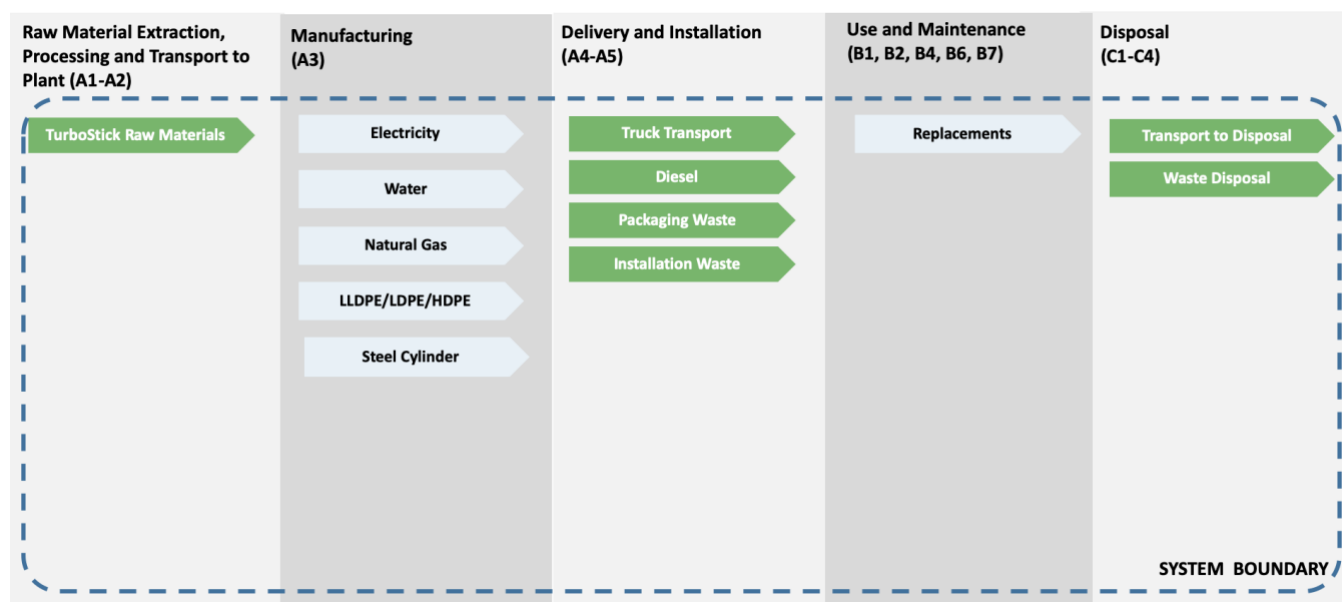


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from the manufacturing facility in Illinois, USA for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V9.2.0.58 Database Service Pack 39. Overall, both primary and secondary data are considered acceptable quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions include up stream and downstream transportation distances, the disposal of packaging material, the method in which the product is disposed of at its end of life and relevant use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. To derive a per unit value for manufacturing inputs such as electricity, water, and natural gas, a series of allocation calculations were adopted. The facility level of utility data was allocated based on production values of different types of products in the same manufacturing facility. Then the data is further allocated among products of different specifications based on the mass because it is believed the energy consumption and water consumption correlated better on a mass basis.

## » Production Stage (A1-A3)

TurboStick® is manufactured in Illinois, US. All the raw materials are supplied from the US. The product is a mixture of four types of substances: polyols, isocyanates, catalysts, and blowing agent, filled and shipped in a steel cylinder.

## » Transport to Construction Site (A4)

The product is assumed to be shipped from the manufacturing facility to distribution facilities in the US via truck. From the distribution facilities, the product is shipped to construction sites. Table 5 gives the transportation details including the distances and the truck dataset used in the model. Transport distances are calculated based on the locations of the manufacturing facility, the distribution facilities, and customers' zip codes retrieved from the sales records.

Table 5: Transport Details

Name	Details	Unit
Type of transport	Truck	-
Fuel type	Diesel	-
Liters of fuel	39.0625	l/100km
Vehicle type	Heavy duty diesel truck/ 45,000 lb payload	-
Transport distance from the manufacturing facility to distribution facilities	1437.95	km
Transport distance from the distribution facilities to construction sites	880.69	km

## » Installation (A5)

TurboStick® can be applied directly from the cylinder through a dispensing pistol without any additional steps. Hence, no specific installation materials are required. The reference flow is calculated on the basis of the coverage rates on TurboStick®'s product data sheets and a 10% installation waste was considered to account for the possibility of some unused amount left in the product containers. The disposal of the pressure cylinder is modeled to be landfilled as it is a standard practice to deal with pressure cylinder potentially containing unused adhesive polymer, while the installation waste disposal is modeled in accordance with EPA's Advancing Sustainable Materials Management: 2015 Fact Sheet. For TurboStick® which uses HFC-134a as the blowing agent, HFC-134a is modeled as the VOC emission flow. As the tools (dispensing pistol) used during the installation of the product are multi-use tools and can be reused after each installation, the per-functional unit impacts are considered negligible and therefore are not included. Detailed installation instructions are provided online. Packaging waste is generated and disposed of in this stage.

Table 6: Installation (A5)

Name	Value	Unit
Product loss per functional unit	8.09E-02	kg/ ESL
Waste materials at the construction site before waste processing, generated by product installation	0.362	kg/ ESL
Steel waste, packaging	0.281	kg/ ESL
VOC Emissions	0.154	Kg/ESL



## » Use Stage (B1-B5 & B6-B7)

Since the product is installed as part of the wall assembly, there are no use phase inputs required to maintain the product. The RSL of the product is 10 years, so five replacements are required to cover the estimated service life (ESL). The product requires no maintenance once installed. It is assumed that the product requires no repairs or refurbishments if it is properly applied. Besides the emissions to the air disclosed in the above table, there are no other emissions to air, soil or water, including those of any regulated substances.

Table 7: Replacement (B4)

Name	Value	Unit
Reference Service Life (RSL)	10	Years
Estimated Service Life (ESL)	60	Years
Replacement cycle	5	(ESL/RSL)-1
Declared product properties	As per Product Identification section	-
Design application parameters	As per technical details in Table 2	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Industry Standard	-

## » End-of-Life Stage (C1-C4)

In this stage, the product is transported to the waste disposal facility and processed. Due to the fact that TurboStick® is applied as part of a wall system including the external coating/finish and are not able to be dismantled based on their material type, it is reasonable to assume that the products at their end-of-life stage are landfilled.

Table 8: End-of-Life Parameters

	TurboStick®	Unit
Collected with mixed construction waste	0.574	kg/ESL
Landfilling	100	%
Product for final deposition	0.574	kg/ESL

## » Life Cycle Assessment Results

As prescribed by ISO 21930:2017, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 9 provides the acronym key of the impact indicators declared in this EPD.

Table 9: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
ADP-Fossil Fuel	Abiotic depletion potential for fossil resources (An indicator derived from CML 2001-Jan 2016)	MJ, net calorific value
<b>Resource Use Parameters</b>		
RPR <sub>E</sub>	Renewable primary energy as energy carrier	MJ, net calorific value
RPR <sub>M</sub>	Renewable primary energy resources as material utilization	MJ, net calorific value
NRPR <sub>E</sub>	Non-renewable primary energy as energy carrier	MJ, net calorific value
NRPR <sub>M</sub>	Non-renewable primary energy as material utilization	MJ, net calorific value
SM	Use of secondary material	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value
RE	Recovered energy	MJ, net calorific value
FW	Use of fresh water	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste disposed	kg
ILLRW	Intermediate and low-level radioactive waste disposed	kg
<b>Carbon Removal and Emission Parameter</b>		
BCRP	Biogenic Carbon Removal from Product	kg CO <sub>2</sub> eq
BCEP	Biogenic Carbon Emission from Product	kg CO <sub>2</sub> eq
BCRK	Biogenic Carbon Removal from Packaging	kg CO <sub>2</sub> eq
BCEK	Biogenic Carbon Emission from Packaging	kg CO <sub>2</sub> eq
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO <sub>2</sub> eq
CCE	Calcination Carbon Emissions	kg CO <sub>2</sub> eq
CCR	Carbonation Carbon Removals	kg CO <sub>2</sub> eq
CWNR	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO <sub>2</sub> eq

## » Sto TurboStick® -- Results

### TRACI Results and ADP-Fossil

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO <sub>2</sub> eq]	2.54E-03	1.60E-04	2.43E-05	0.00E+00	0.00E+00	0.00E+00	1.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.44E-07	0.00E+00	1.98E-05	MND
EP [kg N eq]	1.89E-04	1.32E-05	5.09E-06	0.00E+00	0.00E+00	0.00E+00	1.04E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-08	0.00E+00	1.01E-06	MND
GWP [kg CO <sub>2</sub> eq]	1.23E+00	3.34E-02	3.30E+01	0.00E+00	0.00E+00	0.00E+00	1.71E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E-04	0.00E+00	4.31E-03	MND
ODP [kg CFC 11 eq]	1.30E-08	-1.80E-16	-1.58E-16	0.00E+00	0.00E+00	0.00E+00	6.48E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.27E-18	0.00E+00	-2.27E-16	MND
POCP [kg O <sub>3</sub> eq]	3.82E-02	3.66E-03	3.23E-04	0.00E+00	0.00E+00	0.00E+00	2.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-05	0.00E+00	3.97E-04	MND
ADP-fossil fuel [MJ]	1.72E+01	4.71E-01	5.24E-02	0.00E+00	0.00E+00	0.00E+00	8.88E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-03	0.00E+00	6.72E-02	MND

### Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR <sub>e</sub> [MJ]	5.53E-01	1.47E-02	3.60E-03	0.00E+00	0.00E+00	0.00E+00	2.88E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-04	0.00E+00	5.26E-03	MND
RPR <sub>m</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR <sub>e</sub> [MJ]	1.80E+01	4.74E-01	5.36E-02	0.00E+00	0.00E+00	0.00E+00	9.28E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.35E-03	0.00E+00	6.89E-02	MND
NRPR <sub>m</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	4.94E-03	5.68E-05	1.54E-05	0.00E+00	0.00E+00	0.00E+00	2.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-07	0.00E+00	8.18E-06	MND

### Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	2.25E-07	3.84E-09	2.24E-10	0.00E+00	0.00E+00	0.00E+00	1.14E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-11	0.00E+00	2.42E-10	MND
NHWD [kg]	5.21E-02	1.79E-05	6.09E-02	0.00E+00	0.00E+00	0.00E+00	1.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-07	0.00E+00	9.86E-02	MND
HLRW [kg]	3.60E-07	1.27E-09	5.93E-10	0.00E+00	0.00E+00	0.00E+00	1.82E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.94E-12	0.00E+00	8.39E-10	MND
ILLRW [kg]	3.00E-04	1.05E-06	4.74E-07	0.00E+00	0.00E+00	0.00E+00	1.51E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.41E-09	0.00E+00	6.67E-07	MND

## Carbon Removal and Emission

Indicator	TurboStick®
BCRP [kg CO2 eq]	1.16E-02
BCEP [kg CO2 eq]	1.70E-02
BCRK [kg CO2 eq]	1.38E-03
BCEK [kg CO2 eq]	1.41E-03
BCEW [kg CO2 eq]	0.00E+00
CCE [kg CO2 eq]	0.00E+00
CCR [kg CO2 eq]	0.00E+00
CWNR [kg CO2 eq]	0.00E+00

### » Interpretation

In one reference service life of the product, the production stage, which includes the raw material extraction, transportation from suppliers and manufacturing, is the highest contributor to all impact indicators with the exception of GWP. The GWP impacts from the installation stage are dominant because of the remarkably high GWP intensity of the blowing agent. From the perspective of a whole building lifespan, the vast majority of the impacts are derived from the number of replacements needed. This is directly related to the impacts associated with the manufacture of new products that are used to replace the original. Improving the relatively short lifespan of the products is essential to reducing the overall impact of the product.

### » Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, October 2019
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Sto Studio. Sto Corp, 2019. Available at <https://www.stocorp.com/sto-studio-us/>
- Product Bulletin – Sto TurboStick. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Products\\_TechService/Base%20Coats%20and%20Adhesives/Product%20Bulletins/PB\\_81181\\_Sto\\_TurboStick\\_EN.pdf](https://www.stocorp.com/wp-content/content/Products_TechService/Base%20Coats%20and%20Adhesives/Product%20Bulletins/PB_81181_Sto_TurboStick_EN.pdf)

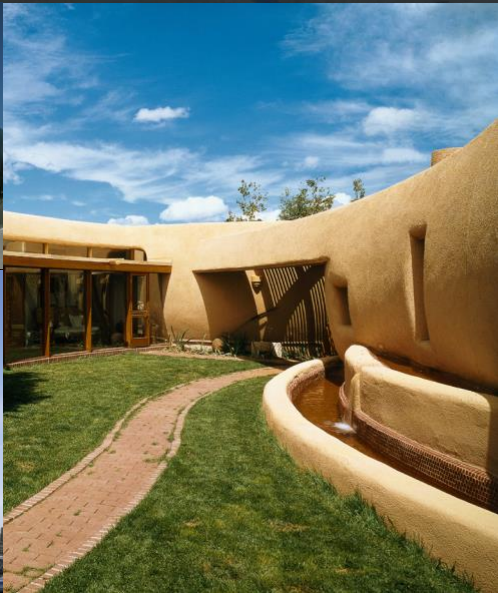


Building with conscience.





**EPD for Sto DrainScreen®**

**Sto DrainScreen®** is a tangled filament nylon core drainage mat for use in above grade vertical wall assemblies beneath stucco, stone, siding, and thin brick veneer. It is intended to promote drainage and drying of wall assemblies.





Manufacturer Name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120, Atlanta, GA 30331 www.stocorp.com   (800) 221-2397
EPD Program Operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 www.epstengroup.com
Compliance to ISO21930:2017	Yes
Product Name	Sto DrainScreen®
Product's Intended Application and Use	Promote drainage and drying of wall assemblies
Declaration Number	01-005
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered substrate for 60 years
Reference Service Life used in assessment	10 Years
Overall Data Quality Assessment Score	Good
Manufacturing Location	Candler, NC, USA
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database, Service Pack 39
ISO 21930: 2017 serves as the core PCR Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

### Comparability

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

## » Company

We believe in 'Building with conscience'.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you're always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That's exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it's new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That's why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through Sto Studio or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Site Covered in this EPD

Manufacturing location is Candler, North Carolina, USA



## » Product Identification

Sto DrainScreen® is offered in roll diameters of 15 and 22 inches. Sto DrainScreen® is a tangled filament nylon core drainage mat for use in above grade vertical wall assemblies beneath stucco, stone, siding, and thin brick veneer. It is intended to promote drainage and drying of wall assemblies. The mat is offered in two thickness options: 6 mm and 10 mm. Though the 10 mm option is a specialized product, the results presented in this EPD are for a sales-weighted average of the two products.

Table 1: List of DrainScreen® Products

Product Name	Thickness	Product Number
Sto DrainScreen®	6 mm	81208
	10 mm	81588

## » Product Description

Sto DrainScreen® is a drainage mat between the cladding and the fully adhered air and moisture barrier. Should water reach the back of the cladding, it can drain from the wall assembly via the drainage mat, which also helps speed the drying. Drainage and drying can be particularly important in hot and humid climates and in areas with wind-driven rain. Sto DrainScreen® functions as a wall cavity drainage component.

- Promotes drainage and drying in stucco, cement board stucco, stone, siding and thin-brick veneer wall assemblies;
- Water vapor moves freely through the drainage mat layer;
- Easy to handle, carry and roll onto the wall; and
- Prevents stucco or mortar from penetration into the cavity for unobstructed drainage

## » Performance Features

Drainage and ventilation mat	Highly breathable
Lightweight, narrow diameter rolls	Laminated with lightweight breathable fabric

## » Technical Details

Table 2: Technical Data\*

Performance	Test Method	Test Criteria	Result
Flame Spread	ASTM E-84	Flame Spread: ≤25 Smoke Developed: ≤450	Flame Spread: <25 Smoke Developed: <75
Thickness (nominal)	Measure	n/a	Nominal ¼" (6mm) Nominal 3/8" (10mm)
Building Code Compliance	Meets requirements of NFPA 285 for use on all Types of construction; refer to ICC ESR 1233		

\*Results are based on lab testing under controlled conditions. Results can vary between labs or from field tests.

## » Material Composition

The material composition of DrainScreen® is listed below:

Table 3: Material composition of DrainScreen®

Ingredient	DrainScreen®
Polypropylene	70-75%
Polyester	10-11%
Elastomeric Copolymer Modifier	6-8%
Nylon 6	4-5%
Flame Retardant	3-4%
Colorant	2-3%

## » Components related to Life Cycle Assessment

The functional unit for the EPD was covering 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in ISO 21930:2017. The reference service life of the product is 10 years which is the warranty of Sto’s wall system. The reference flow required for one functional unit is provided in Table 4.

Table 4: Reference flow and Functional Unit

Product	Functional Unit [1 m <sup>2</sup> ]	Reference Flow [kg]
DrainScreen®	1	2.15



## » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in ISO 21930:2017.

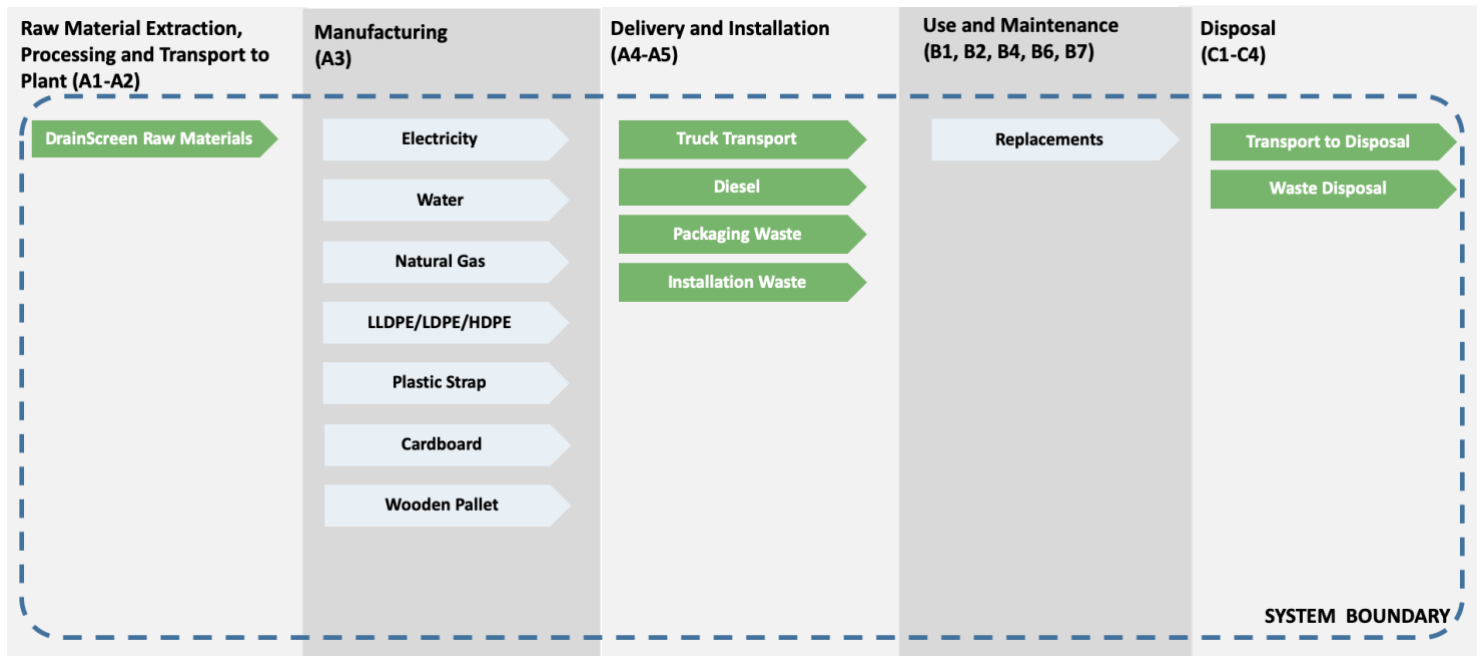


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data as it relates to formulation was collected from the manufacturing facility in North Carolina, USA for the 2018 reference year. For manufacturing specific data, data from Sto facilities manufacturing similar products was used. When primary data did not exist, secondary data were obtained from the Gabi V9.2.0.58 Database Service Pack 39. Overall, both primary and secondary data are considered acceptable quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions include up stream and downstream transportation distances, the disposal of packaging material, the method in which the product is disposed of at its end of life and relevant use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. Utility data was allocated based on production values of different types of production in the same manufacturing facility. Then the data was further allocated among products of different specifications based on the mass because it is believed the energy consumption and water consumption correlated better on a mass basis.

## » Production Stage (A1-A3)

DrainScreen® is manufactured in North Carolina, US. It consists of two layers: the core layer is mainly made of polypropylene and thermoplastic elastomer; and the fabric is made of nylon 6 fiber and polyester fiber. The mass ratio of core layer to fabric varies with the thickness options of DrainScreen®. For 6-mm version, the core layer takes up 84.48% and the percentage rises to 87.72% in 10-mm version. In this study, a weighted average based on the sales records in 2018 is calculated and used. The final product is packaged on cardboard trays and shipped on wood pallets.

## » Transport to Construction Site (A4)

The product is assumed to be shipped from the manufacturing facility to distribution facilities in the US via truck. From the distribution facilities, the product is shipped to construction sites. Table 5 gives the transportation details including the distances and the truck dataset used in the model. Transport distances are calculated based on the locations of the manufacturing facility, the distribution facilities, and customers' zip codes retrieved from the sales records.

Table 5: Transport Details

Name	Details	Unit
Type of transport	Truck	-
Fuel type	Diesel	-
Liters of fuel	39.0625	l/100km
Vehicle type	Heavy duty diesel truck/ 45,000 lb payload	-
Transport distance from the manufacturing facility to distribution facilities	1293.48	km
Transport distance from the distribution facilities to construction sites	769.37	km

## » Installation (A5)

DrainScreen® is installed as part of the wall assembly and no specific installation materials are required. The reference flow is calculated on the basis of the coverage rates on DrainScreen®'s product data sheets and a 10% installation waste was considered to account for the possibility of trimming. The disposal of the installation waste and packaging waste are modeled in accordance with EPA's Advancing Sustainable Materials Management: 2015 Fact Sheet. As the tools used during the installation of the product are multi-use tools and can be reused after each installation, the per-functional unit impacts are considered negligible and therefore are not included. Detailed installation instructions are provided online. Packaging waste is generated and disposed of in this stage.

Table 6: Installation (A5)

Name	Value	Unit
Product loss per functional unit	1.075	kg/ ESL
Waste materials at the construction site before waste processing, generated by product installation	1.626	kg/ ESL
Plastic waste, packaging	0.221	kg/ ESL
Cardboard waste, packaging	0.039	kg/ ESL
Wood waste, packaging	0.291	kg/ ESL
Direct emissions to ambient air, soil, water	0	kg

### » Use Stage (B1-B5 & B6-B7)

Since the product is installed as part of the wall assembly, there are no use phase inputs required to maintain the product and there are no any emissions including any regulated substances to air, soil and water during the use phase. The RSL of the product is 10 years, so five replacements are required to cover the estimated service life (ESL). The product requires no maintenance once installed. It is assumed that the product requires no repairs or refurbishments if it is properly installed.

Table 7: Replacement (B4)

Name	Value	Unit
Reference Service Life (RSL)	10	Years
Estimated Service Life (ESL)	60	Years
Replacement cycle	5	(ESL/RSL)-1
Declared product properties	As per Product Identification section	-
Design application parameters	As per technical details in Table 2	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Industry Standard	-

### » End-of-Life Stage (C1-C4)

In this stage, the product at its end of life is transported to the waste disposal facility and processed. Included in this stage are the following:

- Deconstruction – There are no impacts during this stage as the product is manually removed.
- Transportation to disposal – Estimated fuel requirements made based on weight of product and average distance to landfill.
- Waste processing for landfilling — This process is included in the landfilling process.
- Waste disposal — Due to the fact that all the products in study are installed as part of a wall system including the external coating/finish, and are not able to be dismantled based on their material type, it is reasonable to assume that the products at their end-of-life stage are landfilled.

• Table 8: End-of-Life Parameters

	DrainScreen®	Unit
Collected with mixed construction waste	1.94	kg/ESL
Landfilling	100	%
Product for final deposition	1.94	kg/ESL

## » Life Cycle Assessment Results

As prescribed by the ISO 21930:2017, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 9 provides the acronym key for the impact indicators declared in this EPD.

Table 9: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
ADP-Fossil Fuel	Abiotic depletion potential for fossil resources (An indicator derived from CML 2001-Jan 2016)	MJ, net calorific value
<b>Resource Use Parameters</b>		
RPR <sub>E</sub>	Renewable primary energy as energy carrier	MJ, net calorific value
RPR <sub>M</sub>	Renewable primary energy resources as material utilization	MJ, net calorific value
NRPR <sub>E</sub>	Non-renewable primary energy as energy carrier	MJ, net calorific value
NRPR <sub>M</sub>	Non-renewable primary energy as material utilization	MJ, net calorific value
SM	Use of secondary material	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value
RE	Recovered energy	MJ, net calorific value
FW	Use of fresh water	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste disposed	kg
ILLRW	Intermediate and low-level radioactive waste disposed	kg
<b>Carbon Removal and Emission Parameter</b>		
BCRP	Biogenic Carbon Removal from Product	kg CO <sub>2</sub> eq
BCEP	Biogenic Carbon Emission from Product	kg CO <sub>2</sub> eq
BCRK	Biogenic Carbon Removal from Packaging	kg CO <sub>2</sub> eq
BCEK	Biogenic Carbon Emission from Packaging	kg CO <sub>2</sub> eq
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO <sub>2</sub> eq
CCE	Calcination Carbon Emissions	kg CO <sub>2</sub> eq
CCR	Carbonation Carbon Removals	kg CO <sub>2</sub> eq
CWNR	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes	kg CO <sub>2</sub> eq

## Sto DrainScreen® -- Results

### TRACI Results and ADP-Fossil Fuel

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO <sub>2</sub> eq]	3.24E-03	3.25E-04	1.36E-04	0.00E+00	0.00E+00	0.00E+00	1.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-06	0.00E+00	6.50E-05	MND
EP [kg N eq]	2.10E-04	2.69E-05	2.03E-05	0.00E+00	0.00E+00	0.00E+00	1.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-07	0.00E+00	3.32E-06	MND
GWP [kg CO <sub>2</sub> eq]	1.15E+00	6.79E-02	7.03E-02	0.00E+00	0.00E+00	0.00E+00	6.52E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.73E-04	0.00E+00	1.42E-02	MND
ODP [kg CFC 11 eq]	-1.32E-13	-3.65E-16	-2.40E-16	0.00E+00	0.00E+00	0.00E+00	-6.66E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.16E-18	0.00E+00	-7.44E-16	MND
POCP [kg O <sub>3</sub> eq]	4.48E-02	7.42E-03	7.92E-04	0.00E+00	0.00E+00	0.00E+00	2.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.47E-05	0.00E+00	1.30E-03	MND
ADP-fossil fuel [MJ]	3.26E+01	9.57E-01	6.37E-02	0.00E+00	0.00E+00	0.00E+00	1.69E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-02	0.00E+00	2.21E-01	MND

### Resource Use

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR <sub>e</sub> [MJ]	2.74E+00	2.98E-02	4.49E-03	0.00E+00	0.00E+00	0.00E+00	1.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E-04	0.00E+00	1.73E-02	MND
RPR <sub>m</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR <sub>e</sub> [MJ]	3.51E+01	9.62E-01	6.56E-02	0.00E+00	0.00E+00	0.00E+00	1.82E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-02	0.00E+00	2.26E-01	MND
NRPR <sub>m</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	5.74E-03	1.15E-04	6.34E-05	0.00E+00	0.00E+00	0.00E+00	2.97E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-06	0.00E+00	2.69E-05	MND

### Waste

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	1.31E-08	7.80E-09	2.24E-10	0.00E+00	0.00E+00	0.00E+00	1.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.90E-11	0.00E+00	7.93E-10	MND
NHWD [kg]	9.86E-02	3.63E-05	6.14E-02	0.00E+00	0.00E+00	0.00E+00	2.42E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-07	0.00E+00	3.23E-01	MND
HLRW [kg]	1.37E-06	2.57E-09	9.43E-10	0.00E+00	0.00E+00	0.00E+00	6.87E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E-11	0.00E+00	2.75E-09	MND
ILLRW [kg]	1.00E-03	2.13E-06	7.60E-07	0.00E+00	0.00E+00	0.00E+00	5.03E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-08	0.00E+00	2.19E-06	MND

## Carbon removal and Emission

Indicator	DrainScreen®
BCRP [kg CO2 eq]	3.83E-02
BCEP [kg CO2 eq]	4.02E-02
BCRK [kg CO2 eq]	1.11E-01
BCEK [kg CO2 eq]	3.84E-02
BCEW [kg CO2 eq]	0.00E+00
CCE [kg CO2 eq]	0.00E+00
CCR [kg CO2 eq]	0.00E+00
CWNR [kg CO2 eq]	0.00E+00

### » Interpretation

In one reference service life of the product, the production stage, which includes raw material extraction, transportation from suppliers and manufacturing, is the highest contributor to all impact indicators. The impact from the remaining stages is nearly negligible. From the perspective of a whole building lifespan, the vast majority of the impacts are derived from the number of replacements needed. This is directly related to the impacts associated with the manufacture of new products that are used to replace the original. Improving the relatively short lifespan of the product is essential to reducing the overall impact of the product.

### » Reference

- Life Cycle Assessment, LCA report for Sto Corp. WAP Sustainability, October 2019
- ISO14044:2006 Environmental Management–Life cycle assessment–Requirements and Guidelines.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- Advancing Sustainable Materials Management: 2015 Fact Sheet. US EPA. Available at [https://www.epa.gov/sites/production/files/2018-07/documents/2015\\_smm\\_msw\\_factsheet\\_07242018\\_fnl\\_508\\_002.pdf](https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf)
- Sto Studio. Sto Corp, 2019. Available at <https://www.stocorp.com/sto-studio-us/>
- Product Bulletin – Sto DrainScreen®. Sto Corp. Available at [https://www.stocorp.com/wp-content/content/Products\\_TechService/Mesh%20and%20Accessories/Product%20Bulletins/PB\\_81208\\_Sto\\_DrainScreen\\_EN.pdf](https://www.stocorp.com/wp-content/content/Products_TechService/Mesh%20and%20Accessories/Product%20Bulletins/PB_81208_Sto_DrainScreen_EN.pdf)



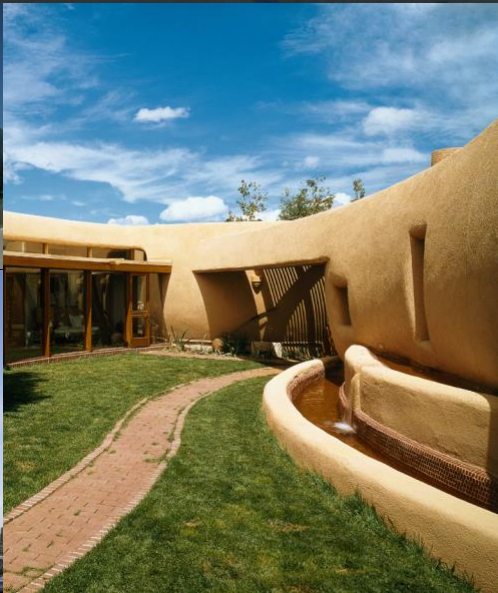
Building with conscience.





EPD for Stolit®  
in varied textures

Product Textures: 1.0, 1.0 Dark, 1.5, 1.5 Dark, Freeform, Freeform Dark, R1.5, R1.5 Dark

Stolit® is a ready-mixed premium acrylic based exterior or interior textured wall finish enhanced with advanced polymer technology, designed for use as a finish coat over prepared vertical concrete, masonry or plaster substrates and in StoTherm® ci wall





<b>PCR Identification</b>	<b>PCR for Architectural Coatings: NAICS 325510 on the basis of ISO 21930:2007, NSF International, 2017. Valid through June 23, 2022</b>
Compliance to ISO1 4040/44, ISO 14025 and ISO 21930	Yes
Product Category	Exterior Coating
Manufacturer's name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120 Atlanta, GA 30331 <a href="http://www.stocorp.com">www.stocorp.com</a>   (800) 221-2397
EPD program operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 <a href="http://www.epstengroup.com">www.epstengroup.com</a>
Declaration Number	01-001
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered and protected substrate for 60 years
Market-base life used in assessment	10 Years
Design life used in assessment	5 Years
Test method employed for determination of design life	Product default warranty
Amount of colorant needed	See Table 3
Overall Data Quality Assessment Score	Good
Site(s) in which the results of the LCA are representative	STO manufacturing sites in Atlanta, Georgia; Glendale, Arizona; and Rutland, Vermont
Information on where explanatory material can be obtained	See references at the end of this document.
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database Version 8.7, Service Pack 39
This declaration was independently verified in accordance with ISO 14025: 2006 and the reference PCR: PCR for Architectural Coatings: NAICS 325510 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14040/44 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

**Comparability**

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.



## » Company

We believe in ‘**Building with conscience**’.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you’re always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That’s exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it’s new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That’s why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through [Sto Studio](#) or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Atlanta Plant

Glendale Plant

Rutland Plant

## » Product Identification

Stolit® finishes are offered in various coarseness and color bases that allow more freedom in building exterior designing and finishing. Table 1 lists the products declared in this EPD.

Table 1: List of Stolit® Products

Product Name	Product Number	Base Type	Finish Type
Stolit® 1.0	80130	Tintable White	Fine
Stolit® 1.0 Dark Colors	82130	Deep	Fine
Stolit® 1.5	80131	Tintable White	Medium
Stolit® 1.5 Dark Colors	82131	Deep	Medium
Stolit® Freeform	80156	Tintable White	Freeform
Stolit® Freeform Dark Colors	82156	Deep	Freeform
Stolit® R1.5	80141	Tintable White	Swirl
Stolit® R1.5 Dark Colors	82141	Deep	Swirl

## » Product Description

Stolit® is a series of ready-mixed, acrylic-based exterior or interior textured wall finishes. Stolit® is used as a decorative and protective wall coating over prepared vertical above grade concrete, masonry and plaster substrates, and in StoTherm® ci Systems. In this study, Stolit® 1.0, 1.5, R1.5 and Freeform are included. Two tint bases are offered: standard and dark colors which respectively can be transcribed to tintable white base and deep base in the PCR.



## » Performance Features

Mildew Resistance	Ready Mixed	Moisture Resistance	Low VOC & Odor
Vapor Permeable	Integral Color	Water-based	

## » Material Composition

The material compositions of Stolit® are listed below:

Table 2: Material composition for Stolit®

Product	Additives	Colorant	Limestone	Acrylic resin	Silica	Silicate	Surfactant	Water
Stolit® R1.5 Dark Colors	0.77%	0.60%	47.76%	5.03%	26.66%	2.69%	0.08%	15.75%
Stolit® R1.5	0.77%	0.60%	47.69%	5.03%	26.60%	2.69%	0.08%	15.88%
Stolit® 1.0 Dark Colors	0.77%	0.60%	49.20%	5.04%	25.26%	2.69%	0.07%	15.71%
Stolit® 1.0	0.77%	0.60%	49.16%	5.03%	25.20%	2.69%	0.07%	15.80%
Stolit® 1.5 Dark Colors	0.59%	0.61%	64.85%	6.95%	7.91%	2.46%	0.18%	15.65%
Stolit® 1.5	0.59%	0.80%	64.55%	6.95%	8.01%	2.46%	0.18%	15.66%
Stolit® Freeform Dark Colors	0.77%	0.58%	67.26%	4.84%	8.18%	2.59%	0.07%	15.08%
Stolit® Freeform	0.74%	0.58%	67.23%	4.84%	8.18%	2.58%	0.07%	15.13%

## » Components related to Life Cycle Assessment

The functional unit for the LCA study was covering and protecting 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in the PCR. The market-based lifetime is 10 years, and the design lifetime is determined either based on quality determined by ASTM tests or on the product warrant. By default, Stolit® finishes have a 5-year warranty. In case a finish is applied on Sto's wall systems, the warranty is extended to 10 years. In this EPD, default warranty is adopted as the design lifetime. The reference flow required for one functional unit is provided in Table 3.

Table 3: Market-based lifetime and reference flow

	Functional Unit	Reference Flow [kg]	Tint needed* [kg]	Reference Flow [kg]	Tint needed* [kg]
<b>Lifespan</b>		<b>Design Lifetime [5 years]</b>		<b>Market-based Lifetime [10 years]</b>	
Stolit® R1.5 Dark Colors	1	30.59	2.69	15.29	1.35
Stolit® R1.5	1	30.59	0.79	15.29	0.40
Stolit® 1.0 Dark Colors	1	29.58	2.60	14.80	1.30
Stolit® 1.0	1	29.58	0.77	14.80	0.38
Stolit® 1.5 Dark Colors	1	34.05	3.00	17.03	1.50
Stolit® 1.5	1	34.05	0.88	17.03	0.44
Stolit® Freeform Dark Colors	1	53.08	4.66	26.53	2.33
Stolit® Freeform	1	53.08	1.37	26.53	0.69

### » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in the PCR.

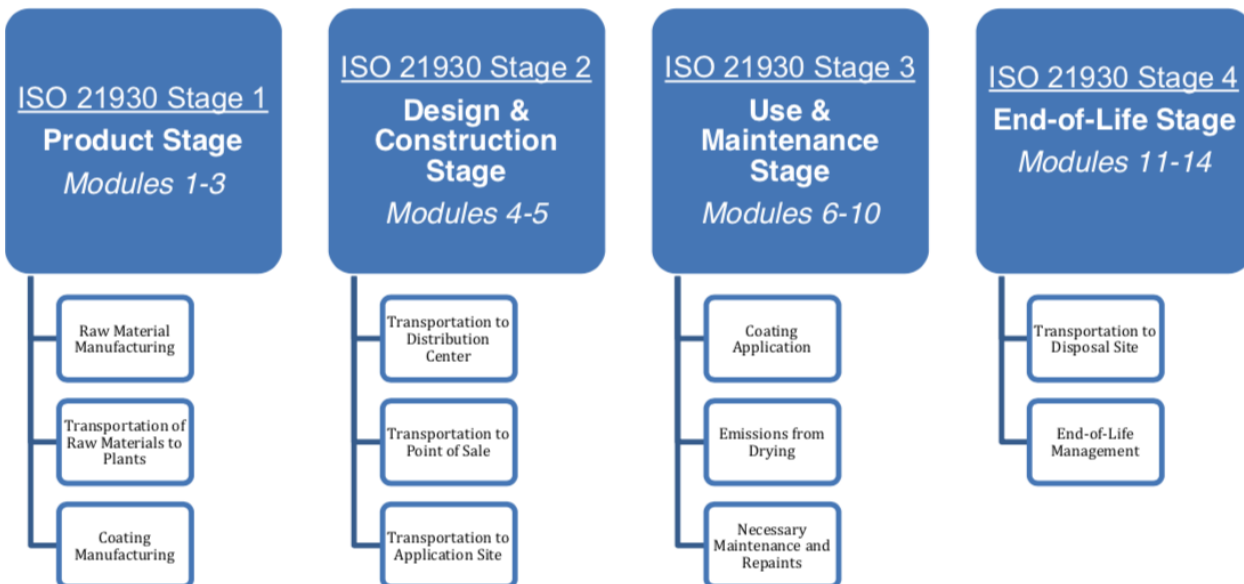


Figure 1: Life stages for the cradle-to-grave LCA

## » Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## » Data Quality

The overall data quality level was determined to be good. Primary data was collected from Sto's facilities in Atlanta, GA, Glendale, AZ and Rutland, VT for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V8.7 Database Service Pack 39. Overall, both primary and secondary data are considered good quality in terms of geographic, temporal and technological coverage.

## » Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions were made in accordance with the PCR and include the transportation distances, the disposal of packaging material and the product at its end of life and use phase assumptions.

## » Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis.

## » Product Stage

Stolit® is produced at Sto's Atlanta, GA, Glendale, AZ and Rutland, VT facilities. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by Sto. Stolit® is supplied in 5-gallon pails.

## » Design and Construction Stage

The design and construction process stage starts with the packaged product leaving the production site and ends with being delivered to the application site.

During this stage, the finished product is moved from a shipping dock for distribution. The end gate is the application site after the purchaser acquires the finished product and transports it to the application site.

## » Use and Maintenance Stage

The use stage begins when the user prepares the product before applying it to a substrate and ends with any leftover coating and discarded packaging entering the end-of-life stage. Detailed application instructions are provided [online](#). The application procedure includes mixing and applying. As recommended, an electric drill/mixer and a spray pump are assumed to be used for mixing and application. The equipment is not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible, but electricity to power application tools has been included.

As prescribed in the PCR, 10% of the wet mass of Stolit® is assumed to be unused and properly disposed of.

## » End-of-Life Stage

Table 4: End-of-life Disposal Scenarios

Waste Flow	Recycling	Incineration	Landfilling
Paper Packaging	66.6%	6.01%	27.39%
Steel Packaging	33.3%	12.01%	54.69%
Plastic Packaging	9.1%	16.36%	74.54%
Unused Product	0%	0%	100%
Post-Consumer Product	0%	0%	100%

In this stage, the disposal of installation waste, packaging waste and product waste at its end of life is included. The disposal pathway of each waste stream is modeled based on the recommendation of PCR and US EPA's latest waste management fact sheet.

## » Life Cycle Assessment Results

As prescribed by the PCR, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 5 provides the acronym key of the impact indicators declared in this EPD.

Table 5: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
<b>TRACI 2.1</b>		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
<b>Resource Use Parameters</b>		
RPR	Use of renewable primary energy	MJ, net calorific value (LHV)
RMR	Use of renewable Material Resources	kg
NRER	Depletion of Non-Renewable Energy Resources	MJ, net calorific value
NRMR	Depletion of Non-Renewable Material Resources	kg
FW	Consumption of Freshwater	m <sup>3</sup>
<b>Waste Parameters</b>		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
<b>Biogenic Carbon Parameter</b>		
BC	Biogenic Carbon	kg CO <sub>2</sub> eq
<b>Energy Differentiation Parameters</b>		
HWP	Hydro/wind Power	MJ, net calorific value (LHV)
FE	Fossil Energy	MJ, net calorific value (LHV)
BE	Bio-energy	MJ, net calorific value (LHV)
NE	Nuclear Energy	MJ, net calorific value (LHV)
OE	Other Energy	MJ, net calorific value (LHV)

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	4.73E-02	6.12E-03	6.31E-03	4.41E-03	
	EP [kg N eq]	2.75E-03	4.98E-04	2.30E-04	7.14E-04	
	GWP [kg CO <sub>2</sub> eq]	1.36E+01	1.19E+00	2.99E+00	9.16E-01	
	ODP [kg CFC 11 eq]	1.71E-09	1.13E-16	1.89E-14	2.49E-15	
	POCP [kg O <sub>3</sub> eq]	5.46E-01	1.40E-01	8.05E-01	7.33E-02	
	RPRE [MJ]	1.64E+01	5.22E-01	3.20E+00	7.57E-01	
	NRPRE [MJ]	2.99E+02	1.69E+01	7.97E+01	1.11E+01	
	FW [m3]	7.08E-02	2.01E-03	1.79E-02	1.42E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.59E+01	0.00E+00	1.35E+00	0.00E+00	
	HWD [kg]	4.77E-06	1.37E-07	1.13E-08	4.58E-08	
	NHWD [kg]	8.46E-01	6.36E-04	9.48E-03	1.70E+01	
	BC [kg CO <sub>2</sub> eq]			1.53E+00		
	HWP [MJ]			9.79E-01		
	FE [MJ]			1.48E+01		
	BE [MJ]			4.84E-01		
	NE [MJ]			3.89E+00		
	OE [MJ]			3.90E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	9.46E-02	1.22E-02	1.26E-02	8.82E-03
EP [kg N eq]		5.50E-03	9.96E-04	4.60E-04	1.43E-03	
GWP [kg CO <sub>2</sub> eq]		2.72E+01	2.38E+00	5.98E+00	1.83E+00	
ODP [kg CFC 11 eq]		3.42E-09	2.26E-16	3.78E-14	4.98E-15	
POCP [kg O <sub>3</sub> eq]		1.09E+00	2.80E-01	1.61E+00	1.47E-01	
RPRE [MJ]		3.28E+01	1.04E+00	6.40E+00	1.51E+00	
NRPRE [MJ]		5.98E+02	3.38E+01	1.59E+02	2.22E+01	
FW [m3]		1.42E-01	4.02E-03	3.58E-02	2.84E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.18E+01	0.00E+00	2.70E+00	0.00E+00	
HWD [kg]		9.54E-06	2.74E-07	2.26E-08	9.16E-08	
NHWD [kg]		1.69E+00	1.27E-03	1.90E-02	3.40E+01	
BC [kg CO <sub>2</sub> eq]				3.07E+00		
HWP [MJ]				1.96E+00		
FE [MJ]				2.97E+01		
BE [MJ]			9.68E-01			
NE [MJ]			7.78E+00			
OE [MJ]			7.81E-01			

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	6.36E-02	6.11E-03	1.93E-03	4.23E-03	
	EP [kg N eq]	2.83E-03	4.98E-04	7.06E-05	7.05E-04	
	GWP [kg CO <sub>2</sub> eq]	1.39E+01	1.19E+00	9.06E-01	8.76E-01	
	ODP [kg CFC 11 eq]	1.71E-09	1.13E-16	5.66E-15	2.35E-15	
	POCP [kg O <sub>3</sub> eq]	5.62E-01	1.40E-01	7.78E-01	6.97E-02	
	RPRE [MJ]	1.67E+01	5.22E-01	9.95E-01	7.11E-01	
	NRPRE [MJ]	3.03E+02	1.69E+01	2.38E+01	1.04E+01	
	FW [m3]	7.24E-02	2.01E-03	5.40E-03	1.34E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.59E+01	0.00E+00	4.00E-01	0.00E+00	
	HWD [kg]	4.77E-06	1.37E-07	3.48E-09	4.35E-08	
	NHWD [kg]	8.54E-01	6.36E-04	2.91E-03	1.62E+01	
	BC [kg CO <sub>2</sub> eq]			1.40E+00		
	HWP [MJ]			9.78E-01		
	FE [MJ]			1.48E+01		
	BE [MJ]			4.84E-01		
	NE [MJ]			3.89E+00		
	OE [MJ]			3.90E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.27E-01	1.22E-02	3.86E-03	8.46E-03
EP [kg N eq]		5.66E-03	9.96E-04	1.41E-04	1.41E-03	
GWP [kg CO <sub>2</sub> eq]		2.78E+01	2.38E+00	1.81E+00	1.75E+00	
ODP [kg CFC 11 eq]		3.42E-09	2.26E-16	1.13E-14	4.70E-15	
POCP [kg O <sub>3</sub> eq]		1.12E+00	2.80E-01	1.56E+00	1.39E-01	
RPRE [MJ]		3.34E+01	1.04E+00	1.99E+00	1.42E+00	
NRPRE [MJ]		6.06E+02	3.38E+01	4.76E+01	2.08E+01	
FW [m3]		1.45E-01	4.02E-03	1.08E-02	2.68E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.18E+01	0.00E+00	8.00E-01	0.00E+00	
HWD [kg]		9.54E-06	2.74E-07	6.96E-09	8.70E-08	
NHWD [kg]		1.71E+00	1.27E-03	5.82E-03	3.24E+01	
BC [kg CO <sub>2</sub> eq]				2.80E+00		
HWP [MJ]				1.96E+00		
FE [MJ]				2.97E+01		
BE [MJ]				9.68E-01		
NE [MJ]				7.77E+00		
OE [MJ]				7.80E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	4.91E-02	5.91E-03	6.11E-03	4.27E-03	
	EP [kg N eq]	2.80E-03	4.82E-04	2.23E-04	6.91E-04	
	GWP [kg CO <sub>2</sub> eq]	1.42E+01	1.15E+00	2.90E+00	8.86E-01	
	ODP [kg CFC 11 eq]	2.06E-09	1.09E-16	1.83E-14	2.41E-15	
	POCP [kg O <sub>3</sub> eq]	5.64E-01	1.35E-01	7.79E-01	7.09E-02	
	RPRE [MJ]	1.77E+01	5.05E-01	3.10E+00	7.33E-01	
	NRPRE [MJ]	3.09E+02	1.63E+01	7.69E+01	1.07E+01	
	FW [m3]	7.34E-02	1.94E-03	1.73E-02	1.37E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.54E+01	0.00E+00	1.30E+00	0.00E+00	
	HWD [kg]	5.67E-06	1.32E-07	1.09E-08	4.43E-08	
	NHWD [kg]	9.34E-01	6.12E-04	9.13E-03	1.65E+01	
	BC [kg CO <sub>2</sub> eq]			1.57E+00		
	HWP [MJ]			9.48E-01		
	FE [MJ]			1.44E+01		
	BE [MJ]			4.69E-01		
	NE [MJ]			3.76E+00		
	OE [MJ]			3.78E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	9.82E-02	1.18E-02	1.22E-02	8.54E-03
EP [kg N eq]		5.60E-03	9.64E-04	4.46E-04	1.38E-03	
GWP [kg CO <sub>2</sub> eq]		2.84E+01	2.30E+00	5.80E+00	1.77E+00	
ODP [kg CFC 11 eq]		4.12E-09	2.18E-16	3.66E-14	4.82E-15	
POCP [kg O <sub>3</sub> eq]		1.13E+00	2.70E-01	1.56E+00	1.42E-01	
RPRE [MJ]		3.54E+01	1.01E+00	6.20E+00	1.47E+00	
NRPRE [MJ]		6.18E+02	3.26E+01	1.54E+02	2.14E+01	
FW [m3]		1.47E-01	3.88E-03	3.46E-02	2.74E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.08E+01	0.00E+00	2.60E+00	0.00E+00	
HWD [kg]		1.13E-05	2.64E-07	2.18E-08	8.86E-08	
NHWD [kg]		1.87E+00	1.22E-03	1.83E-02	3.30E+01	
BC [kg CO <sub>2</sub> eq]				3.13E+00		
HWP [MJ]				1.90E+00		
FE [MJ]				2.87E+01		
BE [MJ]				9.37E-01		
NE [MJ]				7.53E+00		
OE [MJ]				7.56E-01		



	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	6.54E-02	5.91E-03	1.86E-03	4.09E-03	
	EP [kg N eq]	2.89E-03	4.82E-04	6.83E-05	6.82E-04	
	GWP [kg CO <sub>2</sub> eq]	1.46E+01	1.15E+00	8.76E-01	8.48E-01	
	ODP [kg CFC 11 eq]	2.06E-09	1.09E-16	5.47E-15	2.27E-15	
	POCP [kg O <sub>3</sub> eq]	5.81E-01	1.35E-01	7.52E-01	6.74E-02	
	RPRE [MJ]	1.81E+01	5.05E-01	9.63E-01	6.88E-01	
	NRPRE [MJ]	3.13E+02	1.63E+01	2.31E+01	1.01E+01	
	FW [m <sup>3</sup> ]	7.53E-02	1.94E-03	5.22E-03	1.30E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.54E+01	0.00E+00	3.80E-01	0.00E+00	
	HWD [kg]	5.65E-06	1.32E-07	3.37E-09	4.20E-08	
	NHWD [kg]	9.41E-01	6.15E-04	2.81E-03	1.56E+01	
	BC [kg CO <sub>2</sub> eq]			1.44E+00		
	HWP [MJ]			9.47E-01		
	FE [MJ]			1.44E+01		
	BE [MJ]			4.68E-01		
	NE [MJ]			3.76E+00		
	OE [MJ]			3.78E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.31E-01	1.18E-02	3.72E-03	8.18E-03
EP [kg N eq]		5.78E-03	9.64E-04	1.37E-04	1.36E-03	
GWP [kg CO <sub>2</sub> eq]		2.92E+01	2.30E+00	1.75E+00	1.70E+00	
ODP [kg CFC 11 eq]		4.12E-09	2.18E-16	1.09E-14	4.54E-15	
POCP [kg O <sub>3</sub> eq]		1.16E+00	2.70E-01	1.50E+00	1.35E-01	
RPRE [MJ]		3.62E+01	1.01E+00	1.93E+00	1.38E+00	
NRPRE [MJ]		6.26E+02	3.26E+01	4.62E+01	2.02E+01	
FW [m <sup>3</sup> ]		1.51E-01	3.88E-03	1.04E-02	2.60E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.08E+01	0.00E+00	7.60E-01	0.00E+00	
HWD [kg]		1.13E-05	2.64E-07	6.74E-09	8.40E-08	
NHWD [kg]		1.88E+00	1.23E-03	5.62E-03	3.12E+01	
BC [kg CO <sub>2</sub> eq]				2.88E+00		
HWP [MJ]				1.89E+00		
FE [MJ]				2.87E+01		
BE [MJ]				9.37E-01		
NE [MJ]				7.52E+00		
OE [MJ]				7.55E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	5.54E-02	6.81E-03	7.02E-03	4.91E-03
	EP [kg N eq]	3.14E-03	5.55E-04	2.56E-04	7.95E-04
	GWP [kg CO <sub>2</sub> eq]	1.61E+01	1.32E+00	3.33E+00	1.02E+00
	ODP [kg CFC 11 eq]	1.90E-09	1.26E-16	2.11E-14	2.77E-15
	POCP [kg O <sub>3</sub> eq]	6.28E-01	1.55E-01	8.97E-01	8.16E-02
	RPRE [MJ]	2.01E+01	5.81E-01	3.56E+00	8.44E-01
	NRPRE [MJ]	3.51E+02	1.88E+01	8.86E+01	1.23E+01
	FW [m3]	8.38E-02	2.24E-03	1.99E-02	1.58E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	1.77E+01	0.00E+00	1.50E+00	0.00E+00
	HWD [kg]	5.30E-06	1.52E-07	1.25E-08	5.10E-08
	NHWD [kg]	1.06E+00	7.07E-04	1.05E-02	1.90E+01
	BC [kg CO <sub>2</sub> eq]			1.78E+00	
	HWP [MJ]			1.09E+00	
	FE [MJ]			1.65E+01	
	BE [MJ]			5.39E-01	
NE [MJ]			4.33E+00		
OE [MJ]			4.35E-01		
Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
	AP [kg SO <sub>2</sub> eq]	1.11E-01	1.36E-02	1.40E-02	9.82E-03
	EP [kg N eq]	6.28E-03	1.11E-03	5.12E-04	1.59E-03
	GWP [kg CO <sub>2</sub> eq]	3.22E+01	2.64E+00	6.66E+00	2.04E+00
	ODP [kg CFC 11 eq]	3.80E-09	2.52E-16	4.22E-14	5.54E-15
	POCP [kg O <sub>3</sub> eq]	1.26E+00	3.10E-01	1.79E+00	1.63E-01
	RPRE [MJ]	4.02E+01	1.16E+00	7.12E+00	1.69E+00
	NRPRE [MJ]	7.02E+02	3.76E+01	1.77E+02	2.46E+01
	FW [m3]	1.68E-01	4.48E-03	3.98E-02	3.16E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	3.54E+01	0.00E+00	3.00E+00	0.00E+00
	HWD [kg]	1.06E-05	3.04E-07	2.50E-08	1.02E-07
	NHWD [kg]	2.12E+00	1.41E-03	2.10E-02	3.80E+01
	BC [kg CO <sub>2</sub> eq]			3.56E+00	
	HWP [MJ]			2.18E+00	
	FE [MJ]			3.31E+01	
BE [MJ]			1.08E+00		
NE [MJ]			8.66E+00		
OE [MJ]			8.70E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	7.53E-02	6.81E-03	2.14E-03	4.71E-03
	EP [kg N eq]	3.32E-03	5.55E-04	7.86E-05	7.84E-04
	GWP [kg CO <sub>2</sub> eq]	1.67E+01	1.32E+00	1.01E+00	9.75E-01
	ODP [kg CFC 11 eq]	1.90E-09	1.26E-16	6.30E-15	2.61E-15
	POCP [kg O <sub>3</sub> eq]	6.69E-01	1.55E-01	8.66E-01	7.76E-02
	RPRE [MJ]	2.05E+01	5.81E-01	1.11E+00	7.92E-01
	NRPRE [MJ]	3.59E+02	1.88E+01	2.65E+01	1.16E+01
	FW [m3]	8.63E-02	2.24E-03	6.01E-03	1.50E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	1.77E+01	0.00E+00	4.40E-01	0.00E+00
	HWD [kg]	5.33E-06	1.52E-07	3.88E-09	4.84E-08
	NHWD [kg]	1.07E+00	7.07E-04	3.23E-03	1.80E+01
	BC [kg CO <sub>2</sub> eq]			1.64E+00	
	HWP [MJ]			1.09E+00	
	FE [MJ]			1.65E+01	
	BE [MJ]			5.39E-01	
	NE [MJ]			4.33E+00	
OE [MJ]			4.35E-01		
Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
	AP [kg SO <sub>2</sub> eq]	1.51E-01	1.36E-02	4.28E-03	9.42E-03
	EP [kg N eq]	6.64E-03	1.11E-03	1.57E-04	1.57E-03
	GWP [kg CO <sub>2</sub> eq]	3.34E+01	2.64E+00	2.02E+00	1.95E+00
	ODP [kg CFC 11 eq]	3.80E-09	2.52E-16	1.26E-14	5.22E-15
	POCP [kg O <sub>3</sub> eq]	1.34E+00	3.10E-01	1.73E+00	1.55E-01
	RPRE [MJ]	4.10E+01	1.16E+00	2.22E+00	1.58E+00
	NRPRE [MJ]	7.18E+02	3.76E+01	5.30E+01	2.32E+01
	FW [m3]	1.73E-01	4.48E-03	1.20E-02	3.00E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	3.54E+01	0.00E+00	8.80E-01	0.00E+00
	HWD [kg]	1.07E-05	3.04E-07	7.76E-09	9.68E-08
	NHWD [kg]	2.14E+00	1.41E-03	6.46E-03	3.60E+01
	BC [kg CO <sub>2</sub> eq]			3.29E+00	
	HWP [MJ]			2.18E+00	
	FE [MJ]			3.31E+01	
	BE [MJ]			1.08E+00	
NE [MJ]			8.66E+00		
OE [MJ]			8.69E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	8.88E-02	1.06E-02	1.10E-02	7.66E-03	
	EP [kg N eq]	4.96E-03	8.64E-04	3.99E-04	1.24E-03	
	GWP [kg CO <sub>2</sub> eq]	2.51E+01	2.06E+00	5.20E+00	1.59E+00	
	ODP [kg CFC 11 eq]	-8.37E-13	1.96E-16	3.28E-14	4.32E-15	
	POCP [kg O <sub>3</sub> eq]	1.01E+00	2.42E-01	1.40E+00	1.27E-01	
	RPRE [MJ]	2.98E+01	9.05E-01	5.56E+00	1.32E+00	
	NRPRE [MJ]	5.54E+02	2.93E+01	1.38E+02	1.92E+01	
	FW [m3]	1.29E-01	3.49E-03	3.10E-02	2.46E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	2.76E+01	0.00E+00	2.33E+00	0.00E+00	
	HWD [kg]	7.85E-07	2.37E-07	1.95E-08	7.95E-08	
	NHWD [kg]	1.47E+00	1.10E-03	1.64E-02	2.96E+01	
	BC [kg CO <sub>2</sub> eq]	2.71E+00				
	HWP [MJ]	1.70E+00				
	FE [MJ]	2.58E+01				
	BE [MJ]	8.40E-01				
	NE [MJ]	6.75E+00				
	OE [MJ]	6.77E-01				
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.78E-01	2.12E-02	2.20E-02	1.53E-02
EP [kg N eq]		9.92E-03	1.73E-03	7.98E-04	2.48E-03	
GWP [kg CO <sub>2</sub> eq]		5.02E+01	4.12E+00	1.04E+01	3.18E+00	
ODP [kg CFC 11 eq]		-1.67E-12	3.92E-16	6.56E-14	8.64E-15	
POCP [kg O <sub>3</sub> eq]		2.02E+00	4.84E-01	2.80E+00	2.54E-01	
RPRE [MJ]		5.96E+01	1.81E+00	1.11E+01	2.64E+00	
NRPRE [MJ]		1.11E+03	5.86E+01	2.76E+02	3.84E+01	
FW [m3]		2.58E-01	6.98E-03	6.20E-02	4.92E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		5.51E+01	0.00E+00	4.66E+00	0.00E+00	
HWD [kg]		1.57E-06	4.74E-07	3.90E-08	1.59E-07	
NHWD [kg]		2.94E+00	2.20E-03	3.28E-02	5.92E+01	
BC [kg CO <sub>2</sub> eq]		5.42E+00				
HWP [MJ]		3.40E+00				
FE [MJ]		5.15E+01				
BE [MJ]		1.68E+00				
NE [MJ]		1.35E+01				
OE [MJ]		1.35E+00				

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	1.20E-01	1.06E-02	3.34E-03	7.35E-03
	EP [kg N eq]	5.13E-03	8.64E-04	1.23E-04	1.22E-03
	GWP [kg CO <sub>2</sub> eq]	2.58E+01	2.06E+00	1.57E+00	1.52E+00
	ODP [kg CFC 11 eq]	-8.35E-13	1.96E-16	9.82E-15	4.08E-15
	POCP [kg O <sub>3</sub> eq]	1.05E+00	2.42E-01	1.35E+00	1.21E-01
	RPRE [MJ]	3.05E+01	9.05E-01	1.73E+00	1.23E+00
	NRPRE [MJ]	5.63E+02	2.93E+01	4.14E+01	1.81E+01
	FW [m3]	1.33E-01	3.49E-03	9.37E-03	2.33E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	2.76E+01	0.00E+00	6.90E-01	0.00E+00
	HWD [kg]	7.89E-07	2.37E-07	6.04E-09	7.54E-08
	NHWD [kg]	1.49E+00	1.10E-03	5.04E-03	2.81E+01
	BC [kg CO <sub>2</sub> eq]			2.49E+00	
	HWP [MJ]			1.70E+00	
	FE [MJ]			2.58E+01	
	BE [MJ]			8.40E-01	
NE [MJ]			6.74E+00		
OE [MJ]			6.77E-01		
Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
	AP [kg SO <sub>2</sub> eq]	2.40E-01	2.12E-02	6.68E-03	1.47E-02
	EP [kg N eq]	1.03E-02	1.73E-03	2.46E-04	2.44E-03
	GWP [kg CO <sub>2</sub> eq]	5.16E+01	4.12E+00	3.14E+00	3.04E+00
	ODP [kg CFC 11 eq]	-1.67E-12	3.92E-16	1.96E-14	8.16E-15
	POCP [kg O <sub>3</sub> eq]	2.10E+00	4.84E-01	2.70E+00	2.42E-01
	RPRE [MJ]	6.10E+01	1.81E+00	3.46E+00	2.46E+00
	NRPRE [MJ]	1.13E+03	5.86E+01	8.28E+01	3.62E+01
	FW [m3]	2.66E-01	6.98E-03	1.87E-02	4.66E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	5.51E+01	0.00E+00	1.38E+00	0.00E+00
	HWD [kg]	1.58E-06	4.74E-07	1.21E-08	1.51E-07
	NHWD [kg]	2.98E+00	2.20E-03	1.01E-02	5.62E+01
	BC [kg CO <sub>2</sub> eq]			4.98E+00	
	HWP [MJ]			3.39E+00	
	FE [MJ]			5.15E+01	
BE [MJ]			1.68E+00		
NE [MJ]			1.35E+01		
OE [MJ]			1.35E+00		

## » Interpretation

For all the products in study, the majority of the environmental impacts come from the Product Stage, which includes raw material sourcing, transportation and manufacturing. The only exception is POCP whose dominant source is Use & Maintenance Stage because of VOC emission in the curing process. From a functional unit perspective, the lifetime of the product and the coverage rate play a major role in scaling the impacts. This explains why products of coarse finishes have a higher impact than those of fine finishes.

## » Reference

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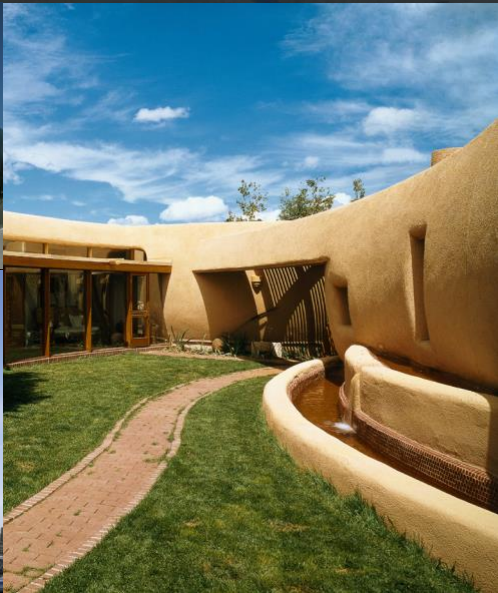
Building with conscience.





**EPD for Stolit® Lotusan®  
in varied textures**

Product Textures: 1.0, 1.0 Dark,  
1.5, 1.5 Dark, Freeform, Freeform  
Dark.

**Stolit® Lotusan®** is a ready-mixed exterior textured finish that mimics the self-cleaning capabilities of the lotus leaf. Replicating the lotus plant's ability to send raindrops rolling gently off its leaves, Stolit® Lotusan® resists dirt pick-up while keeping walls clean and attractive. Stolit® Lotusan® with Lotus-Effect® technology is designed for use as a finish coat over prepared vertical concrete, masonry or plaster substrates and in StoTherm® ci Lotusan® wall claddings.





<b>PCR Identification</b>	<b>PCR for Architectural Coatings: NAICS 325510 on the basis of ISO 21930: 2007, NSF International, 2017. Valid through June 23, 2022</b>
Compliance to to ISO 14040/44, ISO 14025 and ISO 21930	Yes
Product Category	Exterior Coating
Manufacturer's name	Sto Corp. 3800 Camp Creek Parkway SW, Building 1400, Suite 120 Atlanta, GA 30331 <a href="http://www.stocorp.com">www.stocorp.com</a>   (800) 221-2397
EPD program operator	Epsten Group 101 Marietta St. Suite 2600, Atlanta, GA 30303 <a href="http://www.epstengroup.com">www.epstengroup.com</a>
Declaration Number	01-002
Date of Certification	December 18 <sup>th</sup> , 2019
Period of Validity	5 years from date of certification
Functional Unit	One square meter of covered and protected substrate for 60 years
Market-base life used in assessment	10 Years
Design life used in assessment	5 Years
Test method employed for determination of design life	Product default warranty
Amount of colorant needed	See Table 3
Overall Data Quality Assessment Score	Good
Site(s) in which the results of the LCA are representative	STO manufacturing sites in Atlanta, Georgia; Glendale, Arizona; and Rutland, Vermont
Information on where explanatory material can be obtained	See references at the end of this document.
LCA Software and Version Number	GaBi 9.2.0.58
LCI Database and Version Number	GaBi Database Version 8.7, Service Pack 39
This declaration was independently verified in accordance with ISO 14025: 2006 and the reference PCR: PCR for Architectural Coatings: NAICS 325510 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Kate McFeaters <a href="mailto:kmcfeaters@epstengroup.com">kmcfeaters@epstengroup.com</a> 

Comparability

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.



## » Company

We believe in ‘**Building with conscience**’.

That means ensuring that all building products are not only safe, effective and easy to install, but also environmentally responsible and sustainable. We know you’re always looking for the smartest and newest technology to create energy efficient buildings with superior aesthetics.

That’s exactly what our products help you achieve. Products like our wall systems, coatings and finishes are consistent favorites among design professionals, contractors and property owners alike. Whatever your needs or vision may be, we offer products for every type of building project; whether it’s new construction, restoration or panelization, commercial or residential work.

An architect or specifier focuses on aesthetics and feasibility, a contractor needs products that are easy to work with, and a building owner requires high value and low costs on properties. Sto understands these unique needs, and delivers the smart, innovative materials and solutions that make this all possible. That’s why Sto remains the innovative leader in integrated exterior wall systems.

When you combine that commitment to product support and innovation with value-added offerings like consultative design and color services through [Sto Studio](#) or training in proper application techniques through the Sto Institute, you get an integrated exterior wall system solution unmatched in the industry.

## » Manufacturing Sites Covered in this EPD

Atlanta Plant

Glendale Plant

Rutland Plant

## » Product Identification

Stolit® Lotusan® finishes are offered in various coarseness and color bases that allow more freedom in building exterior designing and finishing. Table 1 lists the products declared in this EPD.

Table 1: List of Stolit® Lotusan® Products

Product Name	Product Number	Base Type	Finish Type
Stolit® Lotusan® 1.0	80190	Tintable White	Fine
Stolit® Lotusan® 1.0 Dark Colors	82190	Deep	Fine
Stolit® Lotusan® 1.5	80191	Tintable White	Medium
Stolit® Lotusan® 1.5 Dark Colors	82191	Deep	Medium
Stolit® Lotusan® Freeform	80193	Tintable White	Freeform
Stolit® Lotusan® Freeform Dark Colors	82193	Deep	Freeform

## » Product Description

Stolit® Lotusan® is a series of ready mixed, textured wall coating with Lotus-Effect® technology that mimics the self-cleaning capabilities of the lotus leaf. Stolit® Lotusan® with Lotus-Effect® technology is designed for use as a finish coating over prepared vertical above-grade concrete, masonry or plaster substrates and in StoTherm® Lotusan® Wall Claddings including StoTherm® ci Lotusan®. In this study, Lotusan® 1.0, 1.5 and Freeform are included. Same as Stolit®, two tint bases are offered.



## » Performance Features

Mildew Resistance	Ready Mixed	Moisture Resistance	Low VOC & Odor
Vapor Permeable	Integral Color	Water-based	Super Hydrophobic

## » Material Composition

The material compositions of Stolit® Lotusan® are listed below:

Table 2: Material composition for Stolit® Lotusan®

	Additives	Colorant	Limestone	Acrylic resin	Silica	Silicate	Surfactant	Water
Stolit® Lotusan® 1.0 Dark Colors	4.68%	0.60%	49.26%	5.01%	21.66%	2.68%	0.05%	15.45%
Stolit® Lotusan® 1.0	4.69%	0.60%	49.24%	5.04%	21.45%	2.70%	0.05%	15.62%
Stolit® Lotusan® 1.5 Dark Colors	4.68%	0.60%	49.98%	4.99%	20.88%	2.85%	0.05%	15.37%
Stolit® Lotusan® 1.5	4.68%	0.60%	49.72%	4.98%	21.37%	2.66%	0.05%	15.35%
Stolit® Lotusan® Freeform Dark Colors	4.73%	0.64%	60.60%	5.37%	8.37%	2.87%	0.11%	16.56%
Stolit® Lotusan® Freeform	4.73%	0.64%	60.06%	5.36%	8.36%	2.87%	0.13%	17.10%

## » Components related to Life Cycle Assessment

The functional unit for the LCA study was covering and protecting 1 square meter (m<sup>2</sup>) of substrate for a period of 60 years—the assumed lifetime of a building. The reference flow required for the functional unit is calculated based on the product lifespan scenarios prescribed in the PCR. The market-based lifetime is 10 years, and the design lifetime is determined either based on quality determined by ASTM tests or on the product warrant. By default, Stolit® Lotusan® finishes have a 5-year warranty. In case a finish is applied on Sto’s wall systems, the warranty is extended to 10 years. In this EPD, default warranty is adopted as the design lifetime. The reference flow required for one functional unit is provided in Table 3.

Table 3: Market-based lifetime and reference flow

	Functional Unit	Reference Flow [kg]	Tint needed* [kg]	Reference Flow [kg]	Tint needed* [kg]
Lifespan		Design Lifetime [5 years]		Market-based Lifetime [10 years]	
Stolit® Lotusan® 1.0 Dark Colors	1	29.16	2.60	14.58	1.30
Stolit® Lotusan® 1.0	1	29.16	0.77	14.58	0.38
Stolit® Lotusan® 1.5 Dark Colors	1	33.56	3.00	16.79	1.50
Stolit® Lotusan® 1.5	1	33.56	0.88	16.79	0.44
Stolit® Lotusan® Freeform Dark Colors	1	52.32	4.66	26.16	2.33
Stolit® Lotusan® Freeform	1	52.32	1.37	26.16	0.69

### » Scope and Boundaries of the Life Cycle Assessment

The LCA was performed in accordance with ISO 14040 standards. The study is a cradle-to-grave LCA and includes the following life stages as prescribed in the PCR.

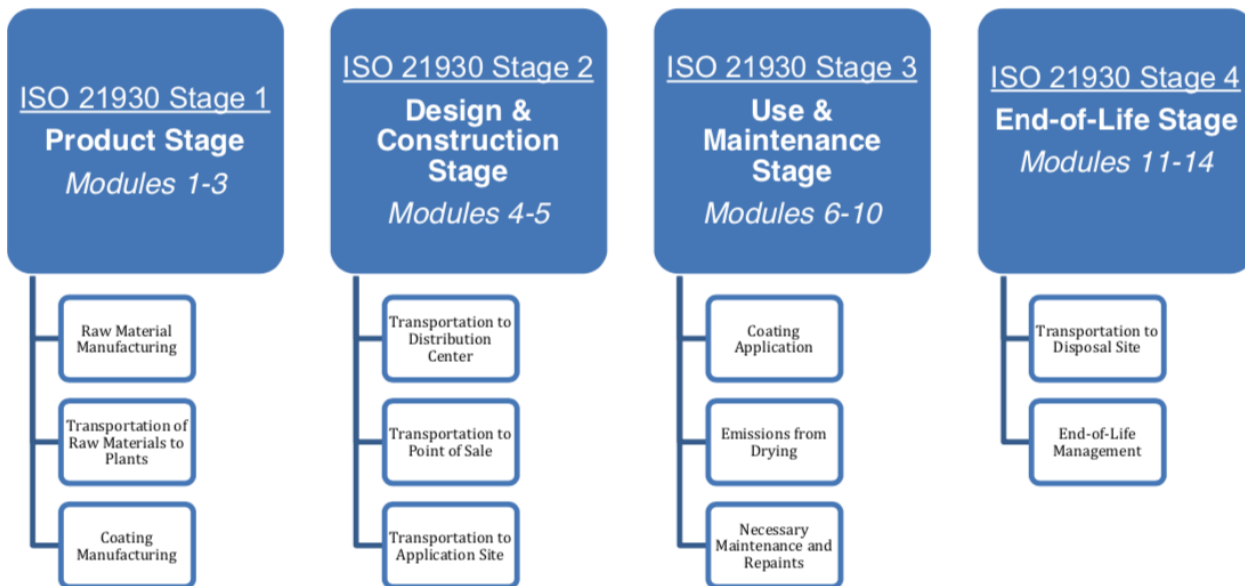


Figure 1: Life stages for the cradle-to-grave LCA

## »» Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

## »» Data Quality

The overall data quality level was determined to be good. Primary data was collected from Sto's facilities in Atlanta, GA, Glendale, AZ and Rutland, VT for the 2018 reference year. When primary data did not exist, secondary data were obtained from the Gabi V8.7 Database Service Pack 39. Overall, both primary and secondary data are considered good quality in terms of geographic, temporal and technological coverage.

## »» Estimates and Assumption

Assumptions were made to represent the cradle-to-grave environmental performance of Sto's products. These assumptions were made in accordance with the PCR and include the transportation distances, the disposal of packaging material and the product at its end of life and use phase assumptions.

## »» Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis.

## »» Product Stage

Stolit® Lotusan® is produced at Sto's Atlanta, GA, Glendale, AZ and Rutland, VT facilities. This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by Sto. Stolit® Lotusan® is supplied in 5-gallon pails.

## »» Design and Construction Stage

The design and construction process stage starts with the packaged product leaving the production site and ends with being delivered to the application site.

During this stage, the finished product is moved from a shipping dock for distribution. The end gate is the application site after the purchaser acquires the finished product and transports it to the application site.

## »» Use and Maintenance Stage

The use stage begins when the user prepares the product before applying it to a substrate and ends with any leftover coating and discarded packaging entering the end-of-life stage. Detailed application instructions are provided online. The application procedure includes mixing and applying. As recommended, an electric drill/mixer and a spray pump are assumed to be used for mixing and application. The equipment is not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible, but electricity to power application tools has been included.

As prescribed in the PCR, 10% of the wet mass of Stolit® is assumed to be unused and properly disposed of.

## »» End-of-Life Stage

Waste Flow	Recycling	Incineration	Landfilling
Paper Packaging	66.6%	6.01%	27.39%
Steel Packaging	33.3%	12.01%	54.69%
Plastic Packaging	9.1%	16.36%	74.54%
Unused Product	0%	0%	100%
Post-Consumer Product	0%	0%	100%

In this stage, the disposal of installation waste, packaging waste and product waste at its end of life is included. The disposal pathway of each waste stream is modeled based on the recommendation of PCR and US EPA's latest waste management fact sheet.

## » Life Cycle Assessment Results

As prescribed by the PCR, TRACI 2.1 impact characterization methodology and IPCC 5th assessment report are adopted to calculate the environment impacts. Table 4 provides the acronym key of the impact indicators declared in this EPD.

Table 4: LCIA impact category and LCI Indicator keys

Abbreviation	Parameter	Unit
TRACI 2.1		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
GWP	Global warming potential including biogenic carbon emission	kg CO <sub>2</sub> eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
POCP	Photochemical ozone creation potential	kg O <sub>3</sub> eq
Resource Use Parameters		
RPR	Use of renewable primary energy	MJ, net calorific value (LHV)
RMR	Use of renewable Material Resources	kg
NRER	Depletion of Non-Renewable Energy Resources	MJ, net calorific value
NRMR	Depletion of Non-Renewable Material Resources	kg
FW	Consumption of Freshwater	m <sup>3</sup>
Waste Parameters		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
Biogenic Carbon Parameter		
BC	Biogenic Carbon	kg CO <sub>2</sub> eq
Energy Differentiation Parameters		
HWP	Hydro/wind Power	MJ, net calorific value (LHV)
FE	Fossil Energy	MJ, net calorific value (LHV)
BE	Bio-energy	MJ, net calorific value (LHV)
NE	Nuclear Energy	MJ, net calorific value (LHV)
OE	Other Energy	MJ, net calorific value (LHV)

» Stolit® Lotusan® 1.0 Dark Colors

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	6.23E-02	5.83E-03	6.11E-03	4.19E-03	
	EP [kg N eq]	3.64E-03	4.75E-04	2.23E-04	6.81E-04	
	GWP [kg CO <sub>2</sub> eq]	1.45E+01	1.13E+00	2.90E+00	8.70E-01	
	ODP [kg CFC 11 eq]	-5.00E-13	1.08E-16	1.83E-14	2.35E-15	
	POCP [kg O <sub>3</sub> eq]	8.08E-01	1.33E-01	1.15E+00	6.94E-02	
	RPRE [MJ]	4.25E+01	4.97E-01	3.10E+00	7.14E-01	
	NRPRE [MJ]	2.95E+02	1.61E+01	7.69E+01	1.04E+01	
	FW [m3]	7.57E-02	1.91E-03	1.73E-02	1.34E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.52E+01	0.00E+00	1.30E+00	0.00E+00	
	HWD [kg]	8.52E-07	1.30E-07	1.09E-08	4.34E-08	
	NHWD [kg]	1.83E+00	6.06E-04	9.13E-03	1.61E+01	
	BC [kg CO <sub>2</sub> eq]			5.29E+00		
	HWP [MJ]			9.34E-01		
	FE [MJ]			1.42E+01		
	BE [MJ]			4.62E-01		
	NE [MJ]			3.71E+00		
	OE [MJ]			3.72E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.25E-01	1.17E-02	1.22E-02	8.38E-03
EP [kg N eq]		7.28E-03	9.50E-04	4.46E-04	1.36E-03	
GWP [kg CO <sub>2</sub> eq]		2.90E+01	2.26E+00	5.80E+00	1.74E+00	
ODP [kg CFC 11 eq]		-1.00E-12	2.16E-16	3.66E-14	4.70E-15	
POCP [kg O <sub>3</sub> eq]		1.62E+00	2.66E-01	2.30E+00	1.39E-01	
RPRE [MJ]		8.50E+01	9.94E-01	6.20E+00	1.43E+00	
NRPRE [MJ]		5.90E+02	3.22E+01	1.54E+02	2.08E+01	
FW [m3]		1.51E-01	3.82E-03	3.46E-02	2.68E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.03E+01	0.00E+00	2.60E+00	0.00E+00	
HWD [kg]		1.70E-06	2.60E-07	2.18E-08	8.68E-08	
NHWD [kg]		3.66E+00	1.21E-03	1.83E-02	3.22E+01	
BC [kg CO <sub>2</sub> eq]				1.06E+01		
HWP [MJ]				1.87E+00		
FE [MJ]				2.83E+01		
BE [MJ]				9.23E-01		
NE [MJ]				7.42E+00		
OE [MJ]				7.45E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	8.00E-02	5.83E-03	1.86E-03	4.01E-03	
	EP [kg N eq]	3.36E-03	4.75E-04	6.83E-05	6.72E-04	
	GWP [kg CO <sub>2</sub> eq]	1.50E+01	1.13E+00	8.76E-01	8.31E-01	
	ODP [kg CFC 11 eq]	-4.92E-13	1.08E-16	5.47E-15	2.22E-15	
	POCP [kg O <sub>3</sub> eq]	7.67E-01	1.33E-01	1.12E+00	6.59E-02	
	RPRE [MJ]	4.13E+01	4.98E-01	9.63E-01	6.69E-01	
	NRPRE [MJ]	2.93E+02	1.61E+01	2.31E+01	9.85E+00	
	FW [m3]	7.61E-02	1.92E-03	5.22E-03	1.27E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.52E+01	0.00E+00	3.80E-01	0.00E+00	
	HWD [kg]	8.49E-07	1.30E-07	3.37E-09	4.11E-08	
	NHWD [kg]	1.84E+00	6.06E-04	2.81E-03	1.53E+01	
	BC [kg CO <sub>2</sub> eq]			5.20E+00		
	HWP [MJ]			9.33E-01		
	FE [MJ]			1.42E+01		
	BE [MJ]			4.61E-01		
	NE [MJ]			3.71E+00		
	OE [MJ]			3.72E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.60E-01	1.17E-02	3.72E-03	8.02E-03
EP [kg N eq]		6.72E-03	9.50E-04	1.37E-04	1.34E-03	
GWP [kg CO <sub>2</sub> eq]		3.00E+01	2.26E+00	1.75E+00	1.66E+00	
ODP [kg CFC 11 eq]		-9.84E-13	2.16E-16	1.09E-14	4.44E-15	
POCP [kg O <sub>3</sub> eq]		1.53E+00	2.66E-01	2.24E+00	1.32E-01	
RPRE [MJ]		8.26E+01	9.96E-01	1.93E+00	1.34E+00	
NRPRE [MJ]		5.86E+02	3.22E+01	4.62E+01	1.97E+01	
FW [m3]		1.52E-01	3.84E-03	1.04E-02	2.54E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.03E+01	0.00E+00	7.60E-01	0.00E+00	
HWD [kg]		1.70E-06	2.60E-07	6.74E-09	8.22E-08	
NHWD [kg]		3.68E+00	1.21E-03	5.62E-03	3.06E+01	
BC [kg CO <sub>2</sub> eq]				1.04E+01		
HWP [MJ]				1.87E+00		
FE [MJ]				2.83E+01		
BE [MJ]				9.23E-01		
NE [MJ]				7.41E+00		
OE [MJ]				7.44E-01		

» Stolit® Lotusan® 1.5 Dark Colors

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	6.98E-02	6.71E-03	7.02E-03	4.82E-03	
	EP [kg N eq]	3.76E-03	5.47E-04	2.56E-04	7.84E-04	
	GWP [kg CO <sub>2</sub> eq]	1.68E+01	1.31E+00	3.33E+00	1.00E+00	
	ODP [kg CFC 11 eq]	-5.83E-13	1.24E-16	2.11E-14	2.70E-15	
	POCP [kg O <sub>3</sub> eq]	8.62E-01	1.53E-01	1.32E+00	7.99E-02	
	RPRE [MJ]	4.70E+01	5.73E-01	3.56E+00	8.22E-01	
	NRPRE [MJ]	3.32E+02	1.85E+01	8.86E+01	1.20E+01	
	FW [m <sup>3</sup> ]	8.52E-02	2.21E-03	1.99E-02	1.54E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.75E+01	0.00E+00	1.50E+00	0.00E+00	
	HWD [kg]	9.85E-07	1.50E-07	1.25E-08	4.99E-08	
	NHWD [kg]	2.10E+00	6.98E-04	1.05E-02	1.86E+01	
	BC [kg CO <sub>2</sub> eq]			6.13E+00		
	HWP [MJ]			1.08E+00		
	FE [MJ]			1.63E+01		
	BE [MJ]			5.32E-01		
	NE [MJ]			4.27E+00		
	OE [MJ]			4.29E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.40E-01	1.34E-02	1.40E-02	9.64E-03
EP [kg N eq]		7.52E-03	1.09E-03	5.12E-04	1.57E-03	
GWP [kg CO <sub>2</sub> eq]		3.36E+01	2.62E+00	6.66E+00	2.00E+00	
ODP [kg CFC 11 eq]		-1.17E-12	2.48E-16	4.22E-14	5.40E-15	
POCP [kg O <sub>3</sub> eq]		1.72E+00	3.06E-01	2.64E+00	1.60E-01	
RPRE [MJ]		9.40E+01	1.15E+00	7.12E+00	1.64E+00	
NRPRE [MJ]		6.64E+02	3.70E+01	1.77E+02	2.40E+01	
FW [m <sup>3</sup> ]		1.70E-01	4.42E-03	3.98E-02	3.08E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.49E+01	0.00E+00	3.00E+00	0.00E+00	
HWD [kg]		1.97E-06	3.00E-07	2.50E-08	9.98E-08	
NHWD [kg]		4.20E+00	1.40E-03	2.10E-02	3.72E+01	
BC [kg CO <sub>2</sub> eq]				1.23E+01		
HWP [MJ]				2.15E+00		
FE [MJ]				3.26E+01		
BE [MJ]				1.06E+00		
NE [MJ]				8.54E+00		
OE [MJ]				8.58E-01		



	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage	
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	9.14E-02	6.71E-03	2.14E-03	4.62E-03	
	EP [kg N eq]	3.86E-03	5.47E-04	7.86E-05	7.74E-04	
	GWP [kg CO <sub>2</sub> eq]	1.72E+01	1.31E+00	1.01E+00	9.57E-01	
	ODP [kg CFC 11 eq]	-5.68E-13	1.24E-16	6.30E-15	2.55E-15	
	POCP [kg O <sub>3</sub> eq]	8.80E-01	1.53E-01	1.29E+00	7.58E-02	
	RPRE [MJ]	4.74E+01	5.73E-01	1.11E+00	7.70E-01	
	NRPRE [MJ]	3.35E+02	1.85E+01	2.65E+01	1.13E+01	
	FW [m3]	8.69E-02	2.21E-03	6.01E-03	1.46E-03	
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	NRMR [kg]	1.75E+01	0.00E+00	4.40E-01	0.00E+00	
	HWD [kg]	9.78E-07	1.50E-07	3.88E-09	4.73E-08	
	NHWD [kg]	2.12E+00	6.98E-04	3.23E-03	1.76E+01	
	BC [kg CO <sub>2</sub> eq]			5.98E+00		
	HWP [MJ]			1.07E+00		
	FE [MJ]			1.63E+01		
	BE [MJ]			5.31E-01		
	NE [MJ]			4.27E+00		
	OE [MJ]			4.29E-01		
	Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
		AP [kg SO <sub>2</sub> eq]	1.83E-01	1.34E-02	4.28E-03	9.24E-03
EP [kg N eq]		7.72E-03	1.09E-03	1.57E-04	1.55E-03	
GWP [kg CO <sub>2</sub> eq]		3.44E+01	2.62E+00	2.02E+00	1.91E+00	
ODP [kg CFC 11 eq]		-1.14E-12	2.48E-16	1.26E-14	5.10E-15	
POCP [kg O <sub>3</sub> eq]		1.76E+00	3.06E-01	2.58E+00	1.52E-01	
RPRE [MJ]		9.48E+01	1.15E+00	2.22E+00	1.54E+00	
NRPRE [MJ]		6.70E+02	3.70E+01	5.30E+01	2.26E+01	
FW [m3]		1.74E-01	4.42E-03	1.20E-02	2.92E-03	
RMR [kg]		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRMR [kg]		3.49E+01	0.00E+00	8.80E-01	0.00E+00	
HWD [kg]		1.96E-06	3.00E-07	7.76E-09	9.46E-08	
NHWD [kg]		4.24E+00	1.40E-03	6.46E-03	3.52E+01	
BC [kg CO <sub>2</sub> eq]				1.20E+01		
HWP [MJ]				2.15E+00		
FE [MJ]				3.26E+01		
BE [MJ]				1.06E+00		
NE [MJ]				8.54E+00		
OE [MJ]				8.57E-01		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	1.13E-01	1.05E-02	1.10E-02	7.51E-03
	EP [kg N eq]	6.53E-03	8.52E-04	3.99E-04	1.22E-03
	GWP [kg CO <sub>2</sub> eq]	2.57E+01	2.04E+00	5.20E+00	1.56E+00
	ODP [kg CFC 11 eq]	-7.86E-13	1.93E-16	3.28E-14	4.22E-15
	POCP [kg O <sub>3</sub> eq]	1.46E+00	2.39E-01	2.06E+00	1.25E-01
	RPRE [MJ]	7.50E+01	8.93E-01	5.56E+00	1.28E+00
	NRPRE [MJ]	5.27E+02	2.89E+01	1.38E+02	1.88E+01
	FW [m3]	1.35E-01	3.44E-03	3.10E-02	2.41E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	2.72E+01	0.00E+00	2.33E+00	0.00E+00
	HWD [kg]	1.54E-06	2.34E-07	1.95E-08	7.78E-08
	NHWD [kg]	3.15E+00	1.09E-03	1.64E-02	2.89E+01
	BC [kg CO <sub>2</sub> eq]			9.44E+00	
	HWP [MJ]			1.68E+00	
FE [MJ]			2.54E+01		
BE [MJ]			8.28E-01		
NE [MJ]			6.65E+00		
OE [MJ]			6.68E-01		
Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
	AP [kg SO <sub>2</sub> eq]	2.26E-01	2.10E-02	2.20E-02	1.50E-02
	EP [kg N eq]	1.31E-02	1.70E-03	7.98E-04	2.44E-03
	GWP [kg CO <sub>2</sub> eq]	5.14E+01	4.08E+00	1.04E+01	3.12E+00
	ODP [kg CFC 11 eq]	-1.57E-12	3.86E-16	6.56E-14	8.44E-15
	POCP [kg O <sub>3</sub> eq]	2.92E+00	4.78E-01	4.12E+00	2.50E-01
	RPRE [MJ]	1.50E+02	1.79E+00	1.11E+01	2.56E+00
	NRPRE [MJ]	1.05E+03	5.78E+01	2.76E+02	3.76E+01
	FW [m3]	2.70E-01	6.88E-03	6.20E-02	4.82E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	5.44E+01	0.00E+00	4.66E+00	0.00E+00
	HWD [kg]	3.08E-06	4.68E-07	3.90E-08	1.56E-07
	NHWD [kg]	6.30E+00	2.18E-03	3.28E-02	5.78E+01
	BC [kg CO <sub>2</sub> eq]			1.89E+01	
HWP [MJ]			3.35E+00		
FE [MJ]			5.08E+01		
BE [MJ]			1.66E+00		
NE [MJ]			1.33E+01		
OE [MJ]			1.34E+00		

	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
Market-based lifetime	AP [kg SO <sub>2</sub> eq]	1.42E-01	1.05E-02	3.34E-03	7.20E-03
	EP [kg N eq]	5.78E-03	8.52E-04	1.23E-04	1.21E-03
	GWP [kg CO <sub>2</sub> eq]	2.60E+01	2.04E+00	1.57E+00	1.49E+00
	ODP [kg CFC 11 eq]	-6.63E-13	1.93E-16	9.82E-15	3.98E-15
	POCP [kg O <sub>3</sub> eq]	1.27E+00	2.39E-01	2.01E+00	1.18E-01
	RPRE [MJ]	7.24E+01	8.93E-01	1.73E+00	1.20E+00
	NRPRE [MJ]	5.15E+02	2.89E+01	4.14E+01	1.77E+01
	FW [m3]	1.35E-01	3.44E-03	9.37E-03	2.28E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	2.72E+01	0.00E+00	6.90E-01	0.00E+00
	HWD [kg]	1.46E-06	2.34E-07	6.04E-09	7.37E-08
	NHWD [kg]	3.17E+00	1.09E-03	5.04E-03	2.74E+01
	BC [kg CO <sub>2</sub> eq]			9.24E+00	
	HWP [MJ]			1.67E+00	
	FE [MJ]			2.54E+01	
	BE [MJ]			8.28E-01	
NE [MJ]			6.65E+00		
OE [MJ]			6.68E-01		
Design lifetime	Indicator	1. Product Stage	2. Design & Construction Stage	3. Use & Maintenance Stage	4. End-of-Life Stage
	AP [kg SO <sub>2</sub> eq]	2.84E-01	2.10E-02	6.68E-03	1.44E-02
	EP [kg N eq]	1.16E-02	1.70E-03	2.46E-04	2.42E-03
	GWP [kg CO <sub>2</sub> eq]	5.20E+01	4.08E+00	3.14E+00	2.98E+00
	ODP [kg CFC 11 eq]	-1.33E-12	3.86E-16	1.96E-14	7.96E-15
	POCP [kg O <sub>3</sub> eq]	2.54E+00	4.78E-01	4.02E+00	2.36E-01
	RPRE [MJ]	1.45E+02	1.79E+00	3.46E+00	2.40E+00
	NRPRE [MJ]	1.03E+03	5.78E+01	8.28E+01	3.54E+01
	FW [m3]	2.70E-01	6.88E-03	1.87E-02	4.56E-03
	RMR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRMR [kg]	5.44E+01	0.00E+00	1.38E+00	0.00E+00
	HWD [kg]	2.92E-06	4.68E-07	1.21E-08	1.47E-07
	NHWD [kg]	6.34E+00	2.18E-03	1.01E-02	5.48E+01
	BC [kg CO <sub>2</sub> eq]			1.85E+01	
	HWP [MJ]			3.35E+00	
	FE [MJ]			5.08E+01	
BE [MJ]			1.66E+00		
NE [MJ]			1.33E+01		
OE [MJ]			1.34E+00		

## » Interpretation

For all the products in study, the majority of the environmental impacts come from the Product Stage, which includes raw material sourcing, transportation and manufacturing. The only exception is POCP whose dominant source is Use & Maintenance Stage because of VOC emission in the curing process. From a functional unit perspective, the lifetime of the product and the coverage rate play a major role in scaling the impacts. This explains why products of coarse finishes have a higher impact than those of fine finishes.

## » Reference

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