Environmental Product Declaration

Siplast Parasolo® PVC KEE Fleeceback Membrane

Siplast is the industry leader in the development and manufacture of advanced, high-performance roofing and waterproofing systems. Since the 1960s, Siplast has been manufacturing high performance products like SBS-modified bitumens to address the changing requirements of modern construction. We have always understood that certain times and unique situations call for different and evolving solutions. That's why we also offer PMMA liquid resin products, single-ply systems, vegetated and reflective white roof systems, reroofable lightweight insulating concrete roof insulation, and a host of other systems. Siplast is with you every step of the way to ensure your project vision fulfills the positive ways you want your work to impact the world. For more information about Siplast, visit www.Siplast.com.

Parasolo® KEE Fleeceback is a high-performing, single-ply membrane utilizing a PVC blend with Ketone Ethylene Ester (KEE) and a non-wicking polyester scrim reinforcement.

Certified Environmental Product Declaration
www.nsf.org

Environmental Product Declaration

Siplast Parasolo® PVC KEE Fleeceback Membrane

Single Ply Roofing Membrane (PVC)

According to ISO 14025, ISO 14044, and ISO 21930:2017

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and ISO 21930-2017. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g., Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	NSF International, 789 N. Dixboro Rd, Ann Arbor, MI 48105, www.nsf.org		
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	NSF Certification Policies for Environmental Product Declarations (EPD): November 1, 2022		
MANUFACTURER NAME AND ADDRESS	Siplast 14911 Quorum Drive, Suite 600 Dallas, TX 752545		
DECLARATION NUMBER	EPD11329		
DECLARED PRODUCT & FUNCTIONAL UNIT	Siplast Parasolo® PVC KEE Fleeceback Membrane Functional Unit = 1 m²		
REFERENCE PCR AND VERSION NUMBER	NSF International: Product Category Rule for Environmental Product Declarations for Single Ply Roofing Membranes, Version 2, Issued 2019 Valid through July 17, 2024		
DESCRIPTION OF PRODUCT APPLICATION/USE	Single Ply Roofing Membrane (PVC)		
PRODUCT RSL DESCRIPTION	40 years		
MARKETS OF APPLICABILITY	Global		
DATE OF ISSUE	August 5, 2026		
PERIOD OF VALIDITY	5 Years		
EPD TYPE	Product Specific		
DATASET VARIABILITY	N/A		
EPD SCOPE	Cradle-to-Grave		
YEAR(S) OF REPORTED PRIMARY DATA	2021		
LCA SOFTWARE & VERSION NUMBER	LCA for Experts v. 10.6		
LCI DATABASE(S) & VERSION NUMBER	Sphera database & USLCI v2.0		
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1; CML 4.1		
The sub-category PCR review was conducted by:	Dr. Thomas P. Gloria, PhD Industrial Ecology Consultants t.gloria@industrial-ecology.com	Mr. Jack Geibig EcoForm jgeibig@ecoform.com	Dr. Michael Overcash Environmental Clarity mrovercash@earthlink.net
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2 (Dec 2018), based on ISO 21930:2017, serves as the core PCR, with additional considerations from CEN Norm EN 15804 (2013) and the USGBC/UL Environment Part A Enhancement (2017) ☐ INTERNAL ☒ EXTERNAL	Joseph Geibig - 		
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Sustainable Solutions Corporation		
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Jack Geibig, EcoForm, LLC jgeibig@ecoform.com 		

Environmental declarations from different programs (ISO 14025) may not be comparable.

Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

Environmental Product Declaration

Siplast Parasolo® PVC KEE Fleeceback Membrane

Single Ply Roofing Membrane (PVC)

According to ISO 14025, ISO 14044, and ISO 21930:2017

General Information

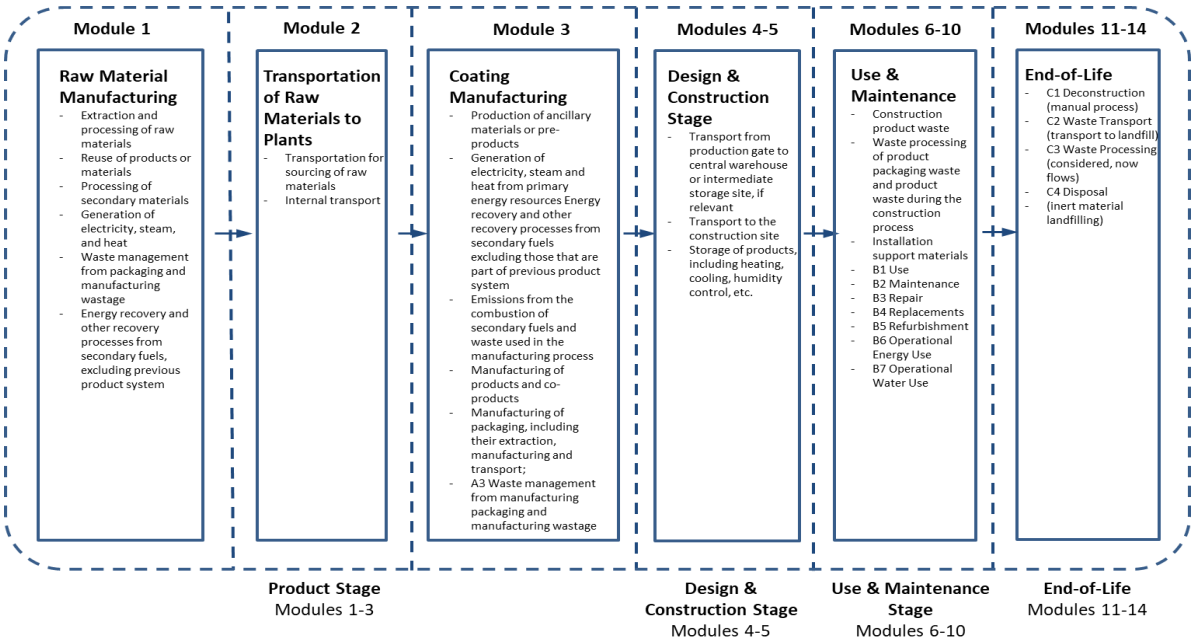
Description of Company/Organization

Siplast is the industry leader in the development and manufacture of advanced, high-performance roofing and waterproofing systems. Since the 1960s, Siplast has been manufacturing high performance products like SBS-modified bitumens to address the changing requirements of modern construction. We have always understood that certain times and unique situations call for different and evolving solutions. That's why we also offer PMMA liquid resin products, single-ply systems, vegetated and reflective white roof systems, reroofable lightweight insulating concrete roof insulation, and a host of other systems. Siplast is with you every step of the way to ensure your project vision fulfills the positive ways you want your work to impact the world. For more information about Siplast, visit www.Siplast.com.

Product Description

Parasolo® PVC KEE Fleeceback membrane is a single-ply roofing product and is designed to be used as an outer roof layer, either in new construction or re-roofing applications. It is made of two layers of polyvinyl chloride (PVC) bonded to a layer of polyester scrim in the middle. This configuration meets all the inherent properties and performance for which PVC is known, including longevity, flexibility, and reflectivity.

Flow Diagram



Manufacturer Specific EPD

This product-specific EPD was developed as a cradle-to-grave (modules A1-C4) Life Cycle Assessment. This EPD accounts for raw material extraction and processing, transport, product manufacturing, distribution, installation, usage, and disposal. Manufacturing data were gathered directly from company personnel. Product representation were determined from the manufacturing inventory based on total production in the reference year. Product formulations are consistent between different thicknesses of this product.

Application

Parasolo® PVC KEE Fleeceback membrane is a single-ply roofing product and is designed to be used as an outer roof layer, either in new construction or re-covering applications.

Material Composition

The primary product components and/or materials must be indicated as a percentage mass to enable the user of the EPD to understand the composition of the product in delivery status.

The composition of a Siplast Parasolo® PVC KEE Fleeceback Membrane Single Ply Roofing Membrane (PVC) is as follows:

	Percentage in mass (%)
Material*	**Value**
PVC Resin	35-55%
KEE	10-30%
Filler	5-20%
Plasticizer	5-20%
Pigment	1-15%
UV Additives	0.25-3%
Biocide	0-3%
Fleeceback	5-15%
Total	**100.00%**

*The GAF product modelled in this study contains no substances that are required to be reported as hazardous, nor are any such substances utilized in its production.

Database Material*	Database Source	Data set valid until _____
Polyvinyl chloride granulate (Suspension, S-PVC)	Sphera	2023
Polyethylene High Density Granulate	Sphera	2023
Polyester Resin (unsaturated) (UP)	Sphera	2023
Polyethylene terephthalate bottle grade granulate (PET) via PTA	Sphera	2023

*Propriety ingredients are not disclosed in this EPD, in accordance with the PCR. These ingredients were modelled using Sphera 2020-2023, ECPI 2019, and USLCI 2003-2016 databases.

Technical Data

Technical details for this product are presented below.

		Fleeceback Sheets*		
PROPERTY (As Manufactured)	**TEST METHOD**	**50 mil**	**60 mil**	**80 mil**
Nominal Thickness Over Scrim	ASTM D7635	0	29.2 mil (0.74 mm)	39.7 mil (1.01 mm)
Breaking Strength	ASTM D751	>380 lbf (1690 N)	>390 lbf (1734 N)	>480 lbf (2135 N)
Seam Strength	ASTM D751	>342 lbf (1521 N)	>390 lbf (1734 N)	>480 lbf (2135 N)
Elongation at Break	ASTM D751	>30%	>30%	>30%
Tear Strength	ASTM D751	>140 lbf (622 N)	>129 lbf (573 N)	>112 lbf (498 N)
Static Puncture Resistance	ASTM D5602	33 lbf (145 N)	33 lbf (145 N)	33 lbf (145 N)
Dynamic Puncture Resistance	ASTM D5635	20J (14.7ft-lbf)	20J (14.7ft-lbf)	20J (14.7ft-lbf)
Accelerated Weathering (Siplast Values†)	ASTM G154†	>179,000 kJ/m² >32,000 h	>179,000 kJ/m² >32,000 h	>179,000 kJ/m² >32,000 h
	ASTM G155‡	>76,800 kJ/m² >30,500 h	>76,800 kJ/m² >30,500 h	>76,800 kJ/m² >30,500 h

*Values stated are approximate and subject to normal manufacturing variation. These values are not guaranteed and are provided solely as a guide.

† ASTM G154 requires an irradiance level of 0.68 W/(m²·nm) at 340 nm. Siplast has tested with 1.55 W/(m²·nm) at 340 nm.

‡ ASTM G155 requires an irradiance level of 0.35 W/(m²·nm) at 340 nm. Siplast has tested with 0.7 W/(m²·nm) at 340 nm.

Placing on the Market / Application Rules

The standards that can be applied for PVC KEE Fleeceback are:
- ASTM D4434 - 21 Type III
- FM Approved (refer to www.roofnav.com for actual assemblies)
- UL listed in ANSI/UL790 Class A
- State of Florida Approved
- Can be used to comply with 2019 Title 24, Part 6, Cool Roof requirements of the California Code of Regulations

Properties of Declared Product as Shipped

After manufacturing, the product is prepared for shipment to the customer. The membrane is reeled on a cardboard core and wrapped in plastic film. Additional packaging materials include product labels, a cardboard protective sheet and steel strap. The product is then shipped on wooden pallets to the customer.

Methodological Framework

Functional Unit

The declaration refers to the functional unit of 1000 m² of installed single-ply roofing membrane, including seams as specified in the PCR.

Name	Value			Unit
Functional Unit	1000 m²			
Weight per functional unit	1588	1878	2368	kg
Thickness to achieve functional unit	50	60	80	mm

System Boundary

This is a cradle-to-grave Environmental Product Declaration intended for Business-to-Business (B2B) purposes. The following life cycle phases were considered:

Product Stage			Construction Process Stage		Use Stage							End-of-Life Stage*				Benefits and Loads Beyond the System Boundaries
Raw material supply	Transport	Manufacturing	Transport from gate to the site	Construction/ installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction /demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

Description of the System Boundary Stages Corresponding to the PCR

(X = Included; MND = Module Not Declared)

*This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of waste state or disposal of final residues.

Reference Service Life

The use phase follows the installation of single ply roof membranes. In a roofing system, the weatherproof membrane is the uppermost layer and protects the building from the elements.. The roof membrane, when installed properly and adequately maintained, protects the interior of the building from the environmental elements and weather during its use. As defined in the governing PCR, the Building Estimated Service Life (ESL) is 75 years. The necessary steps for providing weather protection are specified by manufacturer installation instructions and are mandated by model building codes. The roof membrane's useful life span is influenced by many variables including roof system design, quality of the installation, type and durability of the membrane, roof system component configuration and maintenance as well as weather conditions and events. Real world reroofing scenarios, building owner tendencies, and the expected service life of roof membranes all indicate that reroofing activity will take place during the 75-year building ESL. Reroofing activity may initially occur at 40 years after the installation of the original system when appropriate designs are developed, proper installation is done, and regular maintenance occurs. When reroofing is required, generally, 2 options are available to address the need for a new roof membrane or system. The model building codes describe a "Roof Recover" as an acceptable reroofing practice, which occurs when a new roof covering is installed on top of the existing roof system without disturbing or removing the existing roof covering or the insulation below. Roof Recover, as defined by industry practices, involves visual examination and appropriate testing to ensure that all roof components, including insulation, have not sustained damage or deterioration. This approach allows the existing roof system to remain in place instead of being disposed of into a landfill. The Roof Recover approach is a common practice in the roofing industry, it is permitted by model building codes. Although the Roof Recover approach is a common practice, it is often not captured in reroofing studies available in the public domain, which typically contemplate a full roof replacement. "Roof Replacement" is a common occurrence at the end of the current roof's service life. This process involves the removal of all roof components down to the roof deck, and all components are replaced above the deck, including barrier boards at deck level, air barriers, insulation, coverboards, and weatherproof membrane. This study conservatively assumes all materials are disposed of in a landfill during a Roof Replacement. Therefore, roof membranes' cradle-to-grave assessment incorporates all life cycle stage environmental impacts connected with the original building construction, a Roof Replacement operation at 40-years. For the purposes of calculating the replacement impacts in the B4 modules, this translates to 0.9 replacement cycles for the roofing membrane during the 75-year building ESL (75-year ESL/40-year RSL minus the initial installation = 0.9 replacement cycles).

The only product use phase applicable is the replacement phase (B4), which accounts for the impacts for the replacement cycle at the 40-year RSL. All other use phase stages are considered to be zero for Siplast Parasolo® PVC KEE Fleeceback Membranes and will not be included on results tables.

This Reference Service Life (RSL) is provided solely for life cycle assessment purposes. The actual service life of a roofing membrane may vary based on material specifications, environmental stressors, installation quality, ventilation, building usage and maintenance. This assessment provides no warranty, express or implied, and does not supersede the terms of the manufacturer's warranties or guarantees.

Allocation

Allocation was conducted based on total production mass. All data from Cedar City are primary data and they were collected from facility personnel.

To produce roofing products, energy, water and materials go into the process and waste and emissions are outputs from the manufacturing process. The facility data were allocated by mass (methodology confirmed by site personnel) to determine benchmarked values of manufacturing requirements per unit mass or product. These benchmarked values were averaged for products made at multiple facilities using total production by mass.

Cut-off Criteria

Processes whose total contribution to the final result, with respect to their mass and in relation to all considered impact categories, is less than 1% can be neglected. The sum of the neglected processes may not exceed 5% by mass of the considered impact categories. For that a documented assumption is admissible.

Processes whose total contribution to the final result, with respect to their energy and in relation to all considered impact categories, is less than 1% can be neglected. The sum of the neglected processes may not exceed 5% by energy of the considered impact categories. For that a documented assumption is admissible.

For Hazardous Substances the following requirements apply:

- The Life Cycle Inventory (LCI) of hazardous substances will be included, if the inventory is available.
- If the LCI for a hazardous substance is not available, the substance will appear as an input in the LCI of the product, if its mass represents more than 0.1% of the product composition.
- If the LCI of a hazardous substance is approximated by modeling another substance, documentation will be provided.

The GAF product modelled in this study contains no substances that are required to be reported as hazardous, nor are any such substances utilized in its production

This EPD is in compliance with the cut-off criteria. No processes were neglected or excluded. Capital items for the production processes (machine, buildings, etc.) were not taken into consideration.

Data Sources

Primary data were collected for every process in the product system under the control of Siplast. Secondary data from the Sphera (GaBi Content Version 2022.1) and USLCI databases, 2012, were utilized when necessary. These data were evaluated and have temporal, geographic, and technical coverage appropriate to the scope of the product category.

Data Quality

The data sources used are complete and representative of global systems in terms of the geographic and technological coverage and are a recent vintage (less than ten years old) except for refined petroleum applied in filler material for the product recipe. The data used for primary data are based on direct information sources of the manufacturers. Secondary data sets were used for raw materials extraction and processing, end of life, transportation, and energy production flows. Wherever secondary data is used, the study adopts critically reviewed data for consistency, precision, and reproducibility to limit uncertainty. When a material is not available in the available LCI databases, another chemical which has similar manufacturing and environmental impacts may be used as a proxy, representing the actual chemical.
When upstream data specified in the PCR and/or used in calculating the EPD do not have data for select impact categories or inventory items, they shall be reported as an ‘x’ or ‘-‘ and not zero, and qualified with the note: “Not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories.”

Period Under Review

The period under review is the full calendar year of 2021.

Treatment of Biogenic Carbon

The uptake and release of biogenic carbon throughout the product life cycle follows ISO 21930:2017 Section 7.2.7.

Comparability and Benchmarking

A comparison or an evaluation of EPD data is only possible if all data sets to be compared were created according to ISO 21930 and the building context, respectively the product-specific characteristics of performance, are taken into account. Environmental declarations from different programs may not be comparable. Full conformance with the PCR allows for EPD comparability only when all stages a product's life cycle have been considered, and the same sub-category PCR, when applicable. Additionally, the declared/functional unit must also be comparable. However, variations and deviations are possible. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differenced 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.

Units

The LCA results within this EPD are reported in SI units.

Additional Life Cycle Information

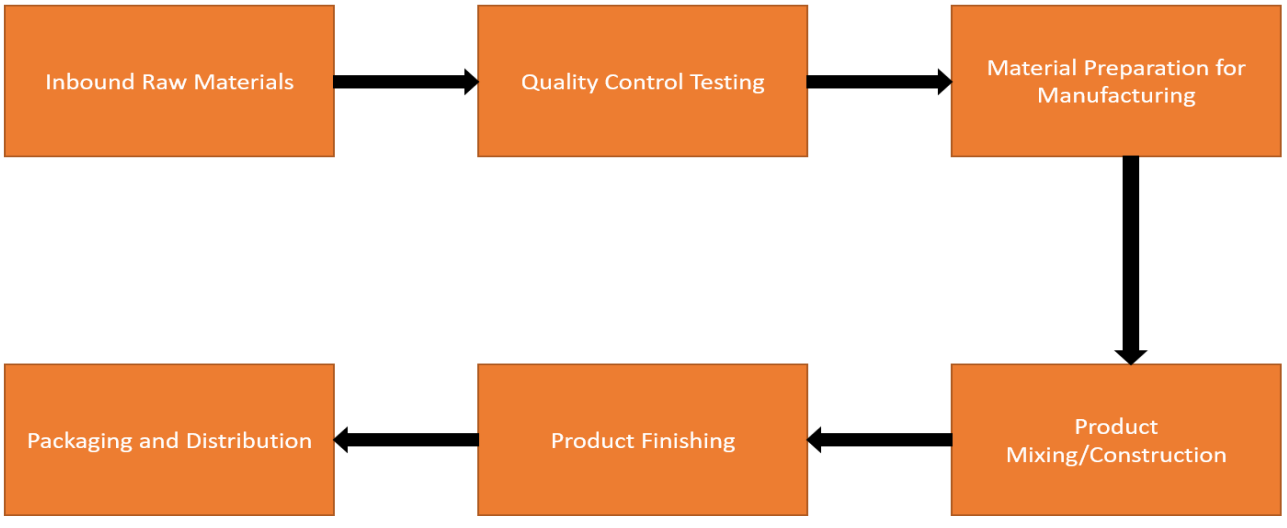
Background data

For life cycle modeling of the considered products, the LCA for Experts v. 10.6 Software System for Life Cycle Engineering, developed by Sphera, is used. The Sphera and USLCI databases contain consistent and documented datasets which are documented online. To ensure comparability of results in the LCA, the basic data of the Sphera database were used for energy, transportation, and auxiliary materials.

Manufacturing

Siplast Parasolo® PVC KEE Fleeceback Membrane is manufactured in Cedar City, Utah and begins with the inbound reception of raw materials. The process begins with adding polymers, performance enhancing ingredients, and other option ingredients to a mixer. The inputs are blended, heated, and then extruded onto the top and bottom of a scrim to form laminated layers. The membrane is then cooled by passing through a series of rollers, wound into rolls or cut to size, and packaged for shipment. The table below describes which facility produces the product of the study.

Manufacturing Location	Relative Representativeness
Cedar City, Utah	100.00%



Product Type	Manufacturing location
PVC KEE Fleeceback	Cedar City, UT

Packaging

The packaging material is composed primarily of plastic materials. The product are shipped on pallets and wrapped in plastic film.

	Quantity (% By Weight)
Material	**Value**
Cardboard	1.30%
Wood	10.01%
Paper	2.95%
Plastic	85.75%
Total	**100.00%**

Transportation

Transport to Building Site (A4)		
Name	**Value (50-mil / 60-mil / 80-mil)**	**Unit**
Fuel type	Diesel	
Liters of fuel	38	l/100km
Transport distance	1661	km
Vehicle Type	Truck	
Capacity utilization (including empty runs)	90	%
Gross density of products transported	32 / 31 / 30	kg/m^3
Weight of products transported	-	kg
Volume of products transported	-	m^3
Capacity utilization volume factor	-	-

Product Installation

Detailed installation instructions are provided online along with the type of fasteners and/or adhesives required for each product. Installation equipment is required though not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible. Note: Compliance with model building codes does not always ensure compliance with state or local building codes, which may be amended versions of these model codes. Always check with local building code officials to confirm compliance.

Installation Into the Building (A5)		
Name	**Value (50-mil / 60-mil / 80-mil)**	**Unit**
Auxiliary materials	-	kg
Water consumption	-	m^3
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	0	MJ
Product loss per functional unit	-	kg
Waste materials at construction site	221	kg
Output substance (recycle)	-	kg
Output substance (landfill)	2619	kg
Output substance (incineration)	-	kg
Packaging waste (recycle)	52	kg
Packaging waste (landfill)	135	kg
Packaging waste (incineration)	34	kg
Biogenic carbon content of packaging	53	kg CO_2eq
Direct emissions to ambient air*, soil, and water	52	kg
VOC emissions	-	µg/m3

*CO2 emissions to air from disposal of packaging

Product Use

The use phase follows the installation of single ply roof membranes. In a roofing system, the weatherproof membrane is the uppermost layer and protects the building from the elements.. The roof membrane, when installed properly and adequately maintained, protects the interior of the building from the environmental elements and weather during its use. As defined in the governing PCR, the Building Estimated Service Life (ESL) is 75 years. The necessary steps for providing weather protection are specified by manufacturer installation instructions and are mandated by model building codes. The roof membrane's useful life span is influenced by many variables including roof system design, quality of the installation, type and durability of the membrane, roof system component configuration and maintenance as well as weather conditions and events. Real world reroofing scenarios, building owner tendencies, and the expected service life of roof membranes all indicate that reroofing activity will take place during the 75-year building ESL. Reroofing activity may initially occur at 40 years after the installation of the original system when appropriate designs are developed, proper installation is done, and regular maintenance occurs. When reroofing is required, generally, 2 options are available to address the need for a new roof membrane or system. The model building codes describe a "Roof Recover" as an acceptable reroofing practice, which occurs when a new roof covering is installed on top of the existing roof system without disturbing or removing the existing roof covering or the insulation below. Roof Recover, as defined by industry practices, involves visual examination and appropriate testing to ensure that all roof components, including insulation, have not sustained damage or deterioration. This approach allows the existing roof system to remain in place instead of being disposed of into a landfill. The Roof Recover approach is a common practice in the roofing industry, it is permitted by model building codes. Although the Roof Recover approach is a common practice, it is often not captured in reroofing studies available in the public domain, which typically contemplate a full roof replacement. "Roof Replacement" is a common occurrence at the end of the current roof's service life. This process involves the removal of all roof components down to the roof deck, and all components are replaced above the deck, including barrier boards at deck level, air barriers, insulation, coverboards, and weatherproof membrane. This study conservatively assumes all materials are disposed of in a landfill during a Roof Replacement. Therefore, roof membranes' cradle-to-grave assessment incorporates all life cycle stage environmental impacts connected with the original building construction, a Roof Replacement operation at 40-years. This translates to 0.9 replacement cycles for the roofing membrane during the 75-year building ESL (75-year ESL/40-year RSL minus initial one installation = 0.9 replacement cycles).

The only product use phase applicable is the replacement phase (B4), which accounts for the impacts for the replacement cycle at the 40-year RSL. All other use phase stages are considered to be zero for Parasolo® PVC KEE Fleeceback and will not be included on results tables.

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Reference Service Life		
Name	**Value**	**Unit**
Reference Service Life	40	years
Estimated Building Service Life	75	years
Number of Replacements	0.9	replacements

Disposal

Parasolo® PVC KEE Fleeceback can be recycled at certain facilities. However, the product is assumed to be 100% landfilled in the end-of-life disposal, in accordance with the PCR. Deconstruction (C1) is considered to be zero for Parasolo® PVC KEE Fleeceback and will not be included on results tables.

End of life (C1-C4)		
Name	**Value (50-mil / 60-mil / 80-mil)**	**Unit**
Collected separately	0.00	kg
Collected as mixed construction waste	1588 / 1878 / 2368	kg
Reuse	0.00	kg
Recycling	0.00	kg
Landfilling	1588 / 1878 / 2368	kg
Incineration with energy recovery	0.00	kg
Energy conversion	-	%
Removals of biogenic carbon	-	kg

LCA Results for 50-mil thickness Membrane

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Results shown below were calculated using TRACI 2.1 Methodology.

TRACI 2.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	4.78E+03	2.77E+02	1.52E+03	6.48E+03	2.69E+01	0.00E+00	5.90E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	8.66E-09	1.05E-08	3.93E-07	3.72E-07	1.02E-09	0.00E+00	8.41E-12
AP	Acidification potential for air emissions	kg SO_2-Eq.	7.95E+00	1.67E+00	8.24E-01	1.28E+01	1.62E-01	0.00E+00	3.60E+00
EP	Eutrophication potential	kg N-Eq.	7.17E-01	9.23E-02	-4.65E-01	1.40E+00	8.95E-03	0.00E+00	1.20E+00
SP	Smog formation potential	kg O_3-Eq.	1.64E+02	4.58E+01	3.91E+01	2.37E+02	4.45E+00	0.00E+00	1.01E+01
FFD	Fossil Fuel Depletion	MJ-surplus	1.45E+04	4.90E+02	2.93E+03	1.62E+04	4.76E+01	0.00E+00	7.61E+01

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results shown below were calculated using CML 2001 - April 2013 Methodology.

CML 4.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	4.76E+03	2.78E+02	1.54E+03	6.69E+03	2.70E+01	0.00E+00	8.27E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	1.89E-08	1.05E-08	3.95E-07	3.83E-07	1.02E-09	0.00E+00	1.21E-10
AP	Acidification potential for air emissions	kg SO_2-Eq.	7.04E+00	1.37E+00	2.55E+00	1.14E+01	1.33E-01	0.00E+00	1.58E+00
EP	Eutrophication potential	kg$(PO_4)^3$-Eq.	1.13E+00	2.44E-01	1.39E-01	3.05E+00	2.36E-02	0.00E+00	1.86E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	1.40E+00	1.60E-01	3.27E-01	2.10E+00	1.55E-02	0.00E+00	4.28E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	1.07E-02	1.15E-07	4.62E-03	1.38E-02	1.12E-08	0.00E+00	1.46E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	1.04E+05	3.54E+03	2.49E+04	1.20E+05	3.43E+02	0.00E+00	5.75E+02

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the resource use throughout the life cycle of the product.

Resource Use									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
RPR_E	Renewable primary energy as energy carrier	MJ	8.20E+03	0.00E+00	1.49E+03	8.80E+03	0.00E+00	0.00E+00	8.51E+01
RPR_M	Renewable primary energy resources as material utilization	MJ	5.11E+02	0.00E+00	0.00E+00	4.60E+02	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	Nonrenewable primary energy as energy carrier	MJ	7.51E+04	3.57E+03	2.63E+04	9.53E+04	3.46E+02	0.00E+00	5.93E+02
$NRPR_M$	Nonrenewable primary energy as material utilization	MJ	3.46E+04	0.00E+00	0.00E+00	3.11E+04	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	3.42E+01	0.00E+00	6.35E+00	3.66E+01	0.00E+00	0.00E+00	1.54E-01

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the output flows and wastes throughout the life cycle of the product.

Output Flows and Waste Categories									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
HWD	Hazardous waste disposed	kg	4.63E-02	0.00E+00	5.07E-06	4.17E-02	0.00E+00	0.00E+00	1.43E-07
NHWD	Non-hazardous waste disposed	kg	9.81E+02	0.00E+00	5.92E+01	2.35E+03	0.00E+00	0.00E+00	1.57E+03
HLRW	High-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW	Intermediate- and low-level radioactive waste	kg	1.65E+00	0.00E+00	4.79E-01	1.93E+00	0.00E+00	0.00E+00	6.52E-03
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	6.85E+01	0.00E+00	0.00E+00	6.17E+01	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Recovered energy exported from system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

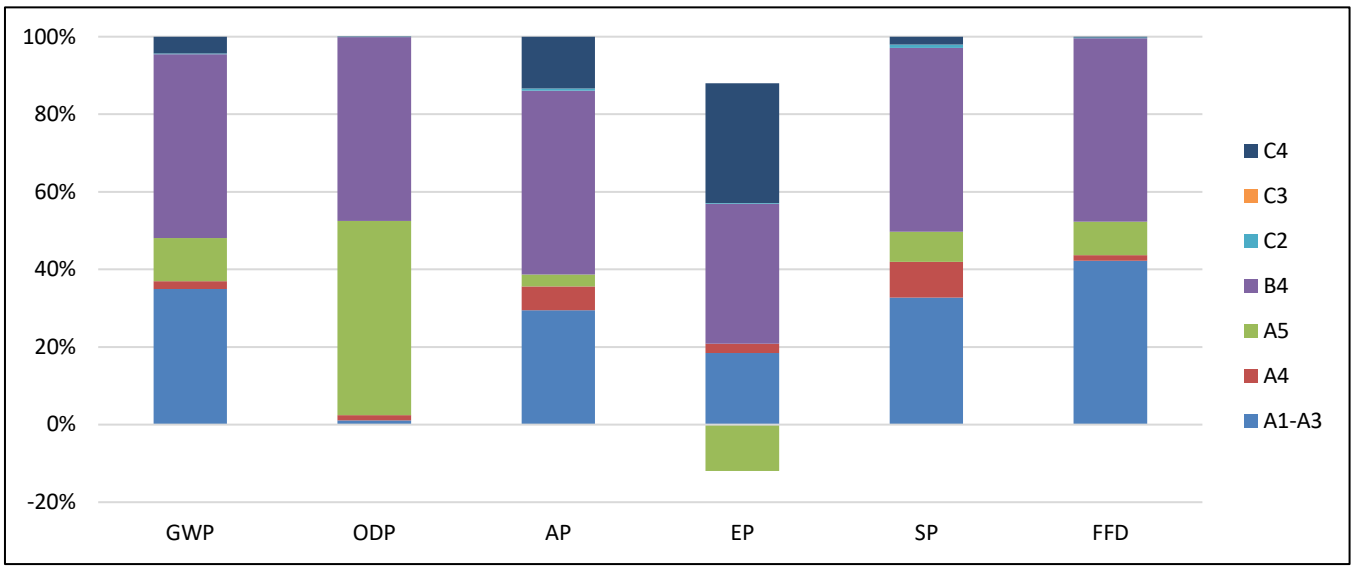
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

Carbon Emissions and Removals									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

LCA Interpretation

The production life cycle stage (A1-A3) dominates the impacts across all impact categories. This is due to the upstream production of materials used in the product, along with natural gas use in the manufacturing of the product. The end-of-life disposal stage (C4) has significant impact in global warming potential, acidification, and eutrophication due to the 100% landfill assumption.



Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories:

— renewable primary energy resources as energy (fuel), (RPRE);
— renewable primary resources as material, (RPRM);
— non-renewable primary resources as energy (fuel) ,(NRPRE);
— non-renewable primary resources as material (NRPRM);
— secondary materials (SM);
— renewable secondary fuels (RSF);
— non-renewable secondary fuels (NRSF);
— recovered energy (RE);
— abiotic depletion potential for non-fossil mineral resources (ADPelements).
— land use related impacts, for example on biodiversity and/or soil fertility;
— toxicological aspects;
— emissions from land use change [GWP 100 (land-use change)];
— hazardous waste disposed;
— non-hazardous waste disposed;
— high-level radioactive waste;
— intermediate and low-level radioactive waste;
— components for reuse;
— materials for recycling;
— materials for energy recovery; and
— recovered energy exported from the product system.

LCA Results for 60-mil thickness Membrane

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Results shown below were calculated using TRACI 2.1 Methodology.

TRACI 2.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	5.57E+03	3.24E+02	1.52E+03	7.32E+03	3.13E+01	0.00E+00	6.89E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	1.02E-08	1.22E-08	3.93E-07	3.75E-07	1.19E-09	0.00E+00	9.81E-12
AP	Acidification potential for air emissions	kg SO_2-Eq.	9.28E+00	1.94E+00	8.24E-01	1.48E+01	1.88E-01	0.00E+00	4.20E+00
EP	Eutrophication potential	kg N-Eq.	8.37E-01	1.08E-01	-4.65E-01	1.70E+00	1.04E-02	0.00E+00	1.40E+00
SP	Smog formation potential	kg O_3-Eq.	1.91E+02	5.35E+01	3.91E+01	2.71E+02	5.18E+00	0.00E+00	1.17E+01
FFD	Fossil Fuel Depletion	MJ-surplus	1.67E+04	5.72E+02	2.93E+03	1.83E+04	5.54E+01	0.00E+00	8.88E+01

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results shown below were calculated using CML 2001 - April 2013 Methodology.

CML 4.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	5.56E+03	3.25E+02	1.54E+03	7.58E+03	3.14E+01	0.00E+00	9.64E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	2.22E-08	1.22E-08	3.95E-07	3.88E-07	1.18E-09	0.00E+00	1.41E-10
AP	Acidification potential for air emissions	kg SO_2-Eq.	8.22E+00	1.60E+00	2.55E+00	1.29E+01	1.55E-01	0.00E+00	1.84E+00
EP	Eutrophication potential	kg$(PO_4)^3$-Eq.	1.31E+00	2.84E-01	1.39E-01	3.54E+00	2.75E-02	0.00E+00	2.17E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	1.62E+00	1.87E-01	3.27E-01	2.38E+00	1.81E-02	0.00E+00	5.00E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	1.26E-02	1.34E-07	4.62E-03	1.55E-02	1.30E-08	0.00E+00	1.70E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	1.22E+05	4.13E+03	2.49E+04	1.37E+05	4.00E+02	0.00E+00	6.71E+02

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the resource use throughout the life cycle of the product.

Resource Use									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
RPR_E	Renewable primary energy as energy carrier	MJ	9.63E+03	0.00E+00	1.49E+03	1.01E+04	0.00E+00	0.00E+00	9.93E+01
RPR_M	Renewable primary energy resources as material utilization	MJ	5.11E+02	0.00E+00	0.00E+00	4.60E+02	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	Nonrenewable primary energy as energy carrier	MJ	9.29E+04	4.17E+03	2.63E+04	1.12E+05	4.03E+02	0.00E+00	6.92E+02
$NRPR_M$	Nonrenewable primary energy as material utilization	MJ	3.46E+04	0.00E+00	0.00E+00	3.11E+04	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	4.00E+01	0.00E+00	6.35E+00	4.19E+01	0.00E+00	0.00E+00	1.80E-01

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the output flows and wastes throughout the life cycle of the product.

Output Flows and Waste Categories									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
HWD	Hazardous waste disposed	kg	5.47E-02	0.00E+00	5.07E-06	4.92E-02	0.00E+00	0.00E+00	1.67E-07
NHWD	Non-hazardous waste disposed	kg	1.16E+03	0.00E+00	5.92E+01	2.75E+03	0.00E+00	0.00E+00	1.83E+03
HLRW	High-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW	Intermediate- and low-level radioactive waste	kg	1.93E+00	0.00E+00	4.79E-01	2.18E+00	0.00E+00	0.00E+00	7.61E-03
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	6.85E+01	0.00E+00	0.00E+00	6.17E+01	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Recovered energy exported from system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

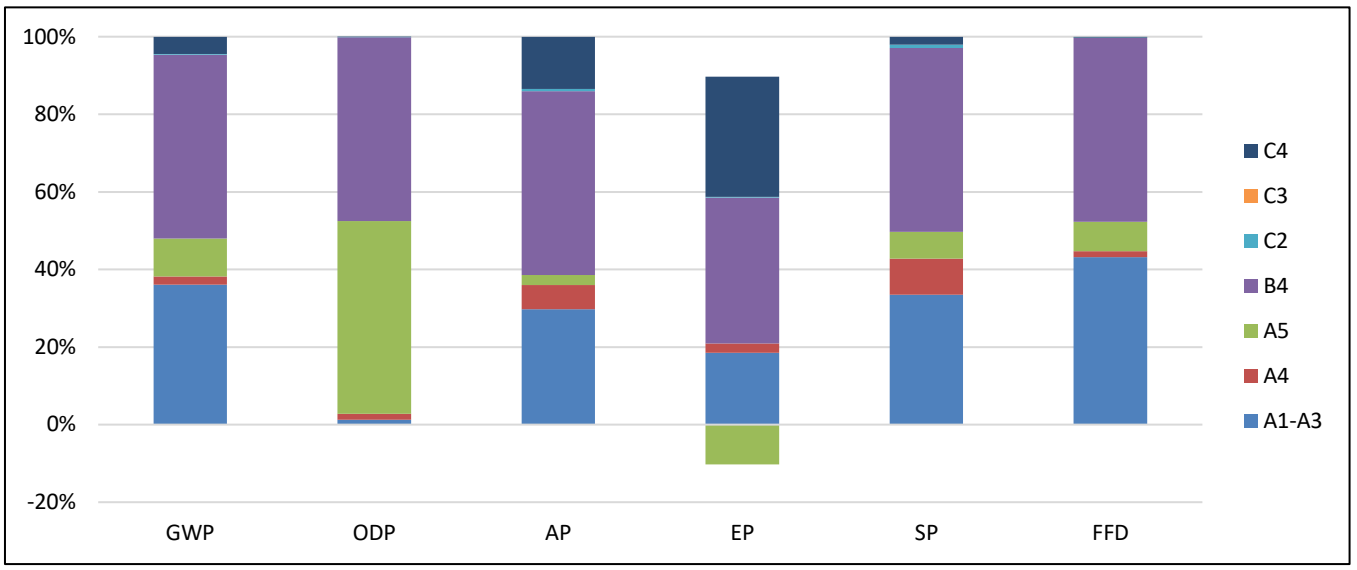
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

Carbon Emissions and Removals									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

LCA Interpretation

The production life cycle stage (A1-A3) dominates the impacts across all impact categories. This is due to the upstream production of materials used in the product, along with natural gas use in the manufacturing of the product. The end-of-life disposal stage (C4) has significant impact in global warming potential, acidification, and eutrophication due to the 100% landfill assumption.



Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories:

— renewable primary energy resources as energy (fuel), (RPRE);
— renewable primary resources as material, (RPRM);
— non-renewable primary resources as energy (fuel) ,(NRPRE);
— non-renewable primary resources as material (NRPRM);
— secondary materials (SM);
— renewable secondary fuels (RSF);
— non-renewable secondary fuels (NRSF);
— recovered energy (RE);
— abiotic depletion potential for non-fossil mineral resources (ADPelements).
— land use related impacts, for example on biodiversity and/or soil fertility;
— toxicological aspects;
— emissions from land use change [GWP 100 (land-use change)];
— hazardous waste disposed;
— non-hazardous waste disposed;
— high-level radioactive waste;
— intermediate and low-level radioactive waste;
— components for reuse;
— materials for recycling;
— materials for energy recovery; and
— recovered energy exported from the product system.

LCA Results for 80-mil thickness Membrane

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Results shown below were calculated using TRACI 2.1 Methodology.

TRACI 2.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	6.93E+03	4.03E+02	1.52E+03	8.78E+03	3.91E+01	0.00E+00	8.59E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	1.28E-08	1.53E-08	3.93E-07	3.80E-07	1.48E-09	0.00E+00	1.22E-11
AP	Acidification potential for air emissions	kg SO_2-Eq.	1.15E+01	2.42E+00	8.24E-01	1.82E+01	2.35E-01	0.00E+00	5.24E+00
EP	Eutrophication potential	kg N-Eq.	1.04E+00	1.34E-01	-4.65E-01	2.22E+00	1.30E-02	0.00E+00	1.74E+00
SP	Smog formation potential	kg O_3-Eq.	2.38E+02	6.67E+01	3.91E+01	3.28E+02	6.47E+00	0.00E+00	1.47E+01
FFD	Fossil Fuel Depletion	MJ-surplus	2.09E+04	7.13E+02	2.93E+03	2.22E+04	6.92E+01	0.00E+00	1.11E+02

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results shown below were calculated using CML 2001 - April 2013 Methodology.

CML 4.1 Impact Assessment									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
GWP	Global warming potential	kg CO_2-Eq.	6.92E+03	4.04E+02	1.54E+03	9.09E+03	3.92E+01	0.00E+00	1.20E+03
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	2.78E-08	1.52E-08	3.95E-07	3.96E-07	1.48E-09	0.00E+00	1.76E-10
AP	Acidification potential for air emissions	kg SO_2-Eq.	1.02E+01	1.99E+00	2.55E+00	1.55E+01	1.93E-01	0.00E+00	2.30E+00
EP	Eutrophication potential	kg$(PO_4)^3$-Eq.	1.63E+00	3.55E-01	1.39E-01	4.38E+00	3.44E-02	0.00E+00	2.71E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	2.00E+00	2.32E-01	3.27E-01	2.89E+00	2.26E-02	0.00E+00	6.24E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	1.58E-02	1.68E-07	4.62E-03	1.84E-02	1.63E-08	0.00E+00	2.13E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	1.51E+05	5.14E+03	2.49E+04	1.64E+05	4.99E+02	0.00E+00	8.37E+02

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the resource use throughout the life cycle of the product.

Resource Use									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
RPR_E	Renewable primary energy as energy carrier	MJ	1.21E+04	0.00E+00	1.49E+03	1.23E+04	0.00E+00	0.00E+00	1.24E+02
RPR_M	Renewable primary energy resources as material utilization	MJ	5.11E+02	0.00E+00	0.00E+00	4.60E+02	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	Nonrenewable primary energy as energy carrier	MJ	1.24E+05	5.19E+03	2.63E+04	1.41E+05	5.04E+02	0.00E+00	8.64E+02
$NRPR_M$	Nonrenewable primary energy as material utilization	MJ	3.46E+04	0.00E+00	0.00E+00	3.11E+04	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	5.00E+01	0.00E+00	6.35E+00	5.09E+01	0.00E+00	0.00E+00	2.24E-01

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

Results below contain the output flows and wastes throughout the life cycle of the product.

Output Flows and Waste Categories									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
HWD	Hazardous waste disposed	kg	6.91E-02	0.00E+00	5.07E-06	6.22E-02	0.00E+00	0.00E+00	2.08E-07
NHWD	Non-hazardous waste disposed	kg	1.46E+03	0.00E+00	5.92E+01	3.42E+03	0.00E+00	0.00E+00	2.28E+03
HLRW	High-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW	Intermediate- and low-level radioactive waste	kg	2.41E+00	0.00E+00	4.79E-01	2.61E+00	0.00E+00	0.00E+00	9.49E-03
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	6.85E+01	0.00E+00	0.00E+00	6.17E+01	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Recovered energy exported from system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

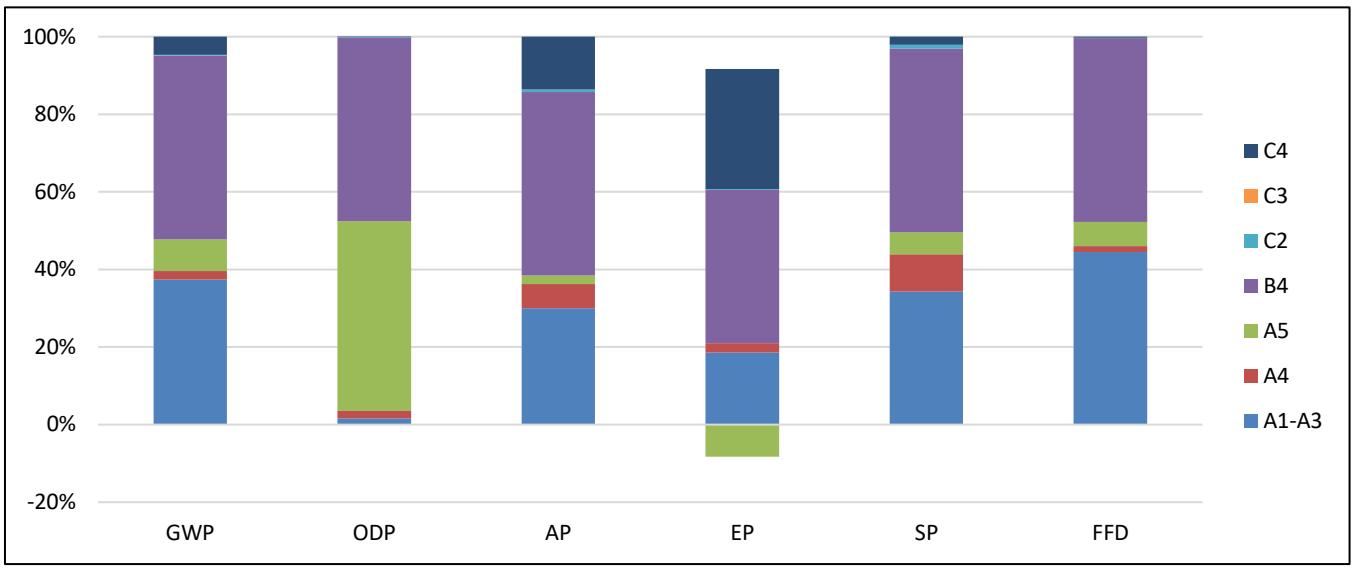
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

Carbon Emissions and Removals									
Parameter	**Parameter**	**Unit**	**A1-A3**	**A4**	**A5**	**B4**	**C2**	**C3**	**C4**
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	5.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**All use phase and disposal stages have been considered and only those with non-zero values have been reported*

LCA Interpretation

The production life cycle stage (A1-A3) dominates the impacts across all impact categories. This is due to the upstream production of materials used in the product, along with natural gas use in the manufacturing of the product. The end-of-life disposal stage (C4) has significant impact in global warming potential, acidification, and eutrophication due to the 100% landfill assumption.



Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories:

— renewable primary energy resources as energy (fuel), (RPRE);
— renewable primary resources as material, (RPRM);
— non-renewable primary resources as energy (fuel) ,(NRPRE);
— non-renewable primary resources as material (NRPRM);
— secondary materials (SM);
— renewable secondary fuels (RSF);
— non-renewable secondary fuels (NRSF);
— recovered energy (RE);
— abiotic depletion potential for non-fossil mineral resources (ADPelements).
— land use related impacts, for example on biodiversity and/or soil fertility;
— toxicological aspects;
— emissions from land use change [GWP 100 (land-use change)];
— hazardous waste disposed;
— non-hazardous waste disposed;
— high-level radioactive waste;
— intermediate and low-level radioactive waste;
— components for reuse;
— materials for recycling;
— materials for energy recovery; and
— recovered energy exported from the product system.

Additional Environmental Information

Environmental and Health During Manufacturing

During the manufacturing of Siplast Parasolo® PVC KEE Fleeceback, all legal regulations regarding emissions to air, wastewater discharge, solid waste disposal and noise emissions are followed.

Environmental and Health During Installation

There is no harmful emissive potential. No damage to health or impairment is expected under normal use corresponding to the intended use of the product.

Extraordinary Effects

Fire

Resistance by the roofing system to fire applied to the exterior roof surface is important. Typically, a UL Class A or B rating is required. Occasionally, depending on the use of the building, special resistance to fire applied from within the building is required. This is normally expressed in the form of hourly ratings, and usually requires the use of a specialized roof assembly. Refer to current Parasolo® PVC KEE Fleeceback listings in the appropriate UL directory to verify roof assembly requirements for specific fire ratings.

Water

No environmental impacts are expected due to water exposure of properly installed Parasolo® PVC KEE Fleeceback membrane.

Mechanical Destruction

Siplast Parasolo® PVC KEE Fleeceback membrane has excellent mechanical strength. The breaking strength and elongation at break performance are measured by ASTM D751.

Delayed Emissions

Global warming potential is calculated using the TRACI 2.1 and CML 4.1 impact assessment methodologies. Delayed emissions are not considered.

Further Information

Siplast
14911 Quorum Drive, Suite 600
Dallas, TX 752545

References

- PCR Part A	UL Environment: Product Category Rules for Building-Related Products and Services in North America, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, v.3.2, December 2018.
- PCR Part B	NSF International: Product Category Rule for Environmental Product Declarations for Single Ply Roofing Membranes
- LCA for Experts	Sphera.one. LCA for Experts (v.10.6).
- ISO 14025	ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.
- ISO 14040	ISO 14040:2009-11, Environmental management — Life cycle assessment — Principles and framework.
- ISO 14044	ISO 14044:2006-10, Environmental management — Life cycle assessment — Requirements and guidelines.
- ISO 21930: 2017	ISO 21930:2017, Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.
- EN 15804	EN 15804:2012-04: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction product
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Contact Information

Study Commissioner

Siplast
James Kirby
Product Sustainability
14911 Quorum Drive, Suite 600
Dallas, TX 75254
james.kirby@siplast.com

LCA Practitioner

Sustainable Solutions Corporation
155 Railroad Plaza, Suite 203
Royersford, PA 19468 USA
(+1) 610 569-1047
info@sustainablesolutionscorporation.com
www.sustainablesolutionscorporation.com