

Environmental Product Declaration
GAF EverGuard® PVC KEE Fleece-back Membranes



GAF, a Standard Industries company, is the leading roofing and waterproofing manufacturer in North America. For more than 135 years, GAF has been trusted to protect what matters most for families, communities and business owners with its innovative solutions and focus on customer service. GAF's leadership extends to its commitment to making a positive impact on its communities, industry, and planet. Learn more at www.GAF.com.

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Environmental
Product Declaration**
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Environmental Product Declaration

GAF EverGuard® PVC KEE Fleece-back 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	GAF 1 Campus Drive, Parsippany, NJ 07054		
DECLARATION NUMBER	EPD11327		
DECLARED PRODUCT & FUNCTIONAL UNIT	GAF EverGuard® PVC KEE Fleece-back Membranes Functional Unit = 1 m ²		
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 GAF EPD Generator Tool Version 1.0		
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)	Joseph Geibig - 		
☐ INTERNAL ☒ EXTERNAL			
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.

General Information

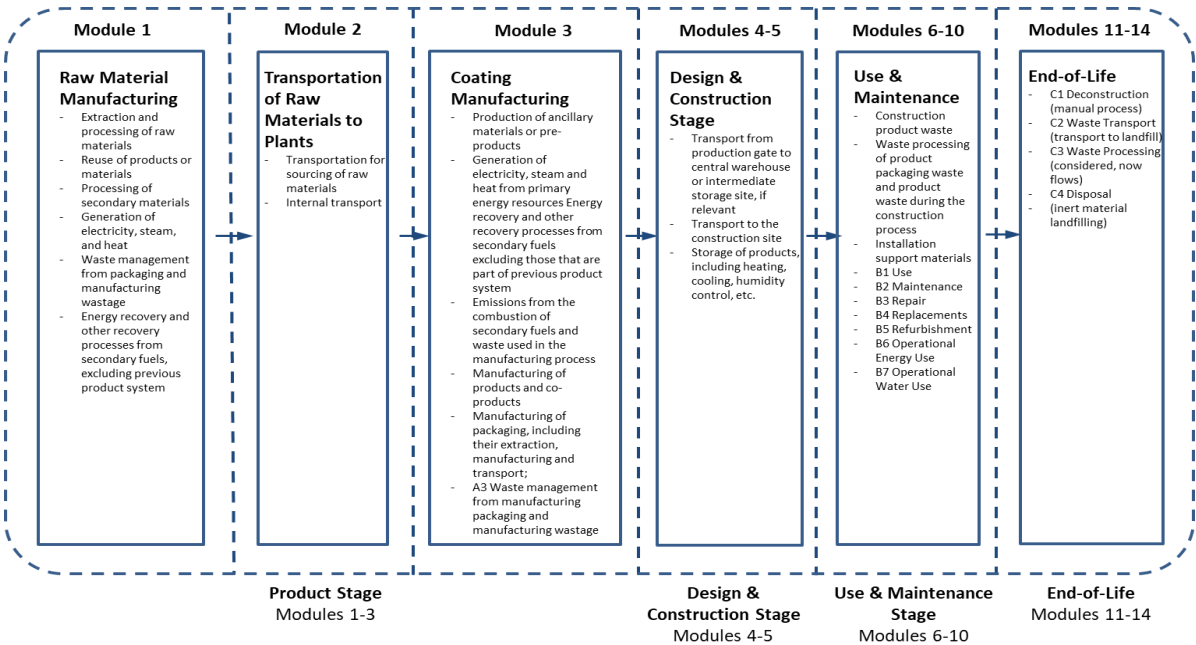
Description of Company/Organization

Founded in 1886, GAF is the leading roofing manufacturer in North America. As a member of the Standard Industries family of companies, GAF is part of the largest roofing and waterproofing business in the world. The company's products include a comprehensive portfolio of roofing and waterproofing solutions for residential and commercial properties as well as for civil engineering applications. The full GAF portfolio of solutions is supported by an extensive national network of factory-certified contractors. GAF continues to be the leader in quality and offers comprehensive warranty protection on its products and systems. The company's success is driven by a commitment to empowering its people to deliver advanced quality and purposeful innovation. For more information about GAF, visit www.gaf.com.

Product Description

GAF EverGuard® PVC KEE Fleece-back Membranes 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

GAF EverGuard® PVC KEE Fleece-back Membranes are 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 GAF EverGuard® PVC KEE Fleece-back Membranes are 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.		

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Technical Data

Technical details for this product are presented below.

Physical properties	ASTM Test Method	50 mil	60 mil	80 mil
Thickness over Scrim	ASTM D 7635	23 mil (0.58 mm)	27 mil (0.69 mm)	38 mil (0.97 mm)
Breaking Strength	ASTM D 751	330 lbf (1,468 N) MD / 296 lbf (1,317 N) CD	346 lbf (1,539 N) MD / 306 lbf (1,361 N) CD	373 lbf (1,659 N) MD / 339 lbf (1,508 N) CD
Elongation at Break	ASTM D 751	43% x 33%	34% x 32%	34% x 32%
Factory Seam Strength	ASTM D 751	0.93	1.01	1.09
Breaking Strength after Heat Aging	ASTM D 3045	90% min	107% x 97%	90% min
Elongation at Break after Heat Aging	ASTM D 3045	90% min	107% x 107%	90% min
Tear Strength	ASTM D 751	133 lbf (592 N) MD/ 138 lbf (614 N) CD	111 lbf (494 N) MD/ 145 lbf (645 N) CD	92 lbf (409 N) MD/ 156 lbf (694 N) CD
Low-Temperature Bend	ASTM D 2136	Pass @ -40°F (-40°C)	Pass @ -40°F (-40°C)	Pass @ -40°F (-40°C)
Xenon Arc WOM Accelerated Weathering (Tested at 0.7 W /m ² in comparison to G155 min of 0.35 W /m ²) ^{††}	ASTM G 155†	>11100 hr (>27973 kJ/m ²)	>11100 hr (>27973 kJ/m ²)	>11100 hr (>27973 kJ/m ²)
Fluorescence QUV Accelerated Weathering (Tested at 1.55 W /m ² in comparison to G154 min of 0.68 W /m ²) ^{††}	ASTM G 154†	>11852 hr (> 66134 kJ/m ²)	>11852 hr (> 66134 kJ/m ²)	>11852 hr (> 66134 kJ/m ²)
Linear Dimensional Change	ASTM D 1204	≤0.2%	-0.36%	-0.39%
Change in Weight after Water Immersion	ASTM D 570	<3%	0.02	<3%
Static Puncture Resistance	ASTM D 5602	33 lbf (145 N)	33 lbf (145 N)	33 lbf (145 N)
Dynamic Puncture Resistance	ASTM D 5635	20 J (14.7ft-lbf)	20 J (14.7ft-lbf)	20 J (14.7ft-lbf)

Placing on the Market / Application Rules

The standards that can be applied for PVC KEE 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 m ²			
Weight per functional unit	1549	1724	1833	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 GAF EverGuard® PVC KEE Fleece-back 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, Utah are primary data and 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.

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 GAF. 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 functional/declared 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, 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.

Units

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

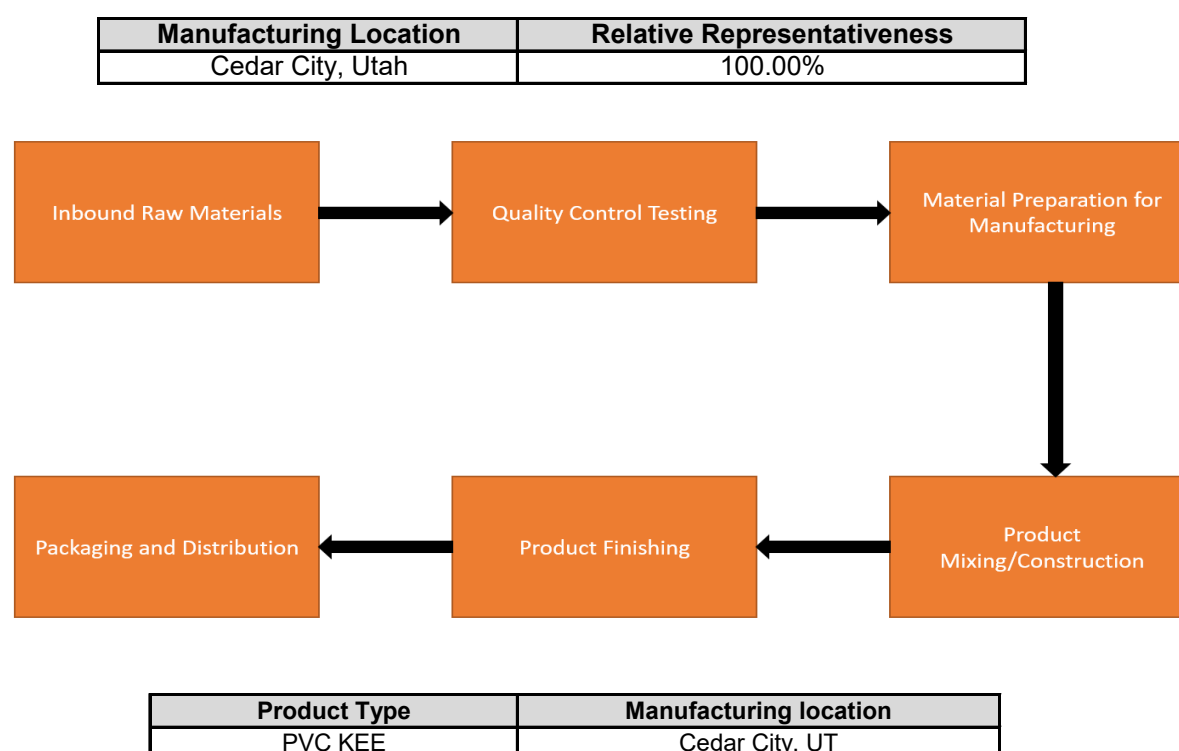
Additional Life Cycle Information

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

GAF EverGuard® PVC KEE Fleece-back 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.



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Single Ply Roofing Membrane (PVC)



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Packaging

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

Material	Quantity (% By Weight)
	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	-	-

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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)	2055	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 ₂ eq
Direct emissions to ambient air*, soil, and water	52	kg
VOC emissions	-	µg/m ³

*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 GAF EverGuard® PVC KEE Fleece-back Membrane and will not be included on results tables. The only product use phase applicable is the replacement phase (B4).

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



Disposal

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 GAF EverGuard® PVC KEE Fleece-back Membranes 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	1549 / 1724 / 1833	kg
Reuse	0.00	kg
Recycling	0.00	kg
Landfilling	1549 / 1724 / 1833	kg
Incineration with energy recovery	0.00	kg
Energy conversion	-	%
Removals of biogenic carbon	-	kg

LCA Results for 50-mil thickness Membrane

LCA 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.	3.92E+03	2.38E+02	1.52E+03	5.59E+03	2.31E+01	0.00E+00	5.08E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	5.29E-09	9.02E-09	3.93E-07	3.67E-07	8.73E-10	0.00E+00	7.24E-12
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	6.73E+00	1.43E+00	8.24E-01	1.10E+01	1.39E-01	0.00E+00	3.10E+00
EP	Eutrophication potential	kg N-Eq.	6.03E-01	7.93E-02	-4.65E-01	1.13E+00	7.68E-03	0.00E+00	1.03E+00
SP	Smog formation potential	kg O ₃ -Eq.	1.41E+02	3.94E+01	3.91E+01	2.09E+02	3.82E+00	0.00E+00	8.67E+00
FFD	Fossil Fuel Depletion	MJ-surplus	1.24E+04	4.21E+02	2.93E+03	1.43E+04	4.08E+01	0.00E+00	6.55E+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.	3.90E+03	2.39E+02	1.54E+03	5.77E+03	2.32E+01	0.00E+00	7.12E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	1.36E-08	9.00E-09	3.95E-07	3.77E-07	8.72E-10	0.00E+00	1.04E-10
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	5.95E+00	1.18E+00	2.55E+00	1.00E+01	1.14E-01	0.00E+00	1.36E+00
EP	Eutrophication potential	kg(PO ₄) ³ -Eq.	9.59E-01	2.09E-01	1.39E-01	2.63E+00	2.03E-02	0.00E+00	1.60E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	1.21E+00	1.37E-01	3.27E-01	1.85E+00	1.33E-02	0.00E+00	3.69E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	9.36E-03	9.90E-08	4.62E-03	1.26E-02	9.60E-09	0.00E+00	1.26E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	8.96E+04	3.04E+03	2.49E+04	1.06E+05	2.94E+02	0.00E+00	4.95E+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	6.77E+03	0.00E+00	1.49E+03	7.50E+03	0.00E+00	0.00E+00	7.33E+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	6.54E+04	3.07E+03	2.63E+04	8.60E+04	2.97E+02	0.00E+00	5.11E+02
NRPR _M	Nonrenewable primary energy as material utilization	MJ	2.80E+04	0.00E+00	0.00E+00	2.52E+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	2.67E+01	0.00E+00	6.35E+00	2.99E+01	0.00E+00	0.00E+00	1.33E-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	3.48E-02	0.00E+00	5.07E-06	3.13E-02	0.00E+00	0.00E+00	1.23E-07
NHWD	Non-hazardous waste disposed	kg	8.15E+02	0.00E+00	5.92E+01	2.00E+03	0.00E+00	0.00E+00	1.35E+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	1.31E+00	0.00E+00	4.79E-01	1.62E+00	0.00E+00	0.00E+00	5.62E-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	5.37E+01	0.00E+00	0.00E+00	4.84E+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*

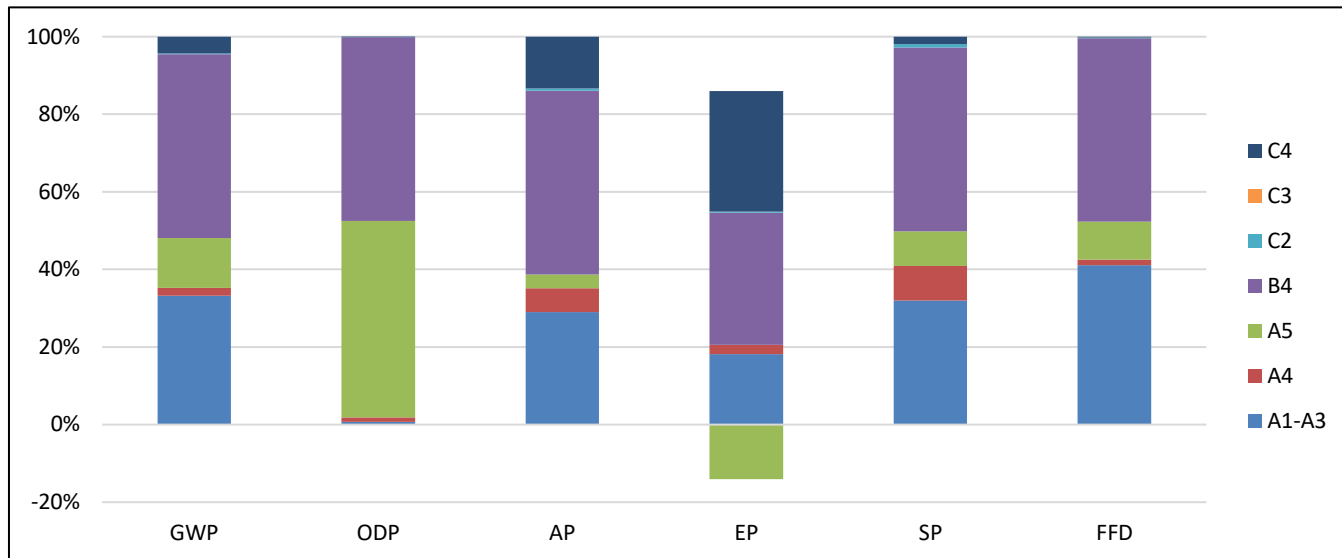
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

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.	5.17E+03	2.99E+02	1.52E+03	6.89E+03	2.90E+01	0.00E+00	6.39E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	9.39E-09	1.13E-08	3.93E-07	3.73E-07	1.10E-09	0.00E+00	9.11E-12
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	8.60E+00	1.80E+00	8.24E-01	1.38E+01	1.74E-01	0.00E+00	3.90E+00
EP	Eutrophication potential	kg N-Eq.	7.75E-01	9.97E-02	-4.65E-01	1.55E+00	9.66E-03	0.00E+00	1.30E+00
SP	Smog formation potential	kg O ₃ -Eq.	1.76E+02	4.95E+01	3.91E+01	2.53E+02	4.80E+00	0.00E+00	1.09E+01
FFD	Fossil Fuel Depletion	MJ-surplus	1.56E+04	5.30E+02	2.93E+03	1.73E+04	5.13E+01	0.00E+00	8.24E+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.	5.15E+03	3.00E+02	1.54E+03	7.13E+03	2.91E+01	0.00E+00	8.96E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	2.05E-08	1.13E-08	3.95E-07	3.85E-07	1.10E-09	0.00E+00	1.31E-10
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	7.62E+00	1.48E+00	2.55E+00	1.22E+01	1.43E-01	0.00E+00	1.71E+00
EP	Eutrophication potential	kg(PO ₄) ³ -Eq.	1.22E+00	2.63E-01	1.39E-01	3.30E+00	2.55E-02	0.00E+00	2.02E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	1.51E+00	1.73E-01	3.27E-01	2.24E+00	1.67E-02	0.00E+00	4.64E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	1.17E-02	1.24E-07	4.62E-03	1.47E-02	1.21E-08	0.00E+00	1.58E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	1.14E+05	3.82E+03	2.49E+04	1.29E+05	3.70E+02	0.00E+00	6.23E+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	8.90E+03	0.00E+00	1.49E+03	9.43E+03	0.00E+00	0.00E+00	9.22E+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	9.01E+04	3.85E+03	2.63E+04	1.09E+05	3.74E+02	0.00E+00	6.43E+02
NRPR _M	Nonrenewable primary energy as material utilization	MJ	2.80E+04	0.00E+00	0.00E+00	2.52E+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	3.70E+01	0.00E+00	6.35E+00	3.91E+01	0.00E+00	0.00E+00	1.67E-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	5.02E-02	0.00E+00	5.07E-06	4.52E-02	0.00E+00	0.00E+00	1.55E-07
NHWD	Non-hazardous waste disposed	kg	1.06E+03	0.00E+00	5.92E+01	2.54E+03	0.00E+00	0.00E+00	1.70E+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	1.78E+00	0.00E+00	4.79E-01	2.04E+00	0.00E+00	0.00E+00	7.07E-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	5.37E+01	0.00E+00	0.00E+00	4.84E+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*

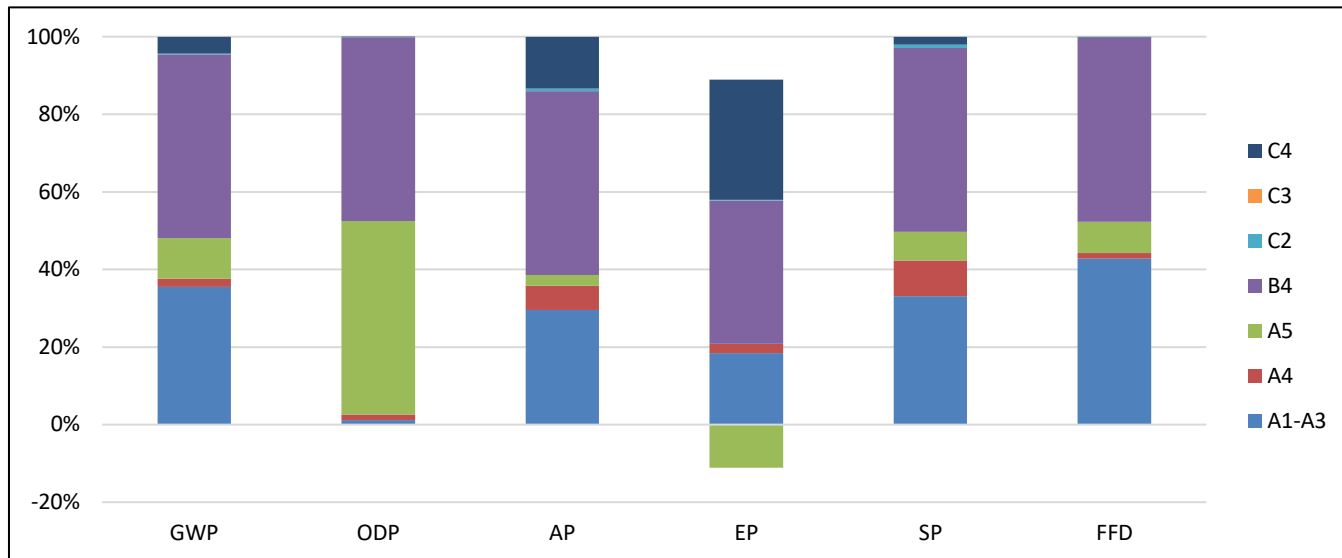
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

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

LCA 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.	5.44E+03	3.16E+02	1.52E+03	7.18E+03	3.07E+01	0.00E+00	6.72E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	9.98E-09	1.20E-08	3.93E-07	3.75E-07	1.16E-09	0.00E+00	9.58E-12
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	9.07E+00	1.90E+00	8.24E-01	1.45E+01	1.84E-01	0.00E+00	4.10E+00
EP	Eutrophication potential	kg N-Eq.	8.18E-01	1.05E-01	-4.65E-01	1.65E+00	1.02E-02	0.00E+00	1.36E+00
SP	Smog formation potential	kg O ₃ -Eq.	1.87E+02	5.23E+01	3.91E+01	2.65E+02	5.08E+00	0.00E+00	1.15E+01
FFD	Fossil Fuel Depletion	MJ-surplus	1.64E+04	5.59E+02	2.93E+03	1.80E+04	5.43E+01	0.00E+00	8.66E+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.	5.44E+03	3.17E+02	1.54E+03	7.44E+03	3.08E+01	0.00E+00	9.41E+02
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	2.17E-08	1.19E-08	3.95E-07	3.87E-07	1.16E-09	0.00E+00	1.37E-10
AP	Acidification potential for air emissions	kg SO ₂ -Eq.	8.03E+00	1.56E+00	2.55E+00	1.27E+01	1.51E-01	0.00E+00	1.80E+00
EP	Eutrophication potential	kg(PO ₄) ³ -Eq.	1.29E+00	2.78E-01	1.39E-01	3.47E+00	2.70E-02	0.00E+00	2.12E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	kg ethane-Eq.	1.59E+00	1.82E-01	3.27E-01	2.34E+00	1.77E-02	0.00E+00	4.88E-01
ADPE	Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	1.23E-02	1.31E-07	4.62E-03	1.52E-02	1.28E-08	0.00E+00	1.66E-05
ADPF	Abiotic depletion potential for fossil resources	MJ	1.19E+05	4.03E+03	2.49E+04	1.34E+05	3.91E+02	0.00E+00	6.55E+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	9.41E+03	0.00E+00	1.49E+03	9.90E+03	0.00E+00	0.00E+00	9.70E+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	9.64E+04	4.07E+03	2.63E+04	1.15E+05	3.95E+02	0.00E+00	6.76E+02
NRPR _M	Nonrenewable primary energy as material utilization	MJ	2.80E+04	0.00E+00	0.00E+00	2.52E+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	3.91E+01	0.00E+00	6.35E+00	4.10E+01	0.00E+00	0.00E+00	1.75E-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	5.35E-02	0.00E+00	5.07E-06	4.82E-02	0.00E+00	0.00E+00	1.63E-07
NHWD	Non-hazardous waste disposed	kg	1.13E+03	0.00E+00	5.92E+01	2.67E+03	0.00E+00	0.00E+00	1.78E+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	1.89E+00	0.00E+00	4.79E-01	2.14E+00	0.00E+00	0.00E+00	7.43E-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	5.37E+01	0.00E+00	0.00E+00	4.84E+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*

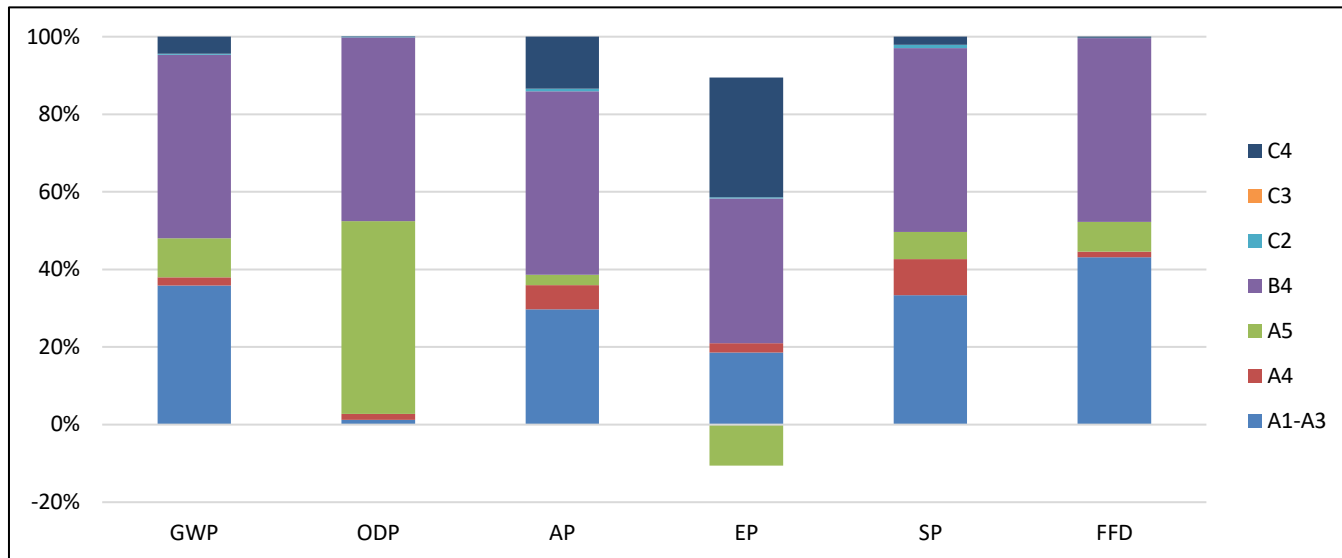
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

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.

Environmental Product Declaration

GAF EverGuard® PVC KEE Fleece-back Membrane

Single Ply Roofing Membrane (PVC)



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

Additional Environmental Information

Environmental and Health During Manufacturing

During the manufacturing of EverGuard® PVC KEE Fleece-back Membrane, 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 by building code. 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 EverGuard® 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 GAF EverGuard® PVC KEE Fleece-back Membranes.

Mechanical Destruction

GAF EverGuard® PVC KEE Fleece-back Membranes have 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

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Environmental Product Declaration

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Single Ply Roofing Membrane (PVC)



According to
ISO 14025, ISO 14044,
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