

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2025-065-0476-01.2

SunStyle®



certainteed
SAINT-GOBAIN

 **SunStyle®**



Date of Issue:
May 12, 2025

Expiration:
May 12, 2030

Last updated:
Jul 09, 2025

General Information

CertainTeed Saint-Gobain

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Product Name:	SunStyle®
Declared Unit:	1 m2 of installed solar roofing product (SunStyle panel)
Declaration Number:	SmartEPD-2025-065-0476-01.2
Date of Issue:	May 12, 2025
Expiration:	May 12, 2030
Last updated:	July 09, 2025
EPD Scope:	Cradle to gate A1 - A3
Market(s) of Applicability:	North America

General Organization Information

SunStyle, a partner of Saint-Gobain, is the global leader in building-integrated photovoltaic (BIPV) roofs. We have manufactured beautiful, proven solar tiles since 2007, with installations all over the world. Our patented solar roof system maximizes your roof’s solar potential, complements any architectural style, and protects your building in even the harshest conditions.

Further information can be found at: <https://www.certainteed.com/products/solar-products/sunstyle>

Limitations, Liability, and Ownership

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of products using EPD information shall be based on the product’s use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the whole building life cycle. EPD comparability is only possible when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. The EPD owner has sole ownership, liability, and responsibility for the EPD.

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017
Core PCR:	Smart EPD® Part A Product Category Rules for Building and Construction Products and Services, 1000, v1.01 Date of issue: January 15, 2024 Valid until: July 15, 2025
Sub-category PCR review panel:	 Contact Smart EPD for more information.

General Program Instructions:  Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

ACLCA PCR Guidance Version:	1.0
ACLCA PCR Conformance Level:	Transparency
LCA Author/Creator:	 Casper Gate  Saint-Gobain North American ESG Sustainability Group  sustainability@saint-gobain.com
EPD Program Operator:	 Smart EPD  info@smartepd.com  www.smartepd.com  585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA
Verification:	Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071: External  Brandon Kuczenski  brandon@scope3consulting.com Independent external verification of EPD, according to ISO 14025 and reference PCR(s): External  Brandon Kuczenski  brandon@scope3consulting.com

Product Information

Declared Unit:	1 m2 of installed solar roofing product (SunStyle panel)
Mass:	16.78 kg
Reference Service Life:	25 Years
Product Specificity:	 Product Average  Product Specific

Product Description

The SunStyle Building-Integrated Photovoltaic (BIPV) Solar Roofing module is designed with active shingles that integrate high-efficiency solar cells, encapsulated between a durable front glass superstrate and a protective substrate. The assembly incorporates cell connectors, string connectors, a junction box, bypass diodes, cables, and module connectors, all meticulously bonded using high-performance adhesives and potting materials. This construction ensures superior structural integrity, weather resistance, and long-term reliability, making it a seamless and efficient roofing solution.

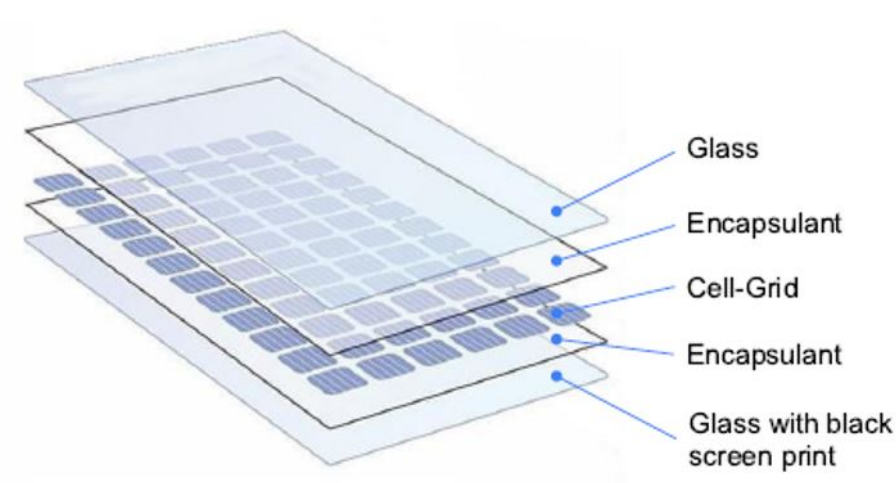


Product Specifications

Product SKU(s):M110

Product Classification Codes:EC3 - Cladding -> RoofPanels

Product Composition Diagram



Material Composition

Material/Component Category	Origin	% Mass
Tempered Solar Glass	Confidential	80-90
Ethylene vinyl acetate	Confidential	7-12
Solar Cell	Confidential	1-4
Copper Wire	Confidential	1-4
Junction Box	Confidential	1-4
Tapes	Confidential	0-2

Packaging Material	Origin	kg Mass
Corrugated Box	Confidential	0.13
Pallets	Confidential	2.64

Biogenic Carbon Content	kg C per m2
Biogenic carbon content in product	None
Biogenic carbon content in accompanying packaging	1.39

Hazardous Materials
No substances required to be reported as hazardous are associated with the production of this product

EPD Data Specificity

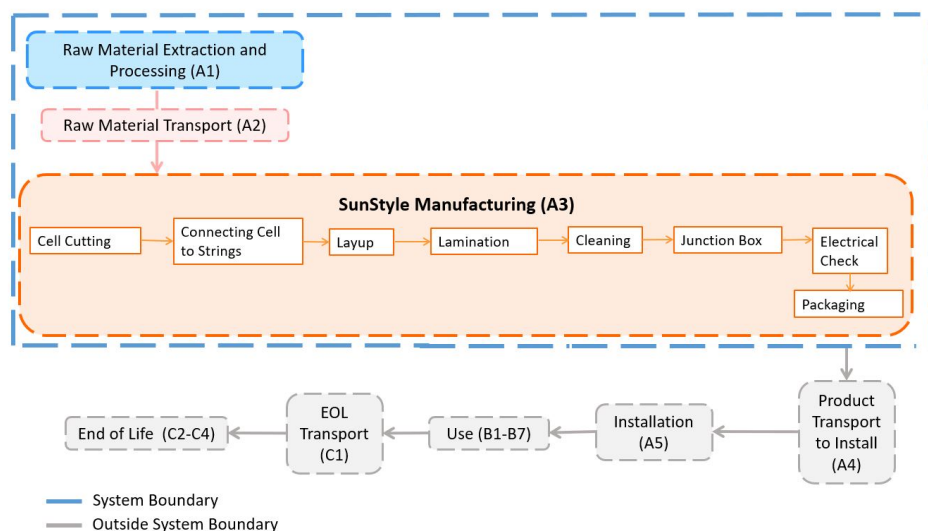
Primary Data Year:	2021
Manufacturing Specificity:	✗ Industry Average ✗ Manufacturer Average ✓ Facility Specific

Averaging:

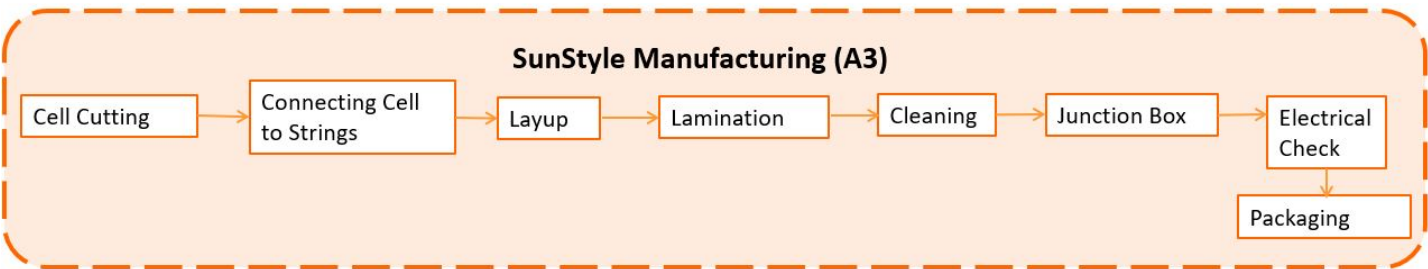
Averaging was not conducted for this EPD

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	ND
	A5	Assembly / Install	ND



Product Flow Diagram



Software and Database

LCA Software:	 Sphera LCA for Experts (formerly GaBi) v. 10.9
LCI Foreground Database(s):	 GaBi Professional Database v. 2024.2
LCI Background Database(s):	 US LCI v. FY17.Q4.02  Ecoinvent v. 3.9.1

Data Quality

A comprehensive data quality assessment was undertaken to ensure consistency, precision, and reproducibility, particularly for secondary data sources. Wherever secondary data is used, the study relies on critically reviewed and widely recognized databases that include built-in data quality indicators such as representativeness, completeness, temporal correlation, geographical relevance, and technological coverage. These indicators provide a general measure of reliability and uncertainty. Using these data quality metrics, the secondary datasets selected for this study are generally rated as having medium-to-high precision. Preference was given to datasets that are recent, geographically appropriate, and technologically relevant to the modeled system. Where older datasets were used due to lack of alternatives, their limitations have been clearly noted and considered in the interpretation of results.

Primary data was collected directly by the Saint-Gobain North American ESG Department for the relevant manufacturing plant(s). This includes site-specific information on energy and material inputs, emissions, waste generation, water usage, and transportation impacts. Efforts were made to verify this primary data through consultation with plant personnel and internal documentation. Sub-metering and additional on-site monitoring are recommended in future assessments to further improve data granularity and accuracy.

Life Cycle Module Descriptions

This Life Cycle Assessment is defined as a cradle-to-gate study, focusing on the SunStyle product lines from the extraction of raw materials through to the completion of manufacturing processes. It does not include downstream stages such as product distribution, installation, use, or end-of-life treatment. For this assessment, the Saint-Gobain North America (SGNA) ESG department, in collaboration with personnel at the manufacturing site, collected primary, site-specific data for the CertainTeed sheets produced at the Solvis LTD facility in Varadin, Croatia for the calendar year 2021. The data encompass material and energy inputs, waste generation, atmospheric emissions, and on-site transportation impacts. It is important to highlight that if the product is transported overseas to its market destination, the related environmental impacts must be accounted for under Module A4. Inclusion of A4 is essential for a full representation of the environmental footprint associated with the product's delivery to the final point of use, particularly for Environmental Product Declaration purposes.

Raw Materials (Module A1)
A thorough analysis of the material inputs was completed for the inventory of this study.

Transportation of raw materials (Module A2)

Raw materials are transported to the manufacturing sites by standard freight truck, train, or ocean freighters. Unless otherwise noted, transport vehicles are fueled with diesel fuel. The Raw material transportation distance were modeled based on the actual data provided by experts from the plant.

Manufacturing (Module A3)

The manufacturing process of Sunstyle solar modules begins with cell cutting, where large photovoltaic (PV) cells are precisely laser-cut into smaller dimensions. These cells are then connected into strings using conductive ribbons soldered to their contact points. During the layup process, the assembly starts with placing the front glass (sunnyside down), followed by a layer of encapsulant (EVA). Soldering underlays are positioned next to support heat distribution during soldering. The strings are then carefully aligned, with string connectors attached and soldered to interconnectors for a complete electrical circuit. A second layer of EVA is placed, and openings are cut for the string connectors, followed by the addition of a black backsheet for protection. An optical check with mirrors ensures accurate alignment before conducting an electroluminescence (EL) test to identify micro-cracks or hidden defects. A final optical inspection precedes lamination, where heat and vacuum bond all layers while removing air bubbles. Post-lamination, the module undergoes cleaning to eliminate residues, after which a junction box containing electrical connectors and bypass diodes is attached to the back. An electrical test verifies parameters like open-circuit voltage, short-circuit current, and peak power output to ensure quality standards are met. Finally, the completed solar modules are securely packaged to prevent damage during transport and storage.

Packaging (Module A3)

Packaging of the final product after production is included in the life cycle assessment. The siding product is banded and placed in corrugated containers. The Sunstyle solar products are then shipped on pallets. The purchased amount of packaging material was provided by the CertainTeed facilities personnel and the weight of each material per linear meter of finished product was calculated.

LCA Discussion

Allocation Procedure

Allocation was conducted based on the production mass data provided by the facility as a percentage of the overall production mass.

Cut-off Procedure

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. For Hazardous Substances as defined by the U.S. Occupational Health and Safety Act 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. This EPD is in compliance with the cut-off criteria. No known flows were deliberately excluded. Capital items for the production processes (machines, buildings, etc.) were not taken into consideration.

This LCA study complies with the established cut-off criteria, with no known data gaps or exclusions beyond those explicitly listed below. The following processes are excluded from the system boundary in accordance with EN 15804 and ISO 14044 standards:

- Construction of capital equipment (Module A3)
- Maintenance of operational and support equipment
- Human labor and employee commuting
- Overhead natural gas usage for space heating at the manufacturing facility (Module A3)
- Final product shipping and distribution (Module A4)
- Product installation (Module A5)
- Product use phase (Modules B1B7)
- Transportation for end-of-life disposal (Module C2)
- End-of-life treatment and disposal (Modules C3 and C4)

These exclusions are standard for a cradle-to-gate assessment and are not expected to significantly affect the overall conclusions of the study

Renewable Electricity

Energy Attribute Certificates (EACs) such as Renewable Energy Certificates (RECs) or Power Purchase Agreements (PPAs) are included in the baseline reported results:

✗ No

Results

Environmental Impact Assessment Results

IPCC AR6 GWP 100, TRACI 2.1, CML 2016 v4.8

per 1 m2 of product of installed solar roofing product (SunStyle panel).

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

Impact Category	Method	Unit	A1	A2	A3	A1A2A3
GWP-total	IPCC AR6 GWP 100	kg CO2 eq	2.24e+1	3.27e+0	2.46e+0	2.81e+1
GWP-fossil	IPCC AR6 GWP 100	kg CO2 eq	2.24e+1	3.27e+0	5.87e+0	3.15e+1
ODP	TRACI 2.1	kg CFC 11 eq	8.67e-7	1.21e-10	1.95e-8	8.87e-7
AP	TRACI 2.1	kg SO2 eq	1.72e-1	5.89e-2	2.46e-2	2.56e-1
EP	TRACI 2.1	kg N eq	4.86e-2	3.19e-3	4.51e-3	5.63e-2
POCP	TRACI 2.1	kg O3 eq	2.37e-2	1.21e-3	1.51e-3	2.64e-2
ADP-fossil	CML 2016 v4.8	MJ	4.01e+1	5.65e+0	9.87e+0	5.56e+1

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particulate Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Global Warming Potential or Climate Change is an indicator aimed at including in a single value the added effect of all the substances contributing to the greenhouse effect.

Global Warming Potential (GWP-Total) includes biogenic carbon, fossil carbon, land use and land use change. To calculate GWP-Total within the above table, the equation below is used:

$$\text{GWP-total} = \text{GWP-biogenic} + \text{GWP-fossil} + \text{GWP-luluc}$$

- *GWP-total* or *GWPtotal (including biogenic)* is the sum of GWP-biogenic, GWP-fossil and GWP-luluc
- *GWP-biogenic* only includes biogenic carbon which is carbon that is stored in bio-sourced materials, like plants, trees, and soil. This excludes fossil.
- *GWP-fossil* or *GWPtotal (excluding biogenic)* only includes fossil carbon which is the carbon dioxide emitted when fossil fuels like coal, oil, or natural gas are combusted. This excludes biogenic.
- *GWP-luluc* only includes the greenhouse gas emissions that arise in connection with changes in the specified carbon stock as a result of land use and land use change, such as deforestation.

Depending on the required or optional standards, GWP can be reported with different methods and indicators including United States Environmental Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI 2.1, etc.), Intergovernmental Panel on Climate Change (IPCC) Assessment Report (AR 5, AR 6, etc.), Environmental Footprint (EF 3.0, 3.1), and/or EN 15804.

GWP can be reported on a time frame such as GWP 100 for 100-year time horizon.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited

comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicators

per 1 m2 of product of installed solar roofing product (SunStyle panel).

Indicator	Unit	A1	A2	A3	A1A2A3
RPRE	MJ	9.60e+1	2.14e+1	1.82e+1	1.36e+2
RPRM	MJ	0	0	0	0
RPRT	MJ	9.60e+1	2.14e+1	1.82e+1	1.36e+2
NRPRE	MJ	4.72e+2	3.55e+2	1.06e+2	9.33e+2
NRPRM	MJ	0	0	0	0
NRPRT	MJ	4.72e+2	3.55e+2	1.06e+2	9.33e+2
ADP-fossil	MJ	0	0	0	0
SM	kg	0	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m3	5.46e-1	5.26e-1	9.38e-3	1.08e+0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM = Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

per 1 m2 of product of installed solar roofing product (SunStyle panel).

Indicator	Unit	A1	A2	A3	A1A2A3
HWD	kg	2.19e-7	2.29e-7	9.98e-9	4.58e-7
NHWD	kg	1.25e-1	1.08e-1	1.65e-2	2.49e-1
RWD	kg	0	0	0	0
HLRW	kg	8.51e-7	8.11e-7	3.95e-8	1.70e-6
ILLRW	kg	7.51e-4	7.08e-4	4.37e-5	1.50e-3
CRU	kg	0	0	0	0
MFR	kg	0	0	0	0
MER	kg	0	0	0	0
MNER	kg	0	0	0	0
EEE	MJ	0	0	0	0
EET	MJ	0	0	0	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Carbon Emissions and Removals

per 1 m2 of product of installed solar roofing product (SunStyle panel).

Indicator	Unit	A1	A2	A3	A1A2A3
BCRP	kg CO2	0	0	0	0
BCEP	kg CO2	0	0	0	0
BCRK	kg CO2	0	0	3.42e+0	3.42e+0
BCEK	kg CO2	0	0	0	0
BCEW	kg CO2	0	0	0	0
CCE	kg CO2	0	0	0	0
CCR	kg CO2	0	0	0	0
CWNR	kg CO2	0	0	0	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

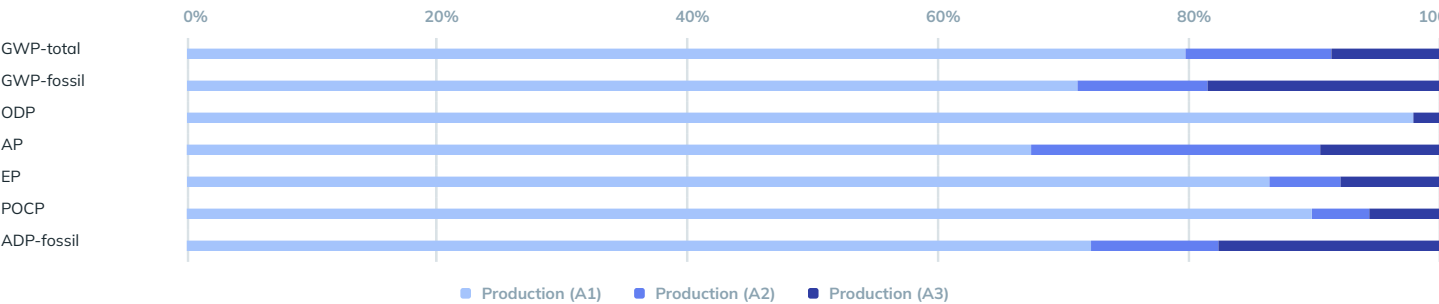
BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

Impact Scaling Factors

Product Name and/or Product Attribute	Product Specific Functional/Declared Unit Multiplier
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Interpretation

The results of the life cycle assessment indicate that the raw material and manufacturing process phase have the most significant impact on the environmental performance of the products under study. More than 73% of the overall global warming potential is attributed to the raw materials stage with manufacturing process contributing 16% to the overall global warming potential of the product. Additionally, Manufacturers shall not make claims based on an industry-average EPD which leads the market to believe the industry-average is representative of manufacturer-specific or product- specific results.



Further Information

Certification

Properties	Standards
Fire	UL 790 Class A
Impact	FM4437 Class 4

PV Module Performance	L/IEC 61215
Wind Resistance	ASTM D3161 Class F
Mechanical Loading	UL7103 Section 31
Grounding	UL2703
Photovoltaic Safety	UL/IEC 61730-1, 61730-2

General Characterstics

Characteristics	Technical Details
Construction	Glass EVA Cells EVA Glass
Solar Cell Type	PERC Monocrystalline
Glass Thickness	3.2 mm (front) + 3.2 mm (back)
Glass Properties	Tempered Solar Glass
Bypass Diode	One Diode per shingle
Temperature Range	-40° F to +185°F
Junction Box	Renhe or TE Connectivity



References

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- SMART EPD PART A PRODUCT CATEGORY RULES FOR BUILDING AND CONSTRUCTION PRODUCTS AND SERVICES Standard 1000-001, version 1.0, January 31, 2024
 - ISO 14040: 2006 Series Environmental Management-Life Cycle Assessment
 - ISO 21930:2017 Sustainability in building construction Environmental declaration of building products
 - Sphera Managed LCA Content Databases. <https://lcadatabase.sphera.com/>
 - US LCI Database. https://www.lcacommons.gov/lca-collaboration/search/page=1&group=National_Renewable_Energy_Laboratory
 - Ecoinvent Database. <http://ecoinvent.org/>
 - SunStyle by CertainTeed: <https://www.certainteed.com/products/solar-products/sunstyle>