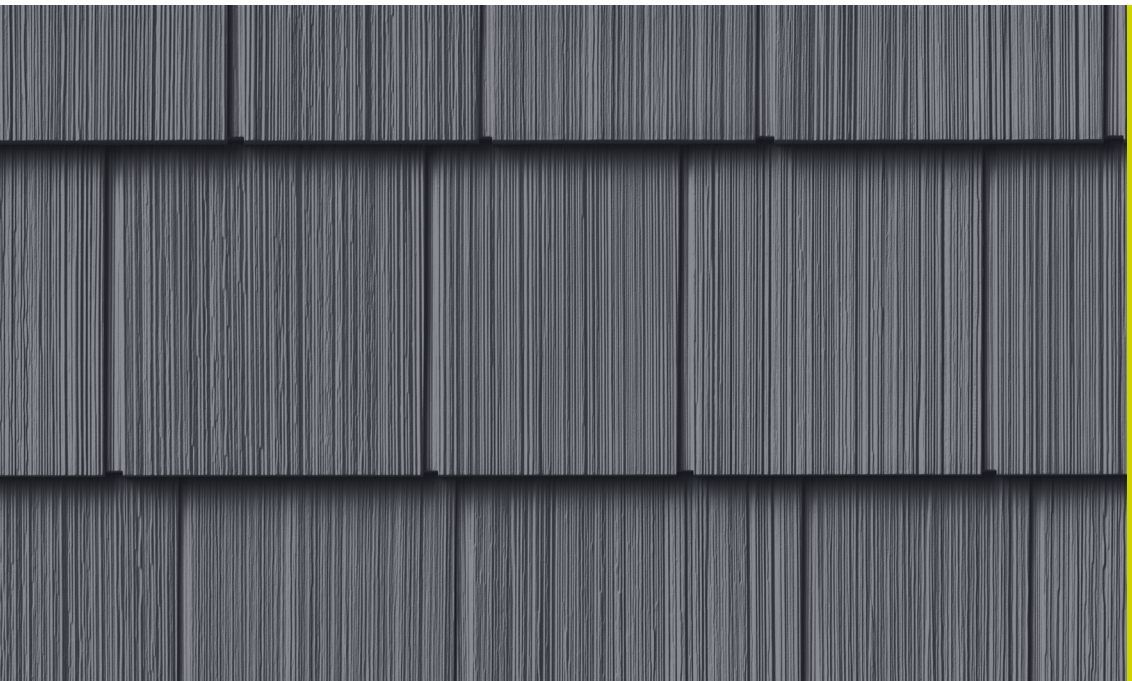
ENVIRONMENTAL PRODUCT DECLARATION
Polypropylene Siding
Polypropylene Siding Industry Average

VINYL SIDING INSTITUTE™

What You Will Find in This EPD



Advantages of Polypropylene Siding

- ✓ Is recyclable
- ✓ Has low impact on global warming
- ✓ Little water is used to manufacture
- ✓ Less than 1% waste in manufacturing
- ✓ Many design options
- ✓ Lightweight and resource efficient
- ✓ Retains colors
- ✓ Virtually no maintenance is required
- ✓ Long life span
- ✓ Resilient in all climates

Carbon Footprint

To understand the measurement of the numbers below check out the BEES (Building for Environmental and Economic Sustainability software) tool online. A tool developed by the NIST (National Institute of Standards and Technology) that measures the life cycles of different types of cladding.

Polypropylene siding manufacturing is an extremely efficient process that require few raw materials. There are relatively low inputs of energy during the extraction, transport, and manufacturing process.

9.81
kg CO2 Eq.

The transport of polypropylene siding from packaging to construction takes little energy because it weighs less than other typical construction building materials.

0.32
kg CO2 Eq.

The installation of siding is done primarily by manual labor. Nails or screws can be used to install the siding. The energy required to operate compressors to power air guns is quite small.

0.78
kg CO2 Eq.

No routine maintenance is required to prolong the lifetime of polypropylene siding, although cleaning is recommended to maintain appearance. Cleaning would normally be done with water and household cleaners.

0.14
kg CO2 Eq.

Replacement is not common. As the lifetime of a building is assumed to be 75 years, a replacement factor of 0.5 is assumed.

6.0
kg CO2 Eq.

The transport of polypropylene siding from demolition to waste processing takes little energy because it weighs less than other typical construction building materials.

0.03
kg CO2 Eq.

Waste processing of polypropylene siding is limited. Recycling opportunities for polypropylene siding are available.

0.00E+00
kg CO2 Eq.

Polypropylene siding is most commonly disposed of in municipal solid waste streams at the end of the product's service life. This study assumes that 20% of the products get incinerated in waste-to-heat energy recovery facilities and the remaining 80% are landfilled.

0.00
kg CO2 Eq.

Polypropylene siding is completely recyclable, as it is a thermoplastic. A number of VSI member companies offer take-back and extended producer responsibility programs to help minimize polypropylene siding waste.

1.73
kg CO2 Eq.

Recyclability

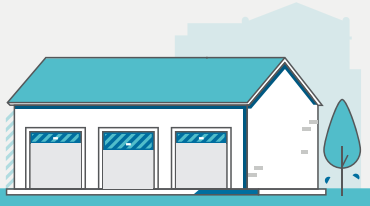
Polypropylene siding is completely recyclable as it is a thermoplastic; however, the infrastructure and logistics to recycle polypropylene siding may be limited in certain regions of the U.S. and Canada. The products analyzed in this declaration did not contain recycled content; however, some VSI manufacturers do offer polypropylene siding options that integrate pre-consumer recycled content into their products to increase resource efficiency manufacturing practices up and down the life cycle of the product.

Here is how it works!

1

GATHER YOUR POLYPROPYLENE SIDING RECLAIMED

Minimize jobsite waste. Load new and used polypropylene siding reclaimed into your truck instead of throwing it in the dump.



2

DELIVER RECLAIMED TO A RECYCLING CENTER

Local Recycling Centers

Check with the center for requirements on polypropylene siding recycling. Services vary based on location.

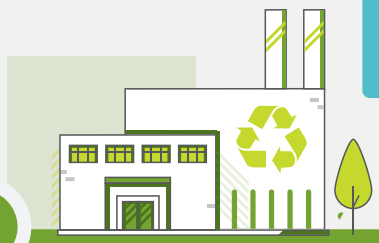
Distribution Centers

Many distributors accept or buy back polypropylene siding reclaimed. Check with your local representative for more details.

Construction & Demolition Waste Pick-Up

Schedule a bulk pick-up with your local C&D waste management center. Services vary by location.

Recycling centers send reclaimed to get processed into reusable material.



3

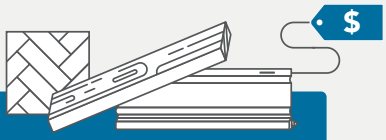
RECYCLED POLYPROPYLENE SIDING IS PROCESSED

The reclaimed is cleaned and ground down into fine granules, which can be melted down to create new products.

4

PROCESSED POLYPROPYLENE CREATES NEW PRODUCTS

Manufacturers and brokers purchase the plastic to make new products including cladding, decking and flooring.



Did you know, polypropylene siding can be recycled to create new products?

Longevity

Polypropylene siding is engineered with purpose — to deliver maximum protection and beauty with minimum hassle and maintenance for years to come. Polypropylene siding has a useful life of 50 years or more, as many manufacturers provide warranties of 50 years or longer. In this life span, polypropylene siding is durable and prevails to the outside elements such as extreme weather, mold, and unwanted pesky critters. It also requires very little upkeep throughout the 50 year life span.

For a more thorough analysis of the life span of polypropylene siding, please see the life cycle assessment data on pages 10-11.

Materials Sustainability

Polypropylene siding products require minimal raw material and produce virtually no waste.

National Green Building Programs

Why get a National Green Building Certification? There are many reasons: increase in property value, qualify for tax credits, but most importantly, a building or community with a NGBS certification recognizes green construction and adds a cost saving benefit from the amount of energy that will be saved over the lifespan of the structure, which will promote better occupancy rates.

Polypropylene Siding Green Credits through Nationally Recognized Programs

LEED (Leadership in Energy and Economic Design)

NGBS (National Green Building Standard)

CalGreen (California Green Building Code)

Did you know, that there are over 350,000 homes certified to the National Green Building Standard?"

Polypropylene Siding Environmental Data

Product Description

In this declaration, an industry-wide average of polypropylene siding using a 0.085" (2.159 mm) thickness of a cedar shake profile is documented. The following manufacturers have participated in this study.

CertainTeed Corporation – McPherson, Kansas, USA

Cornerstone Building Brands – Gaffney, South Carolina, USA

Derby Building Products Inc. – St-Augustin-de-Desmaures, Québec, Canada

The results in this declaration are representative for the United States and Canada. The functional unit for this study is 1 meter squared of installed polypropylene siding with a 50-year service life, with a weight of 8.00 pounds, or 3.64 kilograms. As the lifetime of a building is assumed to be 75 years, a replacement factor of 0.5 is assumed.

Polypropylene siding is an exterior cladding product offered in a diverse selection of colors and textures used to assist remodelers, builders, designers and architects in customizing their new construction and renovation designs.

Polypropylene siding produced by VSI member companies are produced according to the standard ASTM D7254, *Standard Specification for Polypropylene (PP) Siding*.

Polypropylene siding is produced according to the following standards:

- ASTM D7254 Standard Specification for Polypropylene (PP) Siding

Table 1 - Polypropylene Siding Technical Information

Name	Value	Unit
Length	3.66	m
Width	0.178	m
Thickness	2.16	mm
Density	1,025	kg/m^3
Functional Unit	1	m2
Panels per Functional Unit	1.53 panels	
Functional Unit Weight	3.64	kg
CSI MasterFormat	07 46 33	
UNSPSC codes	30151802	
Lifetime	50	years
Standards: ASTM D7793		

Table 2 - Polypropylene Siding Formulation

Constituent	% in Siding
Polypropylene	80%
Calcium Carbonate	15%
Pigments and additives	5%

Manufacturing

To produce polypropylene siding, polypropylene compound beads are melted and injected into molds derived from actual cedar shakes. The polymer cures into the shape from the mold. Various pigments can be added for color variations. Polypropylene siding manufacturing is an extremely efficient injection molding process requiring relatively low inputs of energy and water and the ability to immediately return scrap and off-specification materials (regrind) directly into the manufacturing process results in virtually no manufacturing waste.

Environmental and Health Considerations during Manufacturing

Most polypropylene siding manufacturers have integrated closed-loop water systems which save millions of gallons of water each year per facility. Recycling programs are implemented in many manufacturer's facilities to improve upon resource efficiency and divert waste from landfills.

Packaging

Polypropylene siding is commonly packaged using wood frames to protect the siding in transport. Cardboard may also be used to protect the siding. Cardboard is recyclable in most infrastructure recycling networks throughout North America.

Distribution

Based on the functional unit of 1 m^2, the following data describes the distribution of the product:

Table 3 - Distribution Formulation

Name	Value	Unit
Fuel type	Diesel	
Liters of fuel	9.91×10^{-3}	l/100km
Vehicle type	Truck	
Transport distance	993.34	km
Capacity utilization	90	%
Gross density of products transported	1,064	kg/m^3
Weight of products transported	3.46	kg

Product Installation

Installation is modeled for nails placed 41 cm (16 in) on center; nail use is 0.026 kg (0.057 lb) per 1 m2 (per 10.76 ft2) of siding. Installation waste with a mass fraction of 5% is assumed, and this waste is assumed to go to a landfill. It is assumed that no electricity is used for the installaiton of the product.

While sheathing, weather resistive barriers, and other ancillary materials are required to complete the exterior wall system, these materials are not included in the system boundaries.

VSI has developed a certification program for polypropylene siding installers. Certified Polypropylene Siding Installers have at least two years of installation experience and have demonstrated knowledge of proper installation techniques. This program follows the ASTM D4756 standard for the Standard Practice for Installation of Rigid Poly(Vinyl Chloride) (PVC) Siding and Soffit.

Table 4 - Installation Formulation

Name	Value	Unit
Ancillary materials	0.026	kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	-	m^3
Other resources	-	kg
Electricity consumption	-	kWg
Other energy carriers	-	MJ
Product loss per functional unit	0.18	kg

Use Considerations

No routine maintenance is required to prolong the lifetime of the product, although cleaning is recommended to maintain appearance. Cleaning would normally be done with water and household cleaners. As the lifetime of a building is assumed to be 75 years, a replacement factor of 0.5 is assumed, resulting in the combined impacts being multiplied by a factor of 1.5 (the estimated service life of the building divided by the reference service life of the product).

Table 5 - Use Considerations

Name	Value	Unit
RSL	50	years
Declared product properties and finishes, etc.	See Certified Vinyl Siding Installers program for more details	
Design application		
An assumed quality of work, when installed in accordance with the manufacturer's instructions		
Use conditions		
Outdoor environment		
Indoor environment	n/a	
Maintenance	Clean with water and household cleaners	

Environmental and Health Considerations During Use

Polypropylene siding does not require painting, staining or caulking during installation and only requires periodic cleaning with mild soap and water. Consumption of materials and energy for the use phase can be found in the LCA results section below.

Service Life

The product is assumed to have a useful life of 50 years as many manufacturers provide warranties of 50 years or longer. No routine maintenance is required to prolong the lifetime of the product, although cleaning is recommended to maintain appear-ance. Cleaning would normally be done with water and mild household cleaners. As the lifetime of a building is assumed to be 75 years, a replacement factor of 0.5 is assumed.

Table 6 - Service Life Formulation

Name	Value	Unit
Reference service life	50	years
Replacement cycle	0.5	ESL/ RSL - 1
Energy input, specified by activity	-	kWh
Net freshwater consumption	-	m^3
Ancillary materials	Fasteners: 0.13	kg
Replacement of worn parts	Siding: 1.82	kg
Direct emissions	n/a	kg

Disposal

Table 7 - Disposal Formulation

Name		Value	Unit
Assumptions for scenario development		Products are manually removed and combined with construction and demolition waste.	
Collection process	Collected separately	-	kg
	Collected with mixed construction waste	3.64	kg
Recovery (specified by type)	Reuse	-	kg
	Recycling	-	kg
	Landfill	2.91	kg
	Incineration	0.73	kg
	Incineration with energy recovery	-	kg
	Energy conversion efficiency rate	-	
Disposal (specified by type)	Product or material for final deposition	Siding: 3.64	kg
Removals of biogenic carbon (excluding packaging)		-	kg CO_2

Life Cycle Assessment Study

The functional unit for this study is 1 square meter in a 2.16 mm thick, single 177.8 mm cedar shake profile. The reference service life is 50 years.

The system boundary is cradle-to-grave with all life cycle stages through Modules A to C have been considered.

Table 8 - Life Cycle Assessment Study

Product			Construction Installation		Use							End-of-Life				Benefits of Loads Beyond the System Boundary		
Raw Material Extraction and Processing	Transport	Manufacturing	Transport	Construction/ Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport	Waste Processing	Disposal	Reuse	Recovery	Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND	MND	MND

Allocation: Per production mass at each facility; a weighted average based on production totals between manufacturers was conducted

Cut-Off Rules: No components and materials were knowingly omitted from the LCA.

Data Sources: ecoinvent v3.7 and US LCI

Data Quality:

- Primary Data: 2020 calendar year
- Secondary Data: Representative of North America, based on ecoinvent and US LCI datasets developed or updated within 10 years.

Software: SimaPro v9.2

Period Under Review: Data from 2020 was collected and average based on production from each participating facility

Uncertainty: Monte Carlo uncertainty analysis is conducted in the framework of this EPD project and documented in the LCA report, Annex F, which may be provided upon request.

Life Cycle Assessment Study (continued)

Estimates and Assumptions:

- Products are assumed to travel 500 miles in a diesel-powered truck to the buliding site
- Manual installation occurs with a 5% scrap rate
- Products are assumed to travel 100km in a diesel-powered truck from the buliding site to the waste processor
- 20% of products are incinerated at the end of life; the remainder are landfilled.

These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined, and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Table 9 - Life Cycle Impact Assessment Results

TRACI 2.1		**Unit**	**A1-A3**	**A4**	**A5**	**B2**	**B4**	**C2**	**C3**	**C4**
GWP	Global Warming Potential	kg CO_2 eq	9.81E+00	3.19E-01	7.80E-01	1.42E-01	6.04E+00	2.57E-02	0.00E+00	1.73E+00
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 eq	4.00E-07	1.22E-11	4.18E-08	9.00E-09	3.15E-07	9.81E-13	0.00E+00	2.19E-07
AP	Acidification potential	kg SO2 eq	3.48E-02	1.91E-03	2.78E-03	4.91E-04	2.01E-02	1.54E-04	0.00E+00	2.51E-03
EP	Eutrophication potential	kg N eq	2.77E-02	1.06E-04	2.20E-03	5.00E-03	1.64E-02	8.56E-06	0.00E+00	4.35E-03
POCP	Photochemical ozone creation potential	kg O3 eq	4.91E-01	5.22E-02	4.04E-02	5.94E-03	2.99E-01	4.20E-03	0.00E+00	3.97E-02
FFD	Fossil Fuel Depletion	MJ	3.48E+01	6.12E-01	1.98E+00	5.11E-02	1.84E+01	4.93E-02	0.00E+00	1.10E+00
CML		**Unit**	**A1-A3**	**A4**	**A5**	**B2**	**B4**	**C2**	**C3**	**C4**
GWP	Global Warming Potential	kg CO_2 eq	9.95E+00	3.20E-01	7.89E-01	1.43E-01	6.11E+00	2.58E-02	0.00E+00	1.73E+00
ODP	Depletion potential of the stratospheric ozone layer	kg CFC-11 eq	2.99E-07	1.21E-11	3.27E-08	8.03E-09	2.49E-07	9.71E-13	0.00E+00	1.90E-07
AP	Acidification potential	kg SO_2 eq	3.30E-02	1.57E-03	2.64E-03	4.36E-04	1.89E-02	1.27E-04	0.00E+00	2.36E-03
EP	Eutrophication potential	kg PO_4 eq	1.38E-02	2.79E-04	1.09E-03	2.17E-03	8.16E-03	2.24E-05	0.00E+00	1.90E-03
POCP	Photochemical ozone creation potential	kg C_2H_4 eq	1.84E-03	7.25E-05	1.37E-04	7.43E-05	1.02E-03	5.84E-06	0.00E+00	8.99E-05
ADPE	Abiotic depletion (non-fossil)	kg Sb eq	5.06E-05	0.00E+00	6.99E-06	1.12E-06	2.93E-05	0.00E+00	0.00E+00	3.70E-06
ADPF	Abiotic depletion (fossil)	MJ	2.52E+02	4.11E+00	1.50E+01	5.09E-01	1.33E+02	3.31E-01	0.00E+00	8.53E+00

Modules B1, B3, B5-B7, and C1 are null.

Table 10 - Use of Resources

Resource Use		Unit	A1-A3	A4	A5	B2	B4	C2	C3	C4
NR-PRE	Non-renewable primary resources used as an energy carrier	MJ	1.38E+02	4.11E+00	2.68E+00	6.73E-01	7.69E+01	3.31E-01	0.00E+00	8.97E+00
RPRE	Renewable primary resources used as an energy carrier	MJ	1.23E+01	0.00E+00	1.06E+00	8.02E-01	6.83E+00	0.00E+00	0.00E+00	3.39E-01
NR-PRM	Non-renewable primary resources with energy content used as a material	MJ	1.35E+02	0.00E+00	6.76E+00	0.00E+00	7.10E+01	0.00E+00	0.00E+00	0.00E+00
RPRM	Renewable primary resources with energy content used as a material	MJ	3.24E-01	0.00E+00	0.00E+00	0.00E+00	1.62E-01	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	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	0.00E+00
NRSF	Use of non-renewable secondary fuels	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Fresh water consumption	m3	8.84E-02	0.00E+00	6.06E-03	1.07E-02	5.04E-02	0.00E+00	0.00E+00	6.39E-03

Modules B1, B3, B5-B7, and C1 are null.

Table 11 - Output Flows and Wastes

Output Flows		Unit	A1-A3	A4	A5	B2	B4	C2	C3	C4
HWD	Disposed-of-hazardous WASTE	kg	1.05E-04	0.00E+00	0.00E+00	0.00E+00	5.24E-05	0.00E+00	0.00E+00	0.00E+00
NHWD	Disposed-of non-hazardous WASTE	kg	1.77E-02	0.00E+00	1.82E-01	0.00E+00	1.92E+00	0.00E+00	0.00E+00	3.64E+00
RWD	Disposed-of radioactive WASTE	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	Materials for recycling	kg	1.38E-01	0.00E+00	0.00E+00	0.00E+00	6.91E-02	0.00E+00	0.00E+00	0.00E+00
MET	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	0.00E+00
EEE	Exported electrical energy (waste to energy)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	Exported thermal energy (waste to energy)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BBPr	Bio-based products	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BBPk	Bio-based packaging	kg	2.02E-02	0.00E+00	-2.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Modules B1, B3, B5-B7, and C1 are null.

The production stage (raw materials through manufacturing) is the largest driver of the life cycle of polypropylene siding. The raw materials stage is the primary driver of the production stage. Maintenance and end-of-life stages of polypropylene siding have very minimal influence on the overall life cycle.

References

- ISO 21930: Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
- EPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)
- FTC Part 260, Green guides
- (ILCD) Joint Research Commission, ILCD Handbook: General Guide for Life Cycle Assessment
- Intergovernmental Panel on Climate Change (IPCC)
- ISO 14025 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*
- ISO 14040/Amd1:2020 *Environmental management - Life cycle assessment – Principles and framework*
- ISO 14044:2006/Amd1:2017/Amd2:2020 *Environmental management - Life cycle assessment – Requirements and guidelines*
- ASTM D7254 Standard Specification for Polypropylene (PP) Siding
- ASTM Program Operator Rules. Version 8.0, Revised 04/29/20

LCA Development

This EPD and corresponding LCA were prepared by Sustainable Solutions Corporation of Royersford, Pennsylvania.

Verification and Authorization of the Declaration

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and ISO 21930. Please note that environmental declarations from different programs (based upon differing PCRs may not be comparable. Comparison of the environmental performance of construction works and construction products using EPD information shall be based on the product's use and impacts at the construction works level. In general, EPDs may not be used for comparability purposes when not considered in a construction works context. Given this PCR ensures products meet the same functional requirements, comparability is permissible provided the information given for such comparison is transparent and the limitations of comparability explained. When comparing EPDs created using the PCR, variations and deviations are possible. Examples of variations: different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

Program Operator	ASTM, 1100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428-2959, USA tel +1.610.832.9729 www.astm.org
Declaration Holder	Vinyl Siding Institute
Declaration Number	EPD 327
Declared Product	Industry Averaged Polypropylene Siding
Markets of Applicability	Residential
Reference PCR	ISO 21930:2017 serves as the core PCR and UL Part A. Sub-category Part B: Cladding Product Systems EPD Requirements. Second Edition, 2021
EPD Scope	Cradle to Grave
Date of Issue	7/14/2022
Expiration Day	7/15/2022
Period of Validity	5 years
Software	SimaPro 9.2.0.2
Life Cycle Impact Assessment Methodology	TRACI 2.1, 2012 CML Baseline 2001, Cumulative Energy Demand (LHV) v1.1

The PCR Panel Chair:	Jim Mellentine, Thrive ESG, Jim@ThriveESG.com thriveesg.com
This declaration was independently verified in accordance with ISO 21930:2017, UL Part A, and ISO 14025:2006 by ASTM ☐ Internal ☒ External	
Third-party verifier:	
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About VSI and this EPD

The Vinyl Siding Institute

The Vinyl Siding Institute, Inc. (VSI) is the trade association for manufacturers of vinyl, other polymeric siding, and suppliers to the industry.

VSI focuses on science driven data that clarifies the Life Cycle of vinyl and polymeric siding.

VSI is 100% committed to educating building professionals about how vinyl and polymeric sidings a high performing sustainable building material.

For more information, please visit www.vinylsiding.org or contact the Vinyl Siding Institute at hello@vinylsiding.org.

Participating Members