Declaration Owner
Owens Corning Roofing and Asphalt, LLC
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Products
Oakridge® Asphalt Shingles

Declared Unit
1 m^2 of Constructed Area Using Asphalt Shingles

EPD Number and Period of Validity
SCS-EPD-10443
EPD Valid June 13, 2025 through June 12, 2030

Product Category Rule
PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. March 2022.

PCR Guidance for Building-Related Products and Services Part B: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing EPD Requirements. Version 3.0. May 2021.

Program Operator
SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
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Declaration Owner:	Owens Corning Roofing and Asphalt, LLC
Address:	One Owens Corning Parkway, Toledo, OH, USA
Declaration Number:	SCS-EPD-10443
Declaration Validity Period:	June 13, 2025 through June 12, 2030
Version:	June 13, 2025
Product:	Oakridge® Asphalt Shingles
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
Declared Unit:	1 m^2 of Constructed Area Using Asphalt Shingles
Market of Applicability:	North America
EPD Type:	Product-specific
Range of Dataset Variability:	N/A
EPD Scope:	Cradle to gate with options (A1-A3, C2, C4)
Reference Year of Manufacturer Data:	2023
LCA Practitioner:	Aspire Sustainability LLC
LCA Software:	SimaPro 9.6.0.1
LCI Database:	EcoInvent 3.10.0
LCIA Methodology:	TRACI 2.1 v1.09; CML I-A baseline v4.7; IPCC (2013)
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Beth Cassese, SCS Global Services
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. UL Environment. March. 2022.
PCR Review conducted by:	Lindita Bushi, Athena Sustainable Materials Institute; Hugues Imbeault-Tetreault, Groupe AGECO; Jack Geibig, Ecoform
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing EPD Requirements. Version 3.0. UL Environment. May 2021.
Part B PCR Review conducted by:	Tom Gloria, Industrial Ecology Consultants; Jim Mellentine, Ramboll Environment; Eric Blond
Independent verification of the declaration and data, according to ISO 14025, ISO 21930, and the PCR	☐ internal ☒ external
EPD Verifier:	Beth Cassese, SCS Global Services
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled. In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.*

1. About Owens Corning

Owens Corning is a residential and commercial building products leader committed to building a sustainable future through material innovation. Our products provide durable, sustainable, energy-efficient solutions that leverage our unique capabilities and market-leading positions to help our customers win and grow. We are global in scope, human in scale with more than 25,000 employees in 31 countries dedicated to generating value for our customers and shareholders and making a difference in the communities where we work and live. Founded in 1938 and based in Toledo, Ohio, USA, Owens Corning posted 2024 sales of $11.0 billion.

This Environmental Product Declaration is representative of the products produced at the location listed below.

Atlanta Plant Atlanta, GA, USA	Kearny Plant Kearny, NJ, USA	Summit Plant Summit, IL, USA
Brookville Plant Brookville, IN, USA	Medina Plant Medina, OH, USA	
Compton Plant Compton, CA, USA	Memphis Plant Memphis, TN, USA	
Denver Plant Denver, CO, USA	Minneapolis Plant Minneapolis, MN, USA	
Irving Plant Irving, TX, USA	Portland Plant Portland, OR, USA	
Jacksonville Plant Jacksonville, FL, USA	Savannah Plant Savannah, GA, USA	

2. Product

2.1 Product Identification and Specification

Oakridge® laminated shingles provide premium protection and impressive curb appeal. A full double layer in the nailing zone gives Oakridge® Shingles greater integrity and better holding power compared to shingles with single-layer nail zones.Ω The shingles consist of fiberglass mat impregnated and coated on both sides with filled asphalt and surfaced on the exposed-to-weather portion with mineral granules. They are self-sealing and serve as the primary weather barrier of a roof.

Table 1. *Product Description and Specification for Oakridge® Asphalt Shingles*

Property/Descriptor	Values
Shingle Type	Laminate
Nominal Size	13¼" x 39⅜ " (33.66 cm x 101.01 cm)
Exposure	5⅝" (14.29 cm)
Shingles per Square	64
Bundles per Square	3
Coverage per Square	98.4 ft^2 (9.14 m^2)
Wind Resistance*/μ	110/130 MPH (177/209 KPH)
Algae Resistance§	25 Years*

* See actual warranty for complete details, limitations, and requirements.

μ 110 MPH is standard with 4-nail application. 130 MPH is applicable only with 6-nail application and Owens Corning® Starter Shingle products application along eaves and rakes in accordance with installation instructions.

§ Installation must include use of an approved Owens Corning® Hip & Ridge product. See actual warranty for details. Shingles are algae resistant to help control growth of algae and discoloration.

Ω Owens Corning testing against competing products with wide, single-layer nailing zones when following manufacturers' installation instructions and nailing in the middle of the allowable nailing zone.

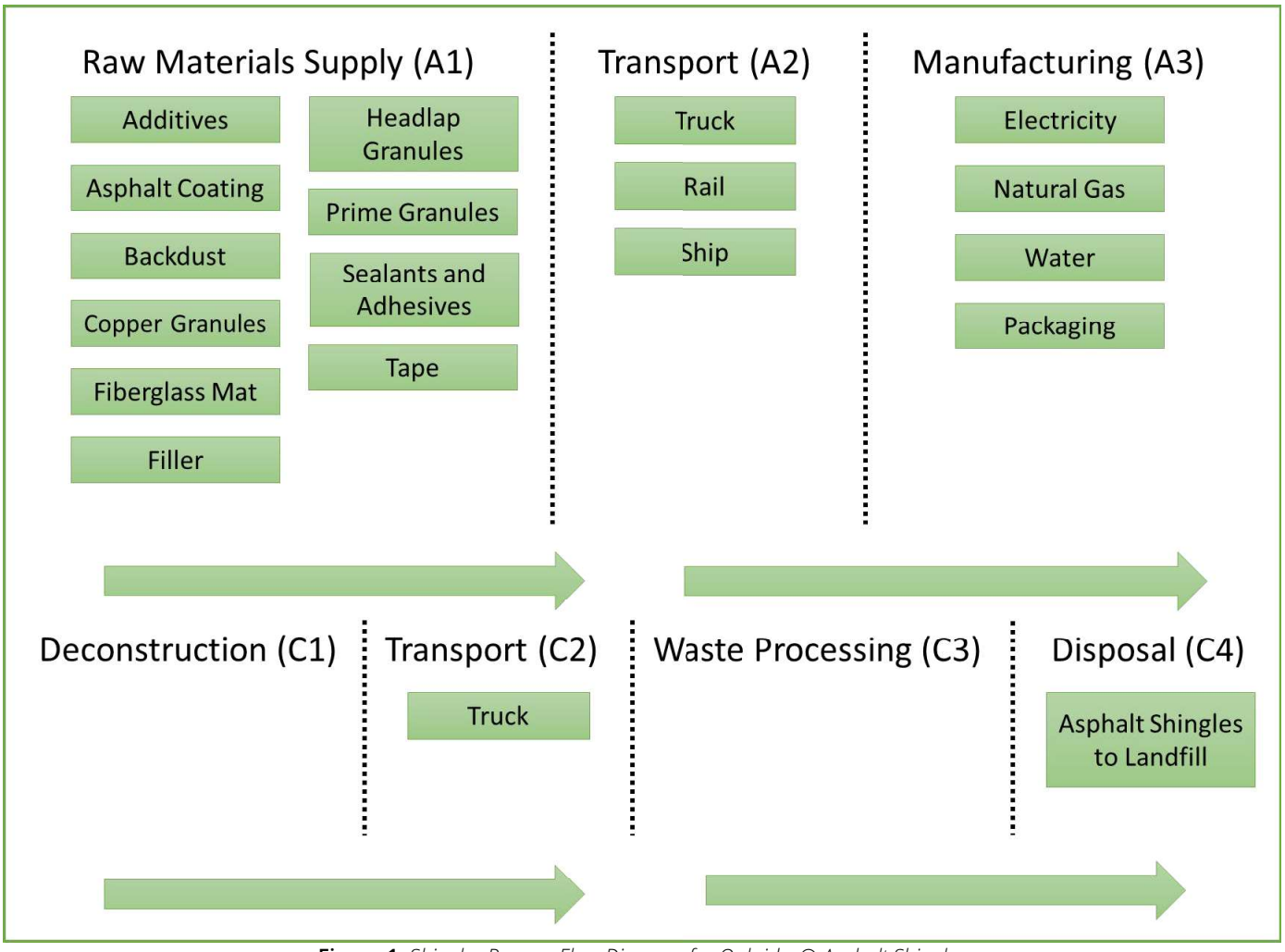

Figure 1. *Shingles Process Flow Diagram for Oakridge® Asphalt Shingles*

2.3 Product Average

This Environmental Product Declaration reflects production of Oakridge® Asphalt Shingles at production facilities in Atlanta, GA, Brookville, IN, Compton, CA, Denver, CO, Irving, TX, Jacksonville, FL, Kearny, NJ, Medina, OH, Memphis, TN, Minneapolis, MN, Portland, OR, Savannah, GA, and Summit, IL. The results of this declaration represent an average performance for the product and manufacturing locations.

2.4 Application

Asphalt Roofing Shingles are considered the first layer of protection in all four seasons for steep slope applications. Owens Corning offers a wide range of shapes, sizes and color choices.

2.5 Material Composition

Primary materials used to manufacture roofing shingles are fiberglass mat, asphalt, filler, and granules. Asphalt is used in multiple components of the shingle, including the coating, as well as laminating adhesives and sealants. Table 2 contains the raw material composition of Oakridge® asphalt shingles considered in this study.

Table 2. *Raw Material Composition for Oakridge® Asphalt Shingles*[≠]

Component	Composition % (by Mass)
Filler	30 - 40%
Prime Granules	20 – 30%
Asphalt Coating	15 - 25%
Headlap Granules	5 - 15%
Backdust	1 - 10%
Fiberglass Mat	1 - 10%
Additives	< 1%
Copper Granules	< 1%
Sealants and Adhesives	< 1%
Tape	< 1%

≠ *No substances require to be reported as hazardous or substances of very high concern are associated with the production of this product.*

2.6 Technical Data

The following tables provide technical specifications for Oakridge® Asphalt Shingles.

Table 3. *Applicable Standards and Codes for Oakridge® Asphalt Shingles*

Standard/Code	Status
ASTM D228	✓
ASTM D3018	Type I
ASTM D3161	Class F Wind Resistance
ASTM D3462	✓
ASTM D7158	Class H Wind Resistance
ASTM E108/UL 790	Class A Fire Resistance
ICC-ES AC438	✓
PRI ER 1378E01	✓
Florida Product Approval	✓
Miami-Dade Product Approval	✓
CSA A123.5	✓

2.7 Properties of Declared Product as Delivered

Oakridge® Shingles are designed to provide long-lasting performance and striking beauty. In addition to a wide range of inviting, popular colors, they also offer a Limited Lifetime Warranty (for as long as you own your home), a 110/130-MPH Wind Resistance Limited Warranty, and an Algae Resistance Limited Warranty available on a regional basis.* Oakridge® Shingles are produced with StreakGuard® Protection to inhibit the growth of airborne blue-green algae that can cause unsightly dark streaks on your roof.Φ Owens Corning provides a 25-year Algae Resistance Limited Warranty.*

*See actual warranty for complete details, limitations, and requirements.
Φ StreakGuard® Algae Resistance Technology is not available in the Compton and Denver service area.

3. LCA: Calculation Rules

3.1 Declared Unit

The declared unit is 1 m^2, corresponding to the amount of asphalt shingles required for 1 m^2 of constructed area. Specifically, this is the amount of asphalt shingles, which, when configured in an overlapping manner specified by the manufacturer's installation instructions, provides the component requirement of a multilayer steep-slope roofing assembly, which provides a water-shedding roof covering for 1 m^2 of constructed area.

Table 4. *Declared Unit Properties*

Name	Unit	Value
Declared Unit	m^2 of constructed area	1
Mass associated with declared unit (kg)	kg	9.71

3.2 System Boundary

This declaration is a product-specific EPD and represents cradle-to-gate with options (A1-A3, C2, C4). Details of the system boundaries may be found in the diagrams below. Packaging and packaging transport are assigned to module A3 (manufacturing) as specified in ISO 21930 and UL Part A.

Table 5. Life Cycle Stages and *Their Information for Oakridge® Asphalt Shingles*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

x = Included in system boundary | MND = Module not declared

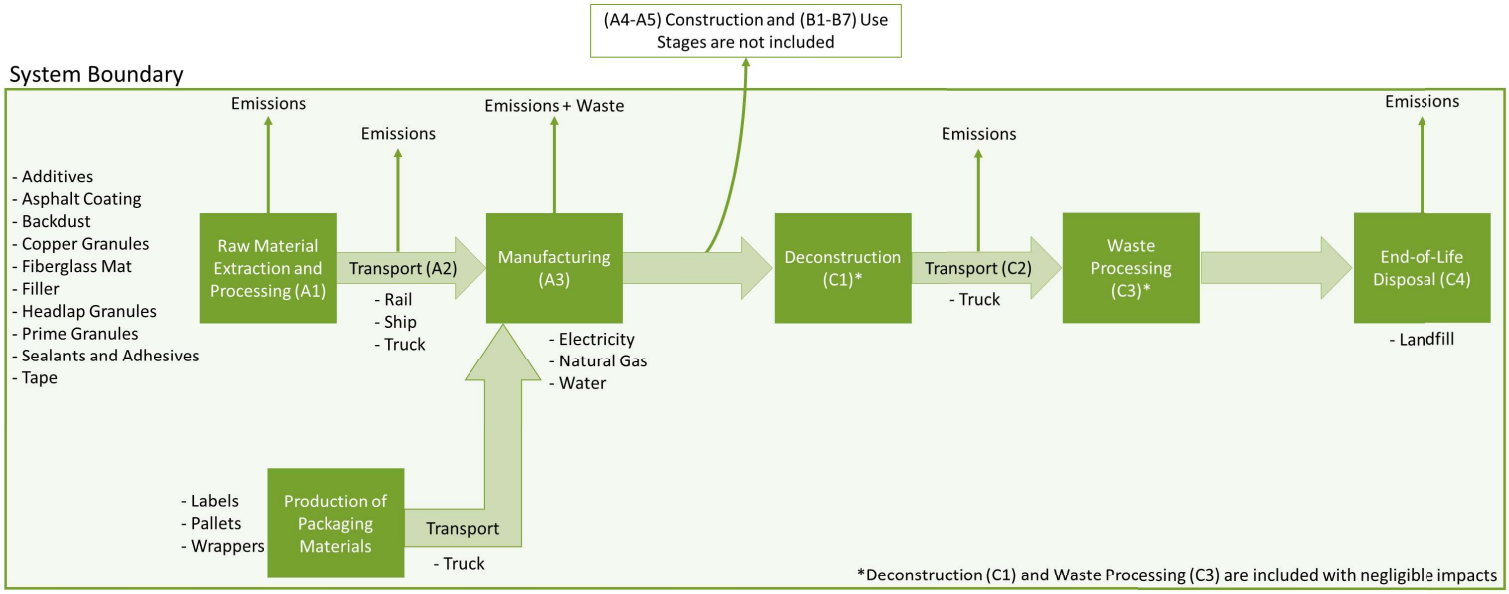

Figure 2. *Flow diagram with Indicated System Boundary for Oakridge® Asphalt Shingles*

3.3 Reference Service Life and Estimated Building Service Life

During the use stage, roofing shingles are passive products that require no external resources. The lifetime of the product is dependent on various environmental factors; however, if it becomes damaged during use or servicing of other building components, it will need to be replaced. Since these circumstances may vary widely, no attempt has been made in this study to estimate a reference service life for this product.

3.4 Allocation

Allocation of primary data was used in this study. In some cases, primary data collected from manufacturing sites were provided on a facility-wide basis and then allocated to the specific shingle product based on production volume (by mass). The types of production activities for the products manufactured at a given manufacturing facility are similar, so mass allocation is considered an acceptable allocation strategy.

3.5 Cut-off Rules

The underlying LCA study is in compliance with the cutoff criteria specified in the PCR. Material inputs greater than 1% (based on total mass input of each unit process) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data were available to warrant inclusion and/or the material input was thought to have significant environmental impact. However, all known mass flows have been included in this study. In addition, all known energy flows (both renewable and non-renewable) have been included in the study. No known flows were deliberately excluded.

3.6 Data Sources

Primary manufacturing data were collected from the included manufacturing locations listed in the Manufacturing section. Secondary data primarily reference the Ecoinvent 3.10.0 database. Table 6 provides LCA modeling data sources. Minor components that have a negligible effect on impact category results are omitted from this table.

Table 6. *Data Sources*

Modules	Flow / Modeled Unit Process	Ecoinvent 3.10.0 Process Dataset(s)	Reference Year
Product Materials			
A1	Additives	Various	2023
A1	Asphalt Coating	Proprietary – modeled internally by Owens Corning	2021
A1	Backdust	Silica sand {RoW}| silica sand production	2023
A1	Copper Granules	(1) Gravel, crushed {RoW}| gravel production, crushed (2) Sodium silicate, without water, in 48% solution state {RoW}| sodium silicate production, hydrothermal liquor (3) Clay {RoW}| market for clay (4) Copper oxide {RoW}| copper oxide production (5) Heavy fuel oil {RoW}| heavy fuel oil production, petroleum refinery operation (6) Carbon black {GLO}| carbon black production (7) Chromium trioxide, flakes {RoW}| chromium trioxide production, flakes	2023
A1	Fiberglass Mat	Proprietary – modeled internally Owens Corning	2023
A1	Filler	(1) Limestone, crushed, washed {RoW}| limestone production, crushed, washed (2) Dolomite {RoW}| dolomite production (3) Silica sand {RoW}| silica sand production	2023
A1	Headlap Granules	(1) Gravel, crushed {RoW}| gravel production, crushed (2) Sodium silicate, without water, in 48% solution state {RoW}| sodium silicate production, hydrothermal liquor, product in 48% solution state (3) Clay {RoW}| market for clay (4) Titanium dioxide {RoW}| market for titanium dioxide (5) Carbon black {GLO}| carbon black production	2023
A1	Prime Granules	(1) Gravel, crushed {RoW}| gravel production, crushed (2) Sodium silicate, without water, in 48% solution state {RoW}| sodium silicate production, hydrothermal liquor (3) Clay {RoW}| market for clay (4) Carbon black {GLO}| carbon black production (5) Titanium dioxide {RoW}| market for titanium dioxide (6) Heavy fuel oil {RoW}| heavy fuel oil production, petroleum refinery operation (7) Chromium trioxide, flakes {RoW}| chromium trioxide production, flakes (8) Naphtha {RoW}| market for naphtha (9) Ferrite {GLO}| ferrite production (10) Sodium aluminate, powder {GLO}| market for sodium aluminate, powder	2023
A1	Sealants and Adhesives	Proprietary – modeled internally by Owens Corning	2023
A1	Tape	(1) Polyethylene terephthalate, granulate, bottle grade {RoW}| polyethylene terephthalate production (2) Extrusion, plastic film {GLO}| market for extrusion, plastic film	2023
Transport			
A2, C2	Ocean (Ship)	Transport, freight, sea, container ship {GLO}| market for transport, freight, sea, container ship	2023
A2, C2	Rail	Transport, freight train {US}| market for transport, freight train	2023
A2, C2	Truck	Transport, freight, lorry >32 metric ton, EURO5 {RoW}| market for transport, freight, lorry >32 metric ton, EURO5	2023
Packaging			
A3	Labels	Kraft paper {RoW}| kraft paper production	2023
A3	Pallet	EUR-flat pallet {RoW}| market for EUR-flat pallet	2023
A3	Wrappers	Packaging film low density polyethylene {RoW}| packaging film production, low density polyethylene	2023

Modules	Flow / Modeled Unit Process	Ecoinvent 3.10.0 Process Dataset(s)	Reference Year
Utilities			
A3	Electricity	Atlanta, GA: Electricity, medium voltage {Atlanta GA US-SERC}| market for electricity, medium voltage Brookville, IN: Electricity, medium voltage {Brookville IN US-RFC}| market for electricity, medium voltage Compton, CA: Electricity, medium voltage {Compton CA US-WECC}| market for electricity, medium voltage Denver, CO: Electricity, medium voltage {Denver CO US-WECC}| market for electricity, medium voltage Irving, TX: Electricity, medium voltage {Irving TX US-WECC}| market for electricity, medium voltage Jacksonville, FL: Electricity, medium voltage {Jacksonville FL US-SERC}| market for electricity, medium voltage Kearny, NJ: Electricity, medium voltage {Kearny, NJ US-RFC}| market for electricity, medium voltage Medina, OH: Electricity, medium voltage {Medina, OH US-RFC}| market for electricity, medium voltage Memphis, TN: Electricity, medium voltage {Memphis TN US-SERC}| market for electricity, medium voltage Minneapolis, MN: Electricity, medium voltage {Minneapolis MN US-WECC}| market for electricity Portland, OR: Electricity, medium voltage {Portland OR US-WECC}| market for electricity, medium voltage Savannah, GA: Electricity, medium voltage {Savannah GA US-SERC}| market for electricity, medium voltage Summit, IL: Electricity, medium voltage {Summit IL US-RFC}| market for electricity, medium voltage	2023
A3	Natural	Natural gas, high pressure {US}| market for natural gas, high pressure	2023
A3	Water	Tap water {RoW}| market for tap water	2023

3.7 Data Quality

Primary data were based on measured and calculated data from Atlanta, GA, Brookville, IN, Compton, CA, Denver, CO, Irving, TX, Jacksonville, FL, Kearny, NJ, Medina, OH, Memphis, TN, Minneapolis, MN, Portland, OR, Savannah, GA, and Summit, IL Owens Corning plants and reflect calendar year 2023 production. It meets requirements for completeness along with temporal, geographical and technological representativeness. Background data were taken from the Ecoinvent database, which is on the approved database list in the PCR.

Table 7. *Data Quality Assessment*

Data Quality Parameter	Data Quality Discussion
Time-related Coverage: Age of data and the minimum length of time over which data is collected	The material and resource inputs and emissions provided by Owens Corning are directly from the manufacturing locations and are based on measured primary data in 2023 for the products. Secondary data for the Life Cycle Inventory (LCI) was obtained primarily from Ecoinvent 3.10 datasets, the most up-to-date version available at the time of the study. The datasets have reference years between 2007 and 2022. In such cases the datasets were evaluated for reasonableness and deemed suitable for this LCA study given that technological advances have likely not occurred for these specific materials and processes. Time related coverage is considered good quality data.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The Ecoinvent 3.10 database typically base their research and measurement on specific producers, usually in Europe and adjust for global energy and transport considerations. Many of the common materials were modeled as global or "rest of world" datasets for consistency and in alignment with internal Owens Corning LCA conventions. The electricity grids selected for the production phase were specific to the region-level grid mixes for the US manufacturing facilities. Geographical coverage is considered very good quality.
Technology Coverage: Specific technology or technology mix	Owens Corning provided the primary material and resource input and emission data, based on their actual 2023 asphalt roofing shingles materials production processes. Technology coverage is considered generally very good quality.

Data Quality Parameter	Data Quality Discussion
Precision: Measure of the variability of the data values for each data expressed	Owens Corning provided the primary material and resource input and emission data, based on their actual 2023 asphalt roofing shingles production processes. Thus, precision is considered very good quality.
Completeness: Percentage of flow that is measured or estimated	Owens Corning provided the primary material and resource input and emission data, based on their actual 2023 asphalt roofing shingles production processes. All materials reported in the data were included in the raw materials phase of the LCA. Energy data was provided by Owens Corning for the manufacturing facility studied; thus, this is considered 100% measured. All known mass and energy flows have been included in this study.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Owens Corning provided the primary material and resource input and emission data, based on their actual 2023 materials production processes. Given Owens Corning 's expertise and in-depth knowledge of wet formed mat and asphalt roofing shingles production, the representativeness of data is generally considered high quality.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	Data sets used in the underlying LCA study were selected based on the most appropriate temporal, geographical, and technological representation of the actual processes and technology. These data sets reflect average processes from multiple sources, and thus generally represent the actual technology utilized to produce the materials. Still, it is often unknown the extent to which secondary data sets deviate from the specific system being studied. Additionally, the same methodology was applied consistently to all the stages of the study. Thus, consistency is considered high quality.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	To ensure consistency, only primary data of the same level of detail and equivalent time interval (i.e., one calendar year) were used, and allocation was conducted similarly for all data categories and life cycle stages. Provided the practitioner has access to the same data sources described in the report, the results would be reproducible except for several proprietary materials that were excluded from the documentation. Therefore, reproducibility is considered high.
Sources of the Data: Description of all primary and secondary data sources	Owens Corning provided the primary material and resource use input and emission data, material composition, supply chain transport, and measured energy consumption. Secondary data was obtained from the Ecoinvent 3.10 database. All data sources used in the study are considered high quality.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	The reproducibility of the study results is merited by the scope information provided in the underlying LCA report. Due to confidentiality of the data values, however, certain details were omitted from this public-facing EPD, which may limit reproducibility by the public. Ecoinvent is comprised of industry-average, peer-reviewed data and utilizes the pedigree matrix to assess the uncertainty of all secondary datasets. Key uncertainty assumptions are stated in the report.

3.8 Period under review

The period of review is calendar year 2023.

3.9 Comparability and Benchmarking

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the

practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled. In addition, comparability of EPDs is limited to those applying a functional unit.

This study does not include comparative assertions intended to be disclosed to the public. It is important to note that the results presented in this report are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.

3.10 Estimates and Assumptions

The ability of LCA to consider the entire life cycle of products makes it an attractive tool for the assessment of potential environmental impacts. Nevertheless, similar to other environmental management analysis tools, LCA has several limitations related to data quality and unavailability of potentially relevant data. It should be kept in mind that the impact assessment results are relative expressions and do not predict impacts on category endpoints, exceeding thresholds, or risks.

The study was conducted by including the relevant system boundaries and best available data for Oakridge® asphalt shingles, using a consistent data collection method and timeframe. In cases where data were reported for the entire facility rather than for the specific manufactured roofing product, mass allocation was used to allocate the facility-wide impacts to the specific product. This assumes that all products equally consume facility inputs and contribute to facility outputs.

Some packaging materials were provided as number of pieces without corresponding unit weights. Some packaging unit weights were determined by analogy with previous LCA modeling for Owens Corning plants, and some packaging unit weights were determined from online spec sheets or calculators.

Secondary LCI data sets were not available for several material inputs. In such cases proxies were used.

4. LCA: Scenarios and Additional Technical Information

4.1 Manufacturing

Owens Corning North American Roofing manufacturing locations can be found across the United States. Primary data from the manufacturing facilities listed in Section 2 were used for the underlying life cycle assessment. Results provided in this declaration are based on a production-weighted average of these manufacturing facilities.

Figure 3 illustrates the manufacturing process of asphalt shingles. The manufacture of both three-tab and laminate shingles are similar, and both processes are depicted.

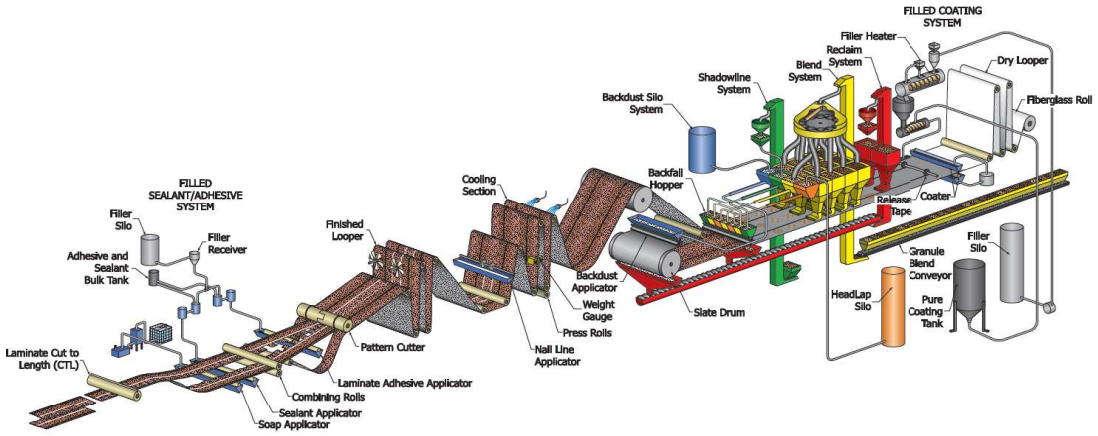

Figure 3. *Manufacturing Process Diagram for Asphalt Shingle Production*

4.2 Packaging

The manufacturing (A3) stage also includes the production of shingle packaging materials and inbound transport of shingle packaging materials to the manufacturing facilities.

At the end of the manufacturing process, the asphalt shingles are bundled in wrappers and stacked on a pallet. Packaging materials, therefore, include labels, pallets, and wrappers. Ribbons and inks are also used in packaging, but their unit weights were not available. These materials were excluded from the study since the estimated quantities were very low and below the cut-off criteria for this study. Additionally, packaging waste disposal was excluded from this study since it is minimal and below the cut-off limit.

4.3 Transport to the Building Site (A4)

The outbound transportation or distribution of the shingle product was not included in the scope of this study.

4.4 Installation into the Building (A5)

Installation of the shingle product was not included in the scope of this study.

4.5 Use (B1-B7)

Roofing shingles are passive products that requires no extra utilities or maintenance to operate over its useful life.

4.6 End-of-Life (C1-C4)

Similarly to the installation process, removal of the shingles is conducted by hand and occasionally requires low energy electric tools. Since the product is not being reclaimed, there is no deconstruction activity or impact for Deconstruction (C1). A distance of 161 km (100 miles) truck transport was assumed for transport from the use site to end of life Disposal (C2). Since the product is not being reclaimed, there is no waste processing activity or impact for the Waste Processing stage (C3). It is assumed that disposal of the asphalt roofing shingles is by inert landfill (C4).

Table 8. *End of Life Summary (C1-C4) for 1 m^2 of Oakridge® Asphalt Shingles*

Name		Value	Unit
Assumptions for scenario development	Although reuse and recycling of asphalt shingles at their end of life is possible, there are no formal and consistent programs for collection and transport. It is assumed that all product is sent to landfill at end of life.		
Collection process	Collected separately	0.00E+00	kg
	Collected with mixed construction waste	9.71E+00	kg
Recovery	Reuse	0.00E+00	kg
	Recycling	0.00E+00	kg
	Landfill	0.00E+00	kg
	Incineration	0.00E+00	kg
	Incineration with energy recovery	0.00E+00	kg
	Energy conversion efficiency rate	0.00E+00	kg
Disposal (Landfill)	Product or material for final deposition	9.71E+00	kg
Removals of biogenic carbon		0.00E+00	kg CO_2

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All values in the tables below are rounded to three significant digits. The following impact indicators, specified by the PCR, are reported below.

These 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.

Table 9. *Life Cycle Impact Assessment Indicators and characterization methods used.*

Abbreviation	Impact Category	Unit	Characterization Method
GWP 100a (2013)	Global Warming Potential	kg CO_2 eq	IPCC 2013 (AR5)
ODP	Ozone Depletion Potential	kg CFC11 eq	TRACI 2.1
AP	Acidification Potential	kg SO_2 eq	TRACI 2.1
EP	Eutrophication Potential	kg N eq	TRACI 2.1
SFP	Smog Formation Potential	kg O_3 eq	TRACI 2.1
ADP_{fossil}	Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	MJ, LHV	CML-baseline v4.7
GWP 100a (2021)	Global Warming Potential	kg CO_2 eq	IPCC 2021 (AR6)

Table 10. *Additional transparency indicators used.*

Parameter	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary energy used as energy carrier (fuel)	[MJ, LHV]	**HWD**: Hazardous waste disposed	[kg]
RPR_M: Renewable primary resources with energy content used as material	[MJ, LHV]	**NHWD**: Non-hazardous waste disposed	[kg]
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	[MJ, LHV]	**HLRW**: High-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
$NRPR_M$: Non-renewable primary resources with energy content used as material	[MJ, LHV]	**ILLRW**: Intermediate- and low-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
SM: Secondary materials	[kg]	**CRU**: Components for re-use	[kg]
RSF: Renewable secondary fuels	[MJ, LHV]	**MR**: Materials for recycling	[kg]
NRSF: Non-renewable secondary fuels	[MJ, LHV]	**MER**: Materials for energy recovery	[kg]
RE: Recovered energy	[MJ, LHV]	**EE**: Recovered energy exported from the product system	MJ, heating value ([Hi] lower heating value) per energy carrier

Table 11. *Carbon Emissions and Removals*

Parameter	Unit
BCRP: Biogenic Carbon Removal from Product	[kg CO2]
BCEP: Biogenic Carbon Emission from Product	[kg CO2]
BCRK: Biogenic Carbon Removal from Packaging	[kg CO2]
BCEK: Biogenic Carbon Emission from Packaging	[kg CO2]
BCEW: Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO2]
CCE: Calcination Carbon Emissions	[kg CO2]
CCR: Carbonation Carbon Removals	[kg CO2]
CWNR: Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO2]

Table 12. *Life Cycle Impact Assessment (LCIA) results for 1 m^2 Oakridge® Asphalt Shingles*

Impact Category	Units	A1 – A3	C1	C2	C3	C4
GWP 100a (2013)	kg CO_2 eq	3.37E+00	0.00E+00	1.24E-01	0.00E+00	2.60E-02
ODP	kg CFC 11 eq	5.54E-07	0.00E+00	1.75E-09	0.00E+00	4.14E-10
AP	kg SO_2 eq	1.49E-02	0.00E+00	2.95E-04	0.00E+00	2.21E-04
EP	kg N eq	1.23E-03	0.00E+00	2.01E-05	0.00E+00	1.40E-05
SFP	kg O_3 eq	2.10E-01	0.00E+00	7.52E-03	0.00E+00	6.94E-03
ADP_{fossil}	MJ, LHV	1.22E+02	0.00E+00	1.65E+00	0.00E+00	3.38E-01
GWP 100a (2021)	kg CO_2 eq	3.51E+00	0.00E+00	1.25E-01	0.00E+00	2.64E-02

Table 13. *Resource Use Indicator Results for 1 m² Oakridge® Asphalt Shingles*

Parameter	Units	A1 – A3	C1	C2	C3	C4
RPR_E	[MJ, LHV]	4.08E+00	0.00E+00	2.65E-03	0.00E+00	1.49E-03
RPR_M	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	[MJ, LHV]	1.25E+02	0.00E+00	1.65E+00	0.00E+00	3.39E-01
$NRPR_M$	[MJ, LHV]	7.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m3]	3.01E-02	0.00E+00	5.54E-05	0.00E+00	1.17E-05

Table 14. *Waste and Output Flow Indicator Results for 1 m² Oakridge® Asphalt Shingles*

Resource Use	Units	A1 – A3	C1	C2	C3	C4
HWD	[kg]	9.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	[kg]	1.54E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	[kg]	1.19E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 15. *Carbon Emissions and Removals Indicator Results for 1 m² Oakridge® Asphalt Shingles*

Resource Use	Units	A1 – A3	C1	C2	C3	C4
BCRP	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	[kg CO2]	2.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

6. LCA: Interpretation

6.1 Interpretation

The largest contributor to all impact categories considered in this study is the product stage (A1 – A3). Within A1 – A3, the Raw Material Extraction and Processing stage (A1) is the largest contributor in each impact category.

6.2 Assumptions and Limitations

The ability of LCA to consider the entire life cycle of products makes it an attractive tool for the assessment of potential environmental impacts. Nevertheless, similar to other environmental management analysis tools, LCA has several limitations related to data quality and unavailability of potentially relevant data. It should be kept in mind that the impact assessment results are relative expressions and do not predict impacts on category endpoints, exceeding thresholds, or risks.

The study was conducted by including the relevant system boundaries and best available data for Oakridge® asphalt shingles, using a consistent data collection method and timeframe for each facility. In cases where data were reported for the entire facility, rather than for the specific shingle material's product, mass allocation was used to allocate the facility-wide impacts to the specific product. This assumes that all products equally consume facility inputs and contribute to facility outputs.

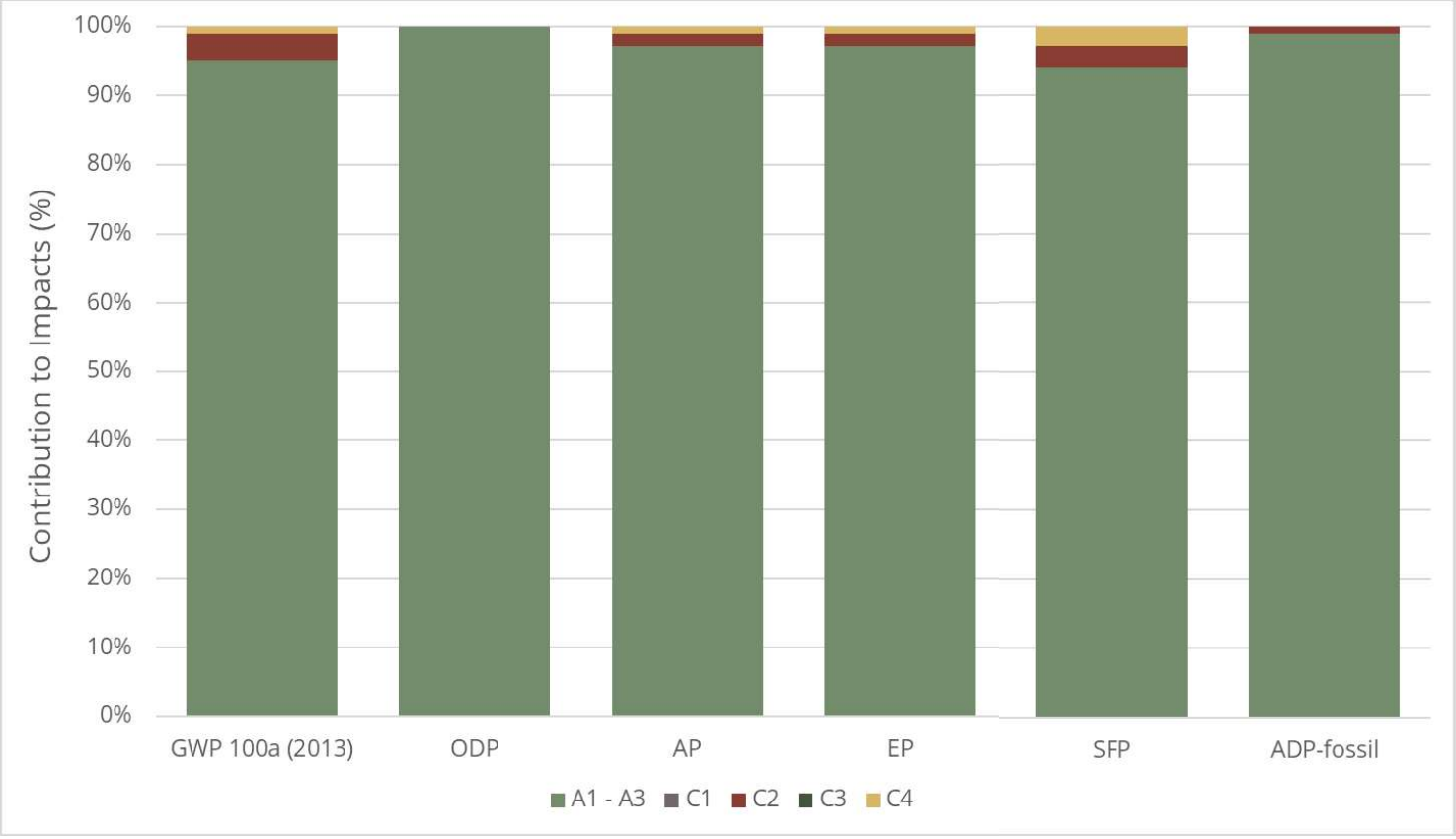

Figure 4. *Contribution Analysis Results for 1 m^2 Oakridge® Asphalt Shingles by Stage*

7. Additional Environmental Information

7.1 Environment and Health during Manufacture

Owens Corning manufacturing facilities of Oakridge® asphalt shingle products maintain quality management systems.

Depending on the plant facility, the following environmental equipment may be used to control emissions: electrostatic precipitator, scrubber, and/or fabric filter (baghouse).

7.2 Environment and Health during Installation

This product is considered an article. The 29 CFR 1910.1200(c) definition of an article is as follows: "Article" means a manufactured item other than a fluid or particle, (i) which is formed to a specific shape or design during manufacture, (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use, and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

7.3 Extraordinary Effects

Fire

This product is Class A fire resistant complying with ASTM E108/UL 790.

7.4 Delayed Emissions

No delayed emissions are expected from this product.

7.5 Further Information

Further information on the product can be found on the manufacturers' website at www.owenscorning.com.

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