## Environmental Product Declaration

# EcoStar™ Majestic Slate and Shake Roofing Tiles

EcoStar Roofing Products

EcoStar is dedicated to helping the world address recyclable materials. Since 1993, we have redirected thousands of tons of valuable raw materials away from landfills each year. By using post-industrial upcycled materials, EcoStar tiles aid in the preservation of natural resources. No trees are cut down and no slates are quarried for the manufacture of EcoStar products.

The Leader in Sustainable Steep-Slope Roofing.

UL CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and EN 15804+A2. 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 | UL Environment<br>2211 Newmarket Pkwy, Marietta, GA 30067 USA |
| GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER | UL Environment, General Program Instructions, v2.5, March 2020. |
| MANUFACTURER NAME AND ADDRESS | Staroba Plastics, EcoStar™<br>42 Edgewood Drive, Holland, NY 14080 |
| DECLARATION NUMBER | *Provided by Program Operator* |
| DECLARED PRODUCT & DECLARED UNIT | EcoStar™ Majestic Slate and Shake Roofing Tiles<br>Declared Unit = 1 metric ton of Majestic Slate and Shake over 75 year building lifetime |
| REFERENCE PCR AND VERSION NUMBER | PCR Guidance-Texts for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019 v1.4 published by Institut Bauen und Umwelt e.V.<br>PCR Guidance-Texts for Building-Related Products and Services, Part B: Requirements on the EPD for Roof Tiles v7 published by Institut Bauen und Umwelt e.V. |
| DESCRIPTION OF PRODUCT(S) APPLICATION/USE | The product is used for roof coverings as a water shedding layer for most steep slope roofing applications. |
| PRODUCT RSL DESCRIPTION | 50 Years |
| MARKETS OF APPLICABILITY | Global |
| DATE OF ISSUE | 3/27/2025 |
| PERIOD OF VALIDITY | 5 years |
| EPD TYPE | Product Specific |
| DATASET VARIABILITY | N/A |
| EPD SCOPE | Cradle-to-Grave |
| YEAR(S) OF REPORTED PRIMARY DATA | 2023 |
| LCA SOFTWARE & VERSION NUMBER | SimaPro 9.6 |
| LCI DATABASE(S) & VERSION NUMBER | Ecoinvent v3.10 & USLCI v2.0 |
| LCIA METHODOLOGY & VERSION NUMBER | TRACI 2.1; EN15804+A2 |

| | |
|---|---|
| The sub-category PCR review was conducted by:<br>This declaration was independently verified in accordance with ISO 14025: 2006. The PCR Guidance-Texts for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019 v1.4 published by Institut Bauen und Umwelt e.V., based on EN 15804+A2 serves as the core PCR.<br>☐ INTERNAL ☒ EXTERNAL | Enter sub-category PCR reviewer signature and name |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: | Enter reviewer's signature here<br>Enter reviewer's name and credentials here |

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 EN 15804+A2 §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

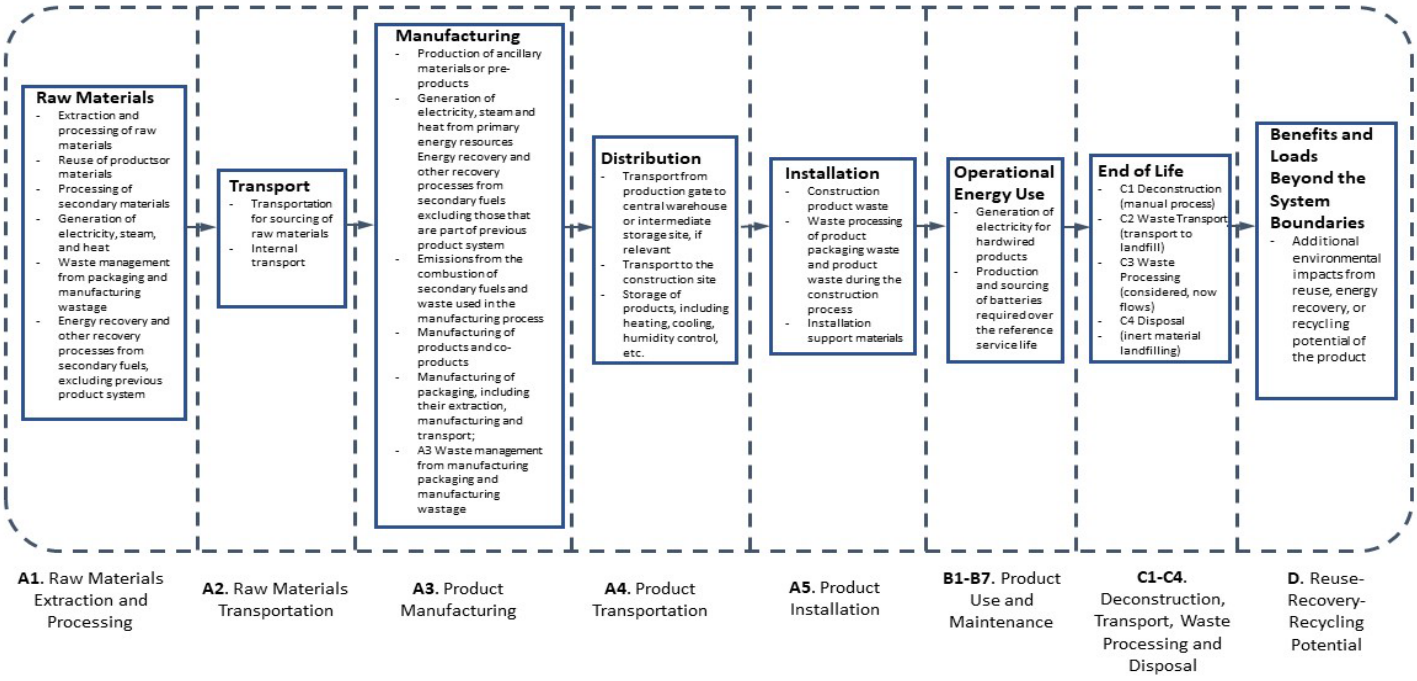
### Description of Company/Organization

EcoStar LLC is celebrating over 30 years of providing innovative and sustainable solutions to the roofing industry. Its synthetic slate, shake and flat tile roofing products are made in the United States with up to 80% recycled content and provide superior protection against extreme weather conditions.

### Product Description

Multiple Products: Majestic Slate, Majestic Niagara Slate, Seneca Shake, Majestic Concrete, Majestic Designer Series

### Flow Diagram




### Manufacturer Specific EPD

This product-specific EPD was developed based on the Cradle-to-Grave Life Cycle Assessment. The EPD accounts for raw material extraction and processing, transport, product manufacturing, distribution, installation, maintenance, disposal, and potential benefits and loads following the end of life disposal. Manufacturing data were gathered directly from company personnel. When updated company-specific data were not available the ratio of production units, within the 2023 calendar year, was used as a proxy. For any product group EPDs, an impact assessment was completed for each product and the highest impacts were reported as conservative representations of the product group. Product grouping was considered appropriate if the individual product impacts differed by no more than ±10% in any impact category.

### Application

The product is used for roof coverings as a water shedding layer for most steep slope roofing 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 average composition of Majestic Slate and Shake is as follows:

| Material | Majestic Slate and Shake |
|---|---|
| Polypropylene | 63.58% |
| SBS Rubber | 35.16% |
| Polyethylene | 1.17% |
| Organic Chemical | 0.06% |
| **Total** | **99.96%** |

### Technical Data

For the declared product, the following technical data in the delivery status must be provided with reference to the test standard:

| Technical Data | |
|---|---|
| Operating Range | -25°F to 200°F (-32°C to 93°C) |
| Tensile (D-412) | 1,500 psi (10,342 kpa) |
| Water Absorption (D570) | 0% by weight |
| UL Listed 790 Fire Resistance | Class C |
| UL2218 Impact | Class 4 |

### Placing on the Market / Application Rules

The standards that can be applied for Majestic Products is:
- AC Building Code 7

### Properties of Declared Product as Shipped

All products are bundled, strapped and then placed on a pallet, typically, 1.17 metric ton per pallet. The pallet is then shrink bagged with the logo on the bag and shipped by individual pallet.

## Methodological Framework

### Functional Unit

The declaration refers to the functional unit of 1 metric ton of EcoStar™ Majestic Slate and Shake Roofing Tiles as specified in the PCR.

| | Majestic Slate and Shake | |
|---|---|---|
| **Name** | **Value** | **Unit** |
| Functional unit | 1 metric ton | |
| Mass | 1000.00 | kg |
| Density | 1.05 | $kg/m^3$ |

## System Boundary

This is a Cradle-to-Grave Environmental Product Declaration. 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 | X |

**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 reference service life of a properly installed Roofing Tiles is 50 years. The building estimated service life is 75 years.

## Allocation

Allocation was determined on a per mass basis for primary data. For secondary data, cut-off methodology was used. This LCA follows an attributional approach as outlined in EN 15804. No burdens are allocated across the system boundary with secondary material, secondary fuel, or recovered energy flows arising from waste.

## 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.

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.

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. The Majestic product did not include hazardous materials and no energy inputs were excluded from the system boundary. This product constains substances listed in the candidate list exceeding 0.1 percentage by mass: no.

## Data Sources

Primary data were collected for every process in the product system under the control of EcoStar™. Secondary data from the SimaPro Ecoinvent v3.10 & USLCI v2.0 databases were utilized. These data were evaluated and have temporal, geographic, and technical coverage appropriate to the scope of the Roofing Tiles product category.

## Data Quality

The data sources used are complete and representative of North America in terms of the geographic and technological coverage and are a recent vintage (i.e. less than ten years old).The data used for primary data are based on direct information sources of the manufacturer. Secondary data sets were used for raw materials extraction and processing, end of life, transportation, and energy production flows. Wherever secondary data are used, the study adopts critically reviewed data for consistency, precision, and reproducibility to limit uncertainty.

## Period Under Review

The period under review is the full calendar year of 2023.

## Treatment of Biogenic Carbon

The uptake and release of biogenic carbon throughout the product life cycle follows EN 15804+A2

## 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 EN 15804+A2 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 Guidance-Texts for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019 v1.4 published by Institut Bauen und Umwelt e.V. and PCR Guidance-Texts for Building-Related Products and Services, Part B: Requirements on the EPD for Roof Tiles v7 published by Institut Bauen und Umwelt e.V. allows EPD comparability only when all stages of the product's life cycle have been considered. However, variations and deviations are possible.

## Estimates and Assumptions

**End of Life**
In the End of Life phase, all materials were assumed to have a 0% recycling rate, and are sent to landfill.

## Units

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

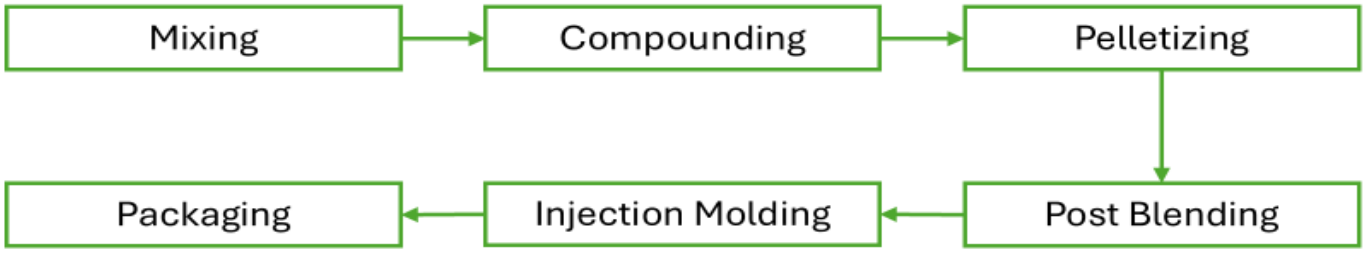
## Additional Environmental Information

### Background data

For life cycle modeling of the considered products, SimaPro is used. The SimaPro database contains consistent and documented datasets which are documented in the online SimaPro documentation. To ensure comparability of results in the LCA, the basic data of the SimaPro database were used for energy, transportation and auxiliary materials.

### Manufacturing

Majestic production begins with a mixture of raw materials including pellets from recycled materials. The raw materials are mechanically blended together according to the product recipe. Any additives are added during the mechanical blending process. Next, the material is extruded to create a new pellet using heat and pressure and blended again. The material is then injection molded, inspected, and packaged. Green energy from the manufacturing process is not calculated separately outside of the green energy used in the electricity grid mix.




### Packaging

87.2% of the packaging is sent to landfill while 8.56% of the packaging is incinerated. The remaining 4.24% are wooden pallets that are reused. The packaging material is composed by cardboard, polyethylene, polypropylene, and wood.

| | Majestic Slate and Shake |
|---|---|
| **Material** | **Quantity (% By Weight)** |
| Wood | 91.47% |
| Steel | 0.06% |
| HDPE | 2.19% |
| Polypropylene | 1.37% |
| Paper | 0.04% |
| Cardboard | 4.87% |
| **Total** | **100%** |

## Transportation

The product is transported 1000 km from the manufacturer to the building site via truck.

| Transport to Building Site (A4) | | |
|---|---|---|
| **Name** | **Majestic Slate and Shake** | **Unit** |
| Fuel type | Diesel | - |
| Liters of fuel (for freight (combination) truck with a 32t payload) | 156 | l/100km per metric ton |
| Capacity utilization (including empty runs) | 90 | % |
| Capacity utilization volume factor | 1 | - |
| Transport distance | 1000 | km |
| Gross density of products transported | 40 | $kg/m^3$ |
| Weight of products transported | 1106 | kg |
| Volume of products transported | 27 | $m^3$ |

## Product Installation

Electricity and nails are required for the installation of the roofing tiles per expert opinion. A 5% installation scrap rate is assumed.

| Installation into the Building (A5) | | |
|---|---|---|
| **Name** | **Majestic Slate and Shake** | **Unit** |
| Auxiliary materials | 8.82 | kg |
| Water consumption | 0.00 | $m^3$ |
| Other resources | 0.00 | kg |
| Electricity consumption | 0.00 | kWh |
| Other energy carriers | 0.00 | MJ |
| Product loss per functional unit | 50.00 | kg |
| Waste materials at construction site | 52.50 | kg |
| Output substance (recycle) | 0.00 | kg |
| Output substance (landfill) | 50.44 | kg |
| Output substance (incineration) | 0.00 | kg |
| Packaging waste (recycle) | 0.34 | kg |
| Packaging waste (landfill) | 1.37 | kg |
| Packaging waste (incineration) | 0.34 | kg |
| Direct emissions to ambient air*, soil, and water | 0.00 | kg $CO_2$ |
| VOC emissions | - | kg |

*CO2 emissions to air from disposal of packaging

The 50 year service life was assumed based on Staroba's customer experience in normal weather conditions for outdoor use when installed in accordance with the manufacturer's guidelines.

| Reference Service Life | | |
|---|---|---|
| **Name** | **Value** | **Unit** |
| Reference Service Life | 50 | years |
| Estimated Building Service Life | 75 | years |
| Number of Replacements | 0.5 | replacements |

## Product Use

No routine maintenance is required to prolong the lifetime of the product. B1, B2, B3, B5, B6, and B7 are assumed to be null.

| Replacements (B4) / Refurbishment (B5) | | |
|---|---|---|
| **Name** | **Value** | **Unit** |
| Replacement cycle | 0.5 | Number/RSL |
| Electricity consumption | n/a | kWh |
| Litres of fuel | n/a | l/100km |
| Replacement of worn parts | n/a | kg |

| Operational Energy Use (B6) | | |
|---|---|---|
| **Name** | **Value** | **Unit** |
| Water consumption (from tap, to sewer) | - | $m^3$ |
| Electricity consumption | 0.0 | kWh |
| Other energy carriers | 0.0 | MJ |
| Equipment output | - | kW |
| Direct emissions to ambient air, soil, and water | - | kg |

## Disposal

At the end of life, 100% of the product is assumed to be sent to landfill.

| End of Life (C1-C4) | | |
|---|---|---|
| **Name** | **Majestic Slate and Shake** | **Unit** |
| Collected separately | 0.00 | kg |
| Collected as mixed construction waste | 1008.82 | kg |
| Reuse | 0.00 | kg |
| Recycling | 0.00 | kg |
| Landfilling | 1008.82 | kg |
| Incineration with energy recovery | 0.00 | kg |
| Energy conversion | 0% | % |
| Material for final deposition | 0.00 | kg |
| Removals of biogenic carbon | 0.00 | kg |

## Re-use Phase

Majestic Slate and Shake are sent to landfill at end-of-life. Packaging materials are recycled during manufacturing and installation.

| Re-Use, Recovery, And/Or Recycling Potential (D) | | |
|---|---|---|
| **Name** | **Value** | **Unit** |
| Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6) | 0.00 | MJ |
| Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6) | 0.00 | MJ |
| Net energy benefit from material flow declared in C3 for energy recovery | 0.00 | MJ |
| Recycling Potential | 5.16 | kg |
| Process and conversion efficiencies | | |
| Further assumptions for scenario development (e.g. further processing technologies, assumptions on correction factors); | | |

## Scaling Factors

Scaling factors can be used to convert from the declared unit (one metric ton) to area. An example of this calculation is below.

$$\frac{Environmental\ Indicator}{Area\ (m^2)} = \frac{Environmental\ Indicator}{Declared\ Unit\ (metric\ ton)} * \frac{Weight\ (metric\ ton)}{Area\ (m^2)}$$

$$\frac{8.67E+01\ kg\ CO_2}{1\ m^2}\ for\ Traditional\ (12") = \frac{5.56E+03\ kg\ CO_2}{1\ metric\ ton} * \frac{0.0156\ metric\ ton}{1\ m^2}$$

| | **Weight Per Area (metric ton/m$^2$)** |
|---|---|
| Traditional (12") | 0.0156 |
| Traditional (10") | 0.0158 |
| Beaver Tail | 0.0156 |
| Beveled Edge | 0.0145 |
| Chisel Point | 0.0125 |
| Hip/Ridge | 0.0137 |

## Majestic Results per Metric Ton Over the Building Lifetime of 75 Years - Including 0.5 Replacements

### EN 15804+A2 Impact Assessment

| Parameter | Parameter | Unit | A1-A3 | A4 | A5 | B4 | B6 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-total | Climate Change - total | kg $CO^2$-Eq. | 2.73E+03 | 9.57E+01 | 2.69E+02 | 2.00E+03 | 0.00E+00 | 0.00E+00 | 9.57E+00 | 1.07E+01 | 8.84E+02 | -4.44E+00 |
| GWP-fossil | Climate Change, fossil | kg $CO^2$-Eq. | 2.87E+03 | 9.57E+01 | 2.03E+02 | 1.62E+03 | 0.00E+00 | 0.00E+00 | 9.57E+00 | 4.46E+00 | 5.78E+01 | -5.41E+00 |
| GWP-biogenic | Climate Change, biogenic | kg $CO^2$-Eq. | -1.34E+02 | 0.00E+00 | 6.62E+01 | 3.79E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.23E+00 | 8.26E+02 | 9.72E-01 |
| GWP-luluc | Climate Change, land use and land use change | kg $CO^2$-Eq. | 1.63E+00 | 0.00E+00 | 1.19E-01 | 8.82E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.41E-04 | 1.46E-02 | -6.84E-03 |
| ODP | Ozone depletion | kg CFC-11 Eq. | 5.28E-05 | 2.44E-09 | 2.99E-06 | 2.81E-05 | 0.00E+00 | 0.00E+00 | 2.44E-10 | 4.22E-09 | 3.43E-07 | -1.74E-07 |
| AP | Acidification | Mole of H+ eq. | 1.44E+01 | 5.10E-01 | 1.03E+00 | 8.10E+00 | 0.00E+00 | 0.00E+00 | 5.10E-02 | 2.61E-03 | 1.72E-01 | -3.08E-02 |
| EP-freshwater | Eutrophication, freshwater | kg P eq. | 6.00E-01 | 0.00E+00 | 5.18E-02 | 3.64E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.93E-04 | 7.67E-02 | -1.73E-03 |
| EP-marine | Eutrophication, marine | kg N eq. | 2.16E+00 | 2.40E-01 | 2.95E-01 | 2.08E+00 | 0.00E+00 | 0.00E+00 | 2.40E-02 | 1.40E-03 | 1.44E+00 | -9.39E-03 |
| EP-terrestrial | Eutrophication, terrestrial | Mole of N eq. | 2.22E+01 | 2.61E+00 | 1.82E+00 | 1.37E+01 | 0.00E+00 | 0.00E+00 | 2.61E-01 | 1.20E-02 | 5.36E-01 | -7.92E-02 |
| POCP | Photochemical ozone formation, human health | kg NMVOC eq. | 7.56E+00 | 6.47E-01 | 5.71E-01 | 4.57E+00 | 0.00E+00 | 0.00E+00 | 6.47E-02 | 2.87E-03 | 3.02E-01 | -2.07E-02 |
| ADP-minerals&metals | Resource use, mineral and metals | kg Sb eq. | 1.71E-02 | 0.00E+00 | 2.03E-03 | 9.60E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.44E-07 | 3.54E-05 | -1.84E-05 |
| ADP-fossil | Resource use, fossils | MJ | 1.98E+04 | 1.20E+03 | 1.38E+03 | 1.13E+04 | 0.00E+00 | 0.00E+00 | 1.20E+02 | 6.85E-01 | 5.99E+01 | -2.42E+01 |
| WDP | Water use | $m^3$ world equiv. | 1.19E+03 | 0.00E+00 | 5.97E+01 | 5.44E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.37E-01 | -1.64E+02 | -1.01E+00 |
| Acronyms | GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption | | | | | | | | | | | |

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

### EN15804+A2 – Indicators, units and models for additional impact categories

| Parameter | Parameter | Unit | A1-A3 | A4 | A5 | B4 | B6 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM | Particulate matter emissions | Disease incidence | 1.34E-04 | 1.33E-06 | 1.06E-05 | 7.41E-05 | 1.33E-07 | 0.00E+00 | 1.33E-07 | 2.41E-08 | 2.23E-06 | -7.21E-07 |
| IRP | Ionizing radiation, human health | kBq U235 Eq. | 1.28E+02 | 0.00E+00 | 9.27E+00 | 6.88E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.19E-03 | 8.02E-01 | -4.75E-01 |
| ETP-fw | Ecotoxicity (freshwater) | CTUe | 3.42E+04 | 2.51E+03 | 3.69E+03 | 2.81E+04 | 2.51E+02 | 0.00E+00 | 2.51E+02 | 1.70E+01 | 1.55E+04 | -5.28E+01 |
| HTP-c | Human toxicity, cancer effects | CTUh | 7.64E-06 | 1.28E-08 | 1.53E-06 | 4.63E-06 | 1.28E-09 | 0.00E+00 | 1.28E-09 | 3.30E-09 | 7.57E-08 | -1.70E-08 |
| HTP-nc | Human toxicity, non-cancer effects | CTUh | 1.62E-05 | 1.62E-06 | 7.68E-06 | 5.02E-05 | 1.62E-07 | 0.00E+00 | 1.62E-07 | 4.25E-09 | 7.47E-05 | -3.41E-08 |
| SQP | Land use related impacts/Soil quality | Pt | 2.48E+04 | 0.00E+00 | 1.56E+03 | 1.35E+04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.04E+00 | 6.25E+02 | -5.08E+02 |

Results shown below were calculated using TRACI 2.1 Methodology.

### TRACI 2.1 Impact Assessment

| Parameter | Parameter | Unit | A1-A3 | A4 | A5 | B4 | B6 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP | Global warming potential | kg $CO_2$-Eq. | 1.8E+03 | 9.4E+01 | 1.8E+02 | 1.2E+03 | 0.0E+00 | 0.0E+00 | 9.4E+00 | 4.4E+00 | 4.6E+02 | -8.4E+00 |
| ODP | Depletion potential of the stratospheric ozone layer | kg CFC-11 Eq. | 2.9E-05 | 3.6E-09 | 1.9E-06 | 1.6E-05 | 0.0E+00 | 0.0E+00 | 3.6E-10 | 4.6E-09 | 3.9E-07 | -5.3E-07 |
| AP Air | Acidification potential for air emissions | kg $SO_2$-Eq. | 9.4E+00 | 5.6E-01 | 7.3E-01 | 5.4E+00 | 0.0E+00 | 0.0E+00 | 5.6E-02 | 2.4E-03 | 1.5E-01 | -4.0E-02 |
| EP | Eutrophication potential | kg N-Eq. | 5.2E+00 | 3.1E-02 | 2.3E+00 | 1.4E+01 | 0.0E+00 | 0.0E+00 | 3.1E-03 | 8.0E-03 | 2.1E+01 | -3.5E-02 |
| SP | Smog formation potential | kg $O_3$-Eq. | 9.4E+01 | 1.5E+01 | 8.6E+00 | 6.1E+01 | 0.0E+00 | 0.0E+00 | 1.5E+00 | 6.9E-02 | 2.4E+00 | -6.4E-01 |
| FFD | Fossil Fuel Depletion | MJ-surplus | 1.4E+03 | 1.8E+02 | 8.1E+01 | 8.1E+02 | 0.0E+00 | 0.0E+00 | 1.8E+01 | 5.6E-03 | 4.3E-01 | -2.3E-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 | B6 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP | Global warming potential | kg $CO_2$-Eq. | 1.8E+03 | 9.4E+01 | 1.9E+02 | 1.3E+03 | 0.0E+00 | 0.0E+00 | 9.4E+00 | 4.4E+00 | 5.7E+02 | -8.6E+00 |
| ODP | Depletion potential of the stratospheric ozone layer | kg CFC-11 Eq. | 2.0E-05 | 3.5E-09 | 1.3E-06 | 1.1E-05 | 0.0E+00 | 0.0E+00 | 3.5E-10 | 3.7E-09 | 2.8E-07 | -2.0E-07 |
| AP Air | Acidification potential for air emissions | kg $SO_2$-Eq. | 9.8E+00 | 4.6E-01 | 7.5E-01 | 5.6E+00 | 0.0E+00 | 0.0E+00 | 4.6E-02 | 1.9E-03 | 1.3E-01 | -2.7E-02 |
| EP | Eutrophication potential | kg$(PO_4)^3$-Eq. | 2.5E+00 | 8.2E-02 | 8.9E-01 | 5.6E+00 | 0.0E+00 | 0.0E+00 | 8.2E-03 | 3.4E-03 | 7.7E+00 | -2.0E-02 |
| POCP | Formation potential of tropospheric ozone photochemical oxidants | kg $C_2H_4$-Eq. | 1.2E+00 | 2.1E-02 | 8.4E-02 | 7.4E-01 | 0.0E+00 | 0.0E+00 | 2.1E-03 | 5.9E-05 | 1.2E-01 | -3.0E-03 |
| ADPE | Abiotic depletion potential for non-fossil resources | kg Sb-Eq. | 1.2E-02 | 0.0E+00 | 1.8E-03 | 7.0E-03 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 6.5E-07 | 3.5E-05 | -2.8E-05 |
| ADPF | Abiotic depletion potential for fossil resources | MJ | 1.4E+04 | 1.2E+03 | 1.0E+03 | 8.2E+03 | 0.0E+00 | 0.0E+00 | 1.2E+02 | 6.2E-01 | 4.7E+01 | -2.5E+01 |

**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 | B6 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | Renewable primary energy as energy carrier | MJ | 2.6E+03 | 0.0E+00 | 3.0E+02 | 1.9E+03 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 9.1E-02 | 1.0E+01 | -1.4E+02 |
| PERM | Renewable primary energy resources as material | MJ | 9.3E+02 | 0.0E+00 | 4.6E+01 | 4.9E+02 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| PENRE | Nonrenewable primary energy as energy carrier | MJ | 8.4E+02 | 1.2E+03 | 1.2E+03 | 9.0E+03 | 0.0E+00 | 0.0E+00 | 1.2E+02 | 6.9E-01 | 6.0E+01 | -3.6E+01 |
| PENRM | Nonrenewable primary energy as material utilization | MJ | 3.1E+04 | 0.0E+00 | 1.6E+03 | 1.6E+04 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| SM | Use of secondary material | kg | 8.7E+02 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| RSF | Use of renewable secondary fuels | MJ | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| NRSF | Use of nonrenewable secondary fuels | MJ | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| RE | Energy recovered from disposed waste | MJ | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| FW | Use of net fresh water | $m^3$ | 2.3E+01 | 0.0E+00 | 1.2E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 9.2E-03 | -3.8E+00 | -4.2E-02 |

**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** | **B6** | **C1** | **C2** | **C3** | **C4** | **D** |
| HWD | Hazardous waste disposed | kg | 2.1E-01 | 0.0E+00 | 1.2E-02 | 1.1E-01 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 2.7E-05 | 2.0E-03 | 1.5E+03 |
| NHWD | Non-hazardous waste disposed | kg | 1.2E+02 | 0.0E+00 | 9.8E+01 | 6.1E+02 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 2.2E+00 | 1.0E+03 | 1.5E+03 |
| HLRW | High-level radioactive waste | kg | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| ILLRW | Intermediate- and low-level radioactive waste | kg | 2.4E-02 | 0.0E+00 | 1.9E-03 | 1.3E-02 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 1.0E-06 | 2.0E-04 | 2.9E-04 |
| CRU | Components for re-use | kg | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| MR | Materials for recycling | kg | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| MER | Materials for energy recovery | kg | 0.0E+00 | 0.0E+00 | 3.4E-01 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| EE | Recovered energy exported from system | MJ | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

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

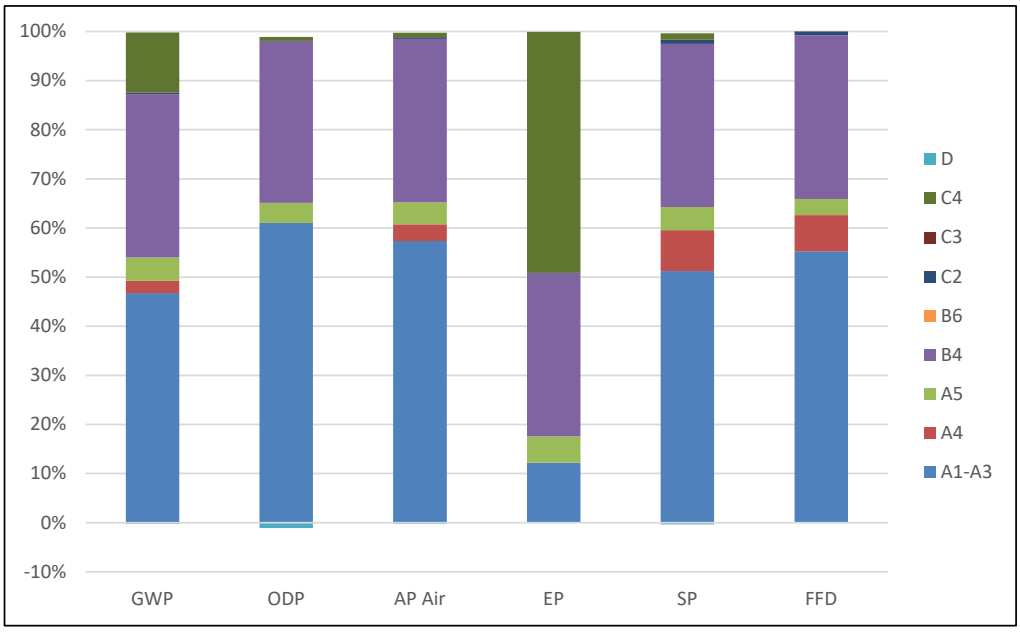
Results below contain direct greenhouse gas emissions and removals throughout the life cycle of the product.

| Resource Use | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Parameter** | **Unit** | **A1-A3** | **A4** | **A5** | **B4** | **B6** | **C1** | **C2** | **C3** | **C4** | **D** |
| 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 | 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 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCRK | Biogenic Carbon Removal from Packaging | kg $CO_2$ | 9.76E+01 | 0.00E+00 | 0.00E+00 | 4.88E+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 | 9.76E+01 | 4.88E+01 | 0.00E+00 | 0.00E+00 | 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 | 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 | 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 | 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 | 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*

## Majestic LCA Interpretation

A1-A3 contribute the majority of the impact across most categories. These impacts are related to energy required to manufacture the roofing tiles. For eutrophication, the majority of the impacts occur in the end of life disposal due to landfill runoff.




## Additional Environmental Information

### Environmental and Health During Manufacturing

Environmental stewardship drives all of the activities at EcoStar LLC. Extreme attention to detail is given to all phases of the manufacturing process to ensure that OSHA and environmental requirements are met or exceeded. We have followed a stringent quality program since 1997 and are audited every six months in accordance with ISO 9001, UL and other certification agencies. EcoStar processes in excess of 30 million pounds annually (compounding and molding) with very small amounts of waste.

### 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**
Product meets UL 790 Class A fire Rating. There are no extraordinary effects associated with exposure to fire for this product.
**Water**
Product designed to shed water and does not absorb water. There are no extraordinary effects associated with exposure to water for this
**Mechanical Destruction**
Product once installed is warranted for 50 plus years - no mechanical destruction. There are no extraordinary effects associated with the mechanical destruction of the product.

### Delayed Emissions

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

Offering superior performance and durability, EcoStar products are manufactured with recycled rubber and plastics and are highly flexible. It is a corporate goal to become zero landfill. All incoming packaging (corrugated and plastic wrap) is reprocessed and hydraulic

### Further Information

42 Edgewood Drive, Holland,  NY 14080

## References


- CBC, Title 24 — Barrier Free guidelines
- ASTM E90 — Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- ASTM E283 — Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- BHMA A156.21 — Thresholds
- UL 10(b) — Gasketing Material for Fire Doors
- UL 10(c) — Positive Pressure Gasketing Material for Fire Doors
- UL 2818 — GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings

- Characterization Method — IPCC. 2014. Climate Change 2013. The Physical Science Basis. Cambridge University Press. (http://www.ipcc.ch/report/ar5/wg1/).
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- Characterization Method — Jenkin M.E., & Hayman G.D. Photochemical ozone creation potentials for oxygenated volatile organic compounds: sensitivity to variations in kinetic and mechanistic parameters. Atmospheric Environment. 1999, 33 (8), 1275-1293.
- Characterization Method — WMO. 1999. Scientific Assessment of Ozone Depletion: 1998, World Meteorological Organization Global Ozone Research and Monitoring Project - Report No. 44, WMO, Geneva.
- Characterization Method — Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers- version 1.2, January 2017.

## Contact Information

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