

Owner: MicroShade A/S  
No.: MD-23167-EN  
Issued: 21-12-2023  
Valid to: 21-12-2023

3<sup>rd</sup> PARTY VERIFIED

**EPD**

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804



**Owner of declaration**

MicroShade  
Ejby Industrivej 70, 2600  
Glostrup, Denmark  
VAT no. 27492207



**Issued:**

21-12-2023

**Valid to:**

21-12-2028

**Programme**

EPD Danmark  
[www.epddanmark.dk](http://www.epddanmark.dk)



- Industry EPD
- Product EPD

**Basis of calculation**

This EPD is developed in accordance with the European standard EN 15804+A2.

**Comparability**

EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database.

**Validity**

This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

**Use**

The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

**Declared product(s)**

MicroShade®

Number of declared datasets/product variations: 1

**Production site**

The main production site is in Glostrup, Denmark. Subprocesses take place in Belgium (BE) and Germany (DE).

**EPD type**

- Cradle-to-gate with modules C1-C4 and D
- Cradle-to-gate with options, modules C1-C4 and D
- Cradle-to-grave and module D
- Cradle-to-gate
- Cradle-to-gate with options

**Product(s) use**

The EPD covers MicroShade® which provides integrated, passive solar shading which is to be installed into either a double or triple pane insulating glazing unit.

**Declared/ functional unit**

1 m<sup>2</sup> of MicroShade®.

**Year of production site data (A3)**

2023

**EPD version**

Version 1, [21-12-2023]

|  |
|--|
| CEN standard EN 15804 serves as the core PCR   |
| Independent verification of the declaration and data, according to EN ISO 14025  |
| <input type="checkbox"/> internal <input checked="" type="checkbox"/> external   |
| Third party verifier:<br><br>Guangli Du, Aalborg University |

Martha Katrine Sørensen  
EPD Danmark

**Life cycle stages and modules (MND = module not declared)**

| Product             |           |               | Construction process |                      | Use |             |        |             |               |                        |                       |                            | End of life |                  |          |  | Beyond the system boundary |
|---------------------|-----------|---------------|----------------------|----------------------|-----|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-------------|------------------|----------|--|----------------------------|
| Raw material supply | Transport | Manufacturing | Transport            | Installation process | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport   | Waste processing | Disposal | Re-use, recovery and recycling potential |                            |
| A1                  | A2        | A3            | A4                   | A5                   | B1  | B2          | B3     | B4          | B5            | B6                     | B7                    | C1                         | C2          | C3               | C4       | D  |                            |
| <b>X</b>            | <b>X</b>  | <b>X</b>      | MND                  | MND                  | MND | MND         | MND    | MND         | MND           | MND                    | MND                   | MND                        | MND         | MND              | MND      | MND                                      |                            |

# Product information

## Product description

The main product components are shown in the table below.

| Material                | Weight-% of declared product |
|-------------------------|------------------------------|
| Polyester film          | 41,6%                        |
| Polyolefine liner       | 29,3%                        |
| Epoxyacrylate copolymer | 17,8%                        |
| Acrylate copolymer      | 10,8%                        |
| Inorganic constituents  | 0,4%                         |

## Product packaging:

The composition of the sales- and transport packaging of the product is shown in the table below.

| Material               | Weight-% of packaging |
|------------------------|-----------------------|
| Pallet                 | 53%                   |
| Cardboard box          | 32%                   |
| Core board (cardboard) | 15%                   |

## Representativity

This declaration, including data collection and the modeled foreground system including results, represents the Cradle-to-gate impacts of producing 1 m<sup>2</sup> MicroShade® at the production sites in Denmark, Belgium, and Germany. The product specific data, covering the production process and packaging of the products, as well as supplier location and information on inbound transport, has been collected for the first six months of year 2023. Allocation of manufacturing data was based on the bill of materials or allocated based on square meters. Background data is based on Ecoinvent 3.9.1. All datasets are valid for year 2023 and the overall data representativeness is assessed to be fair.

## Hazardous substances

MicroShade® does not contain substances listed on the "Candidate List of Substances of Very High Concern for authorisation" (<http://echa.europa.eu/candidate-list-table>)

## Essential characteristics

Technical information can be obtained by contacting the manufacturer or on the manufacturers website: <https://microshade.com/microshade/>

## Reference Service Life (RSL)

Not relevant for this study. MicroShade® is integrated into the insulating glazing unit and the reference service life therefore depends on the service life of the glazing.

## Picture of product



# LCA background

## Declared unit

The LCI and LCIA results in this EPD relates to the declared unit (1m<sup>2</sup> MicroShade®).

| Name                       | Value | Unit               |
|----------------------------|-------|--------------------|
| Declared unit              | 1     | m <sup>2</sup>     |
| Density                    | 0,22  | kg/m <sup>2</sup>  |
| Conversion factor to 1 kg. | 4,55  | m <sup>2</sup> /kg |

## Functional unit

Not relevant for the assessment.

## PCR

This EPD is developed according to the core rules for the product category of construction products in EN 15804+A2:2019.

## Guarantee of Origin – certificates

No certified green electricity is used.

## Foreground system:

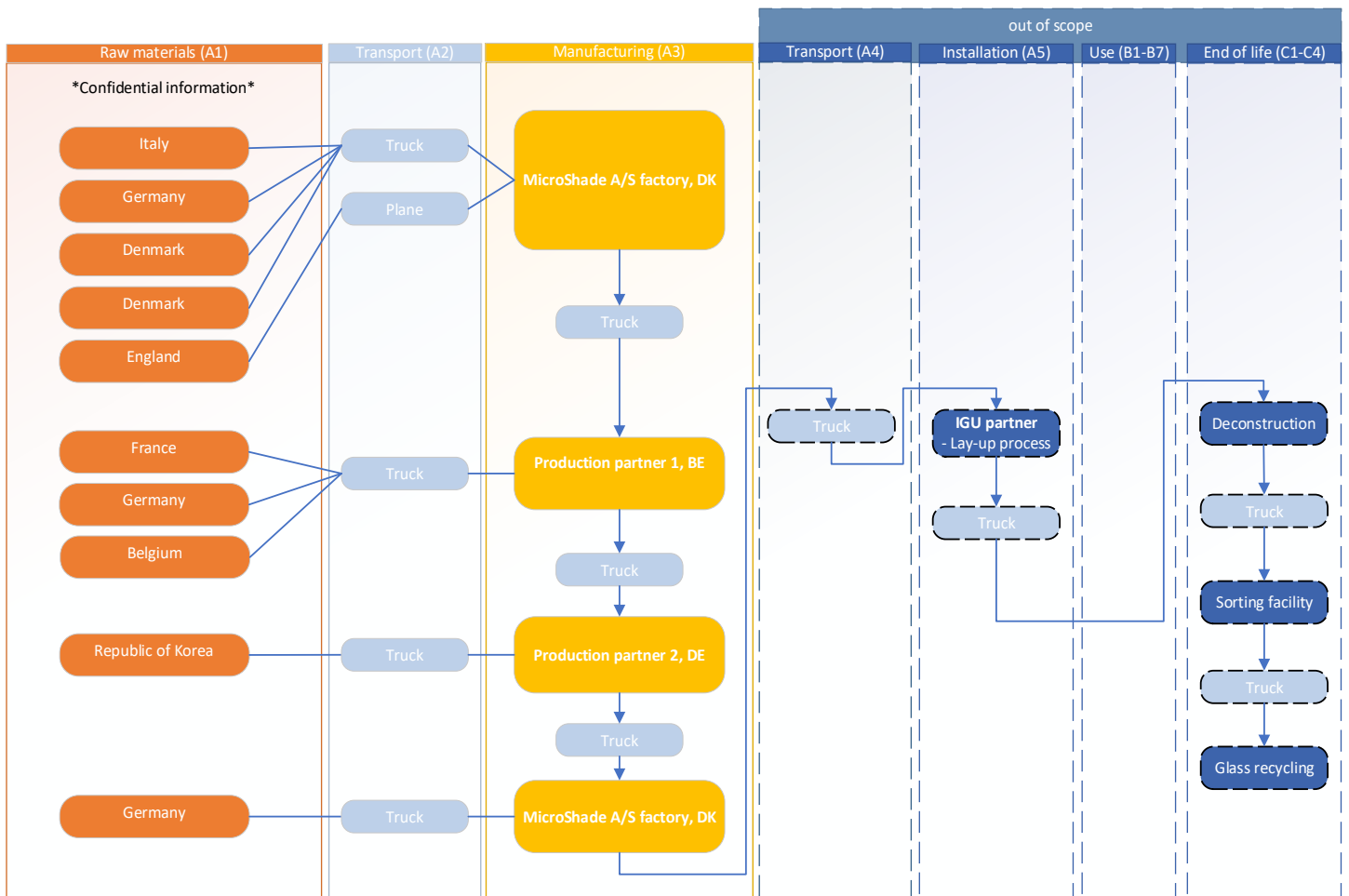
Processes at production sites in Belgium and Germany is modelled using residual mix.

Processes at the Danish site is modelled using specific residual mix (a mix of wind, biogas, and solar).

## Background system:

Upstream processes (A1) are modelled using average global or European grid mix.

## Flow diagram



## System boundary

This EPD is based on a cradle-to-gate LCA, in which ~97% of mass input flows have been accounted for. Generally, packaging materials are included in the assessment. However, specific packaging materials for goods supplied to the production partners in Germany and Belgium are excluded due to a lack of data, representing approximately 3% of the total mass.

The general rules for the exclusion of inputs and outputs follows the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

### Product stage (A1-A3) includes:

A1 – Extraction and processing of raw materials  
Include impacts from the extraction and production of raw materials and semifinished goods such as polymer films, coatings, and adhesives. The specific raw materials used are considered confidential and, therefore, are not listed in the flow diagram. Instead, the location of the supplier is indicated.

A2 – Transport to the production site  
Include all transportation service from suppliers to the MicroShade production sites, including ship, aircraft, and lorry freight.

A3 – Manufacturing processes  
The production of MicroShade® involves several steps. The Microstructure undergoes a 4-step process at the MicroShade A/S production factory in Glostrup. Once the microstructure is produced, a colour coating is applied, and finally, the

product is laminated together with a window film. The completed product is then transported to a glazing partner, where MicroShade® is integrated into the glazing unit.

This phase includes manufacturing process of the final product and the packaging materials (both raw materials, semi-finished goods, and the final product packaging). It includes the utilisation of electricity, water, gas, and auxiliary materials. Scrap and waste from production and the associated waste treatment is also accounted for up to the final disposal.

### End of Life (C1-C4):

Following the EN 15804+A2 MicroShade® qualifies for exemption of modules C1-C4 and D due to the following reasons: (1) it is not a stand-alone product but rather an integrated component used in combination with glazing in a window assembly and is inseparable at the end of life, (2) it follows the glazing's end of life and is unidentifiable in a recycling process where glass is crushed and melted into new glass, and (3) MicroShade® does not contain biogenic carbon.

It is worth mentioning that 86% of waste outflows are accounted for since they occur in A3. Only the finished product and its final packaging are not declared, constituting 14% of waste outflows. The majority of waste is, therefore, included as part of this EPD, even though the C-modules are not declared.

# LCA results

| ENVIRONMENTAL IMPACTS PER 1 m <sup>2</sup> MicroShade® |  |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--|--|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Parameter  | Unit   | A1-A3     | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D  |
| GWP-total  | [kg CO <sub>2</sub> eq.]   | 14,69E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| GWP-fossil   | [kg CO <sub>2</sub> eq.]   | 1,11E+01  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| GWP-biogenic   | [kg CO <sub>2</sub> eq.]   | 3,51E+00  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| GWP-luluc  | [kg CO <sub>2</sub> eq.]   | 9,24E-02  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ODP  | [kg CFC 11 eq.]  | 1,24E-05  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| AP   | [mol H <sup>+</sup> eq.]   | 5,01E-02  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EP-freshwater  | [kg P eq.]   | 3,47E-03  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EP-marine  | [kg N eq.]   | 1,06E-02  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EP-terrestrial   | [mol N eq.]  | 1,18E-01  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| POCP   | [kg NMVOC eq.]   | 3,67E-02  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ADPm <sup>1</sup>                                      | [kg Sb eq.]  | 2,84E-04  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ADPf <sup>1</sup>                                      | [MJ]   | 2,21E+02  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| WDP <sup>1</sup>                                       | [m <sup>3</sup> world eq. deprived]  | 5,22E+00  | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Caption  | GWP-total = Global Warming Potential - total; 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 = Ozone Depletion; AP = Acidification; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water depletion potential |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|  | The numbers are declared in scientific notation, fx 1,95E+02. This number can also be written as: 1,95*10 <sup>2</sup> or 195, while 1,12E-11 is the same as 1,12*10 <sup>-11</sup> or 0,000000000112.   |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Disclaimer   | <sup>1</sup> The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.   |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| ADDITIONAL ENVIRONMENTAL IMPACTS PER 1 m <sup>2</sup> MicroShade® |  |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|--|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Parameter   | Unit   | A1-A3    | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D  |
| PM  | [Disease incidence]  | 5,19E-07 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| IRP <sup>2</sup>  | [kBq U235 eq.]   | 3,45E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ETP-fw <sup>1</sup>   | [CTUe]   | 1,70E+02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HTP-c <sup>1</sup>  | [CTUh]   | 1,03E-08 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HTP-nc <sup>1</sup>   | [CTUh]   | 1,29E-07 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| SQP <sup>1</sup>  | -  | 9,20E+01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Caption   | PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)  |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|   | The numbers are declared in scientific notation, fx 1,95E+02. This number can also be written as: 1,95*10 <sup>2</sup> or 195, while 1,12E-11 is the same as 1,12*10 <sup>-11</sup> or 0,000000000112.   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Disclaimers   | <sup>1</sup> The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|   | <sup>2</sup> This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator. |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| RESOURCE USE PER 1 m <sup>2</sup> MicroShade® |   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Parameter                                     | Unit  | A1-A3    | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D  |
| PERE  | [MJ]  | 4,63E+01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERM  | [MJ]  | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERT  | [MJ]  | 4,63E+01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRE   | [MJ]  | 2,21E+02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRM   | [MJ]  | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRT   | [MJ]  | 2,21E+02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| SM  | [kg]  | 1,17E-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RSF   | [MJ]  | 6,45E-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NRSF  | [MJ]  | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FW  | [m <sup>3</sup> ]   | 1,21E-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Caption                                       | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|   | The numbers are declared in scientific notation, fx 1,95E+02. This number can also be written as: 1,95*10 <sup>2</sup> or 195, while 1,12E-11 is the same as 1,12*10 <sup>-11</sup> or 0,0000000000112.   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

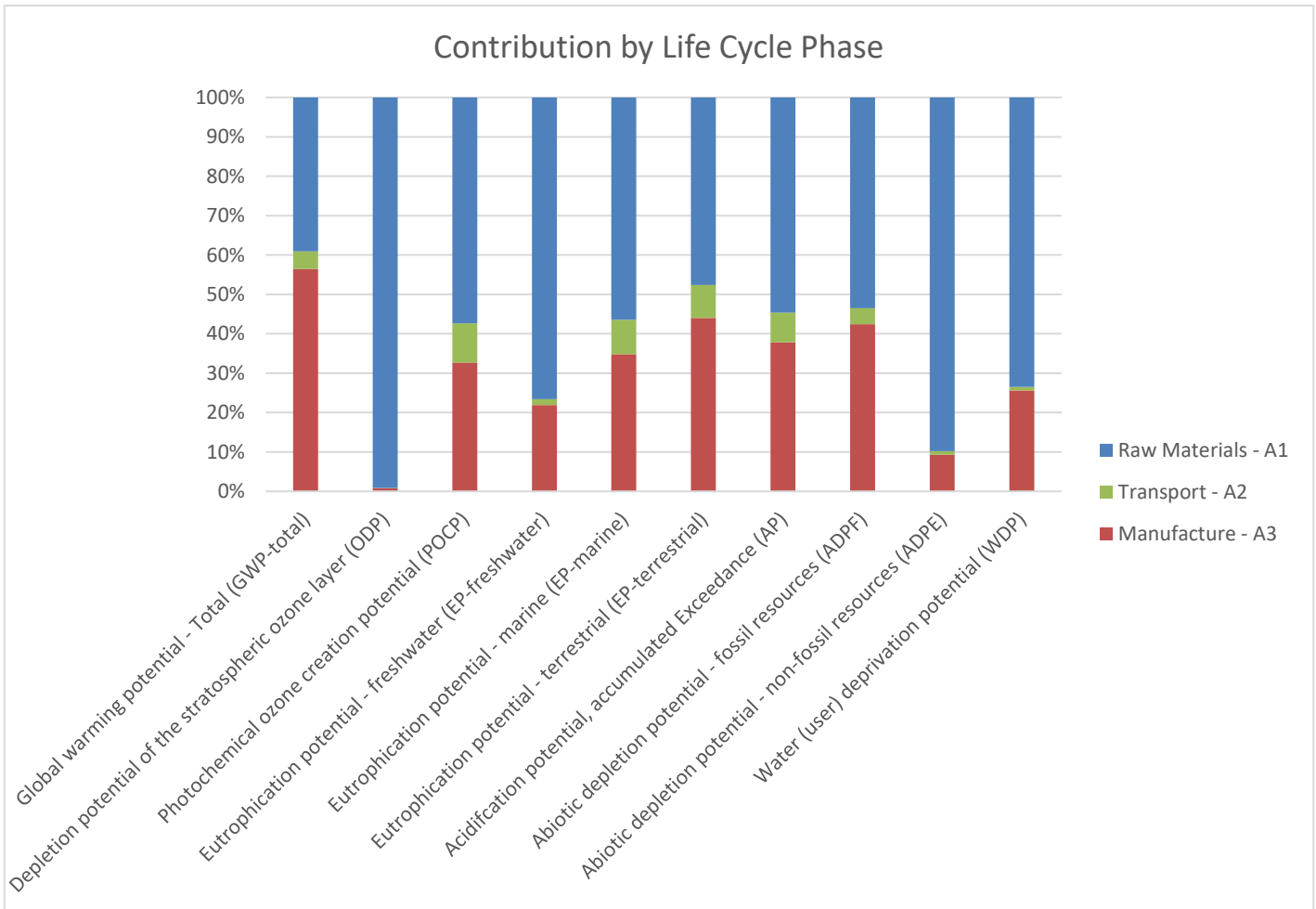
| WASTE CATEGORIES AND OUTPUT FLOWS PER 1 m <sup>2</sup> MicroShade® |   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--|---|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Parameter  | Unit  | A1-A3    | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D  |
| HWD  | [kg]  | 5,86E-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NHWD   | [kg]  | 1,13E+01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RWD  | [kg]  | 8,30E-04 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CRU  | [kg]  | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MFR  | [kg]  | 1,11E-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MER  | [kg]  | 3,68E-04 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EEE  | [MJ]  | 6,74E-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EET  | [MJ]  | 1,61E-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Caption  | HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|  | The numbers are declared in scientific notation, fx 1,95E+02. This number can also be written as: 1,95*10 <sup>2</sup> or 195, while 1,12E-11 is the same as 1,12*10 <sup>-11</sup> or 0,0000000000112.   |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| BIOGENIC CARBON CONTENT PER 1 m <sup>2</sup> MicroShade® |  |                     |
|--|--|---------------------|
| Parameter  | Unit   | At the factory gate |
| Biogenic carbon content in product                       | kg C   | 0E+00               |
| Biogenic carbon content in accompanying packaging        | kg C   | 5,50E-02            |
| Note   | 1 kg biogenic carbon is equivalent to 44/12 kg a CO <sub>2</sub> |                     |

## Additional information

### LCA interpretation

The figure below illustrates the contributions by life cycle phase. It is noticeable that the majority of impacts occur in A1, where the impacts are caused by the purchased raw materials to be used in the production of MicroShade®. The exception is in the GWP-total category, where the A3 phase is the most impactful due to the emissions from the electricity use. A2 has a relatively small impact compared to A1 and A3.



Focusing on GWP-total, it is observed that the A3 phase is the biggest contributor, followed closely by the A1 phase. The primary contributors across the phases are electricity use (40%), production of plastic granulate (16.7%), and waste incineration (11.5%). Other noteworthy contributors include the production of epoxy resins (10.2%) and potassium carbonate (3.8%).

In A2, the GWP-total impact naturally results from combusting fossil fuels. The most impactful transport process involves transporting the special polymers from a supplier in Italy to MicroShade's site in Denmark using a smaller truck/van. This process accounts for almost 4% of the GWP-total.




**Indoor air**

*The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.1.*

**Soil and water**

*The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.2.*

# References

|                                      |  |
|--------------------------------------|--|
| <b>Publisher</b>                     | <br><a href="http://www.epddanmark.dk">www.epddanmark.dk</a><br><small>Template version 2023.1</small> |
| <b>Programme operator</b>            | Danish Technological Institute<br>Buildings & Environment<br>Gregersensvej<br>DK-2630 Taastrup<br><a href="http://www.teknologisk.dk">www.teknologisk.dk</a>                             |
| <b>LCA-practitioner</b>              | Emil Fraenkel and Janus Kirkeby<br>Ramboll Denmark<br>Hannemanns Allé 53   |
| <b>LCA software /background data</b> | <i>Umberto 11 incl. ecoinvent EN15804<br/>           3.9.1 database</i>  |
| <b>3<sup>rd</sup> party verifier</b> | Guangli Du<br>BUILD – The Department of the Built<br>Environment, Aalborg University Copenhagen<br><a href="mailto:gdu@build.aau.dk">gdu@build.aau.dk</a>                                |

## General programme instructions

General Programme Instructions, version 2.0, spring 2020  
[www.epddanmark.dk](http://www.epddanmark.dk)

### EN 15804

DS/EN 15804 + A2:2019 - "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

### EN 15942

DS/EN 15942:2011 – "Sustainability of construction works – Environmental product declarations – Communication format business-to-business"

### ISO 14025

DS/EN ISO 14025:2010 – "Environmental labels and declarations – Type III environmental declarations – Principles and procedures"

### ISO 14040

DS/EN ISO 14040:2008 – "Environmental management – Life cycle assessment – Principles and framework"

### ISO 14044

DS/EN ISO 14044:2008 – "Environmental management – Life cycle assessment – Requirements and guidelines"