## ENVIRONMENTAL PRODUCT DECLARATION
As per ISO 14025 and EN 15804+A1

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner of the Declaration</td>
<td>alwitra GmbH</td>
</tr>
<tr>
<td>Publisher</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Programme holder</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Declaration number</td>
<td>EPD-ALW-201900185-IBC1-EN</td>
</tr>
<tr>
<td>ECO EPD Ref. No.</td>
<td>ECO-00001085</td>
</tr>
<tr>
<td>Issue date</td>
<td>17.01.2020</td>
</tr>
<tr>
<td>Valid to</td>
<td>16.01.2025</td>
</tr>
</tbody>
</table>

EVA roofing and waterproofing membranes
EVALON® V, VG, VSK, VGSK, dual

**alwitra GmbH**

---

www.ibu-epd.com | https://epd-online.com
1. General information

alwitra GmbH

EVA roofing and waterproofing membranes EVALON® V, VG, VSK, VGSK, dual

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Owner of the declaration
alwitra GmbH
Am Forst 1
54296 Trier
Germany

Declaration number
EPD-ALW-201900185-IBC1-EN

Declared product / Declared unit
1 m² of average produced roofing and waterproofing membrane EVALON® V, VG, VSK, VGSK, dual

Scope:
This EPD is an average EPD for roofing and waterproofing membranes EVALON® V, VG, VSK, VGSK, dual made by alwitra GmbH. The products are manufactured in 54411 Hermeskeil, Germany.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

This EPD has been drawn up according to the requirements stipulated in EN 15804+A1. Following, the standard is simply referred to as EN 15804.

Verification
The European standard EN 15804 serves as the core PCR

Independent verification of the declaration and Information according to ISO 14025:2010

<table>
<thead>
<tr>
<th>Internally</th>
<th>Externally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Dipl. Ing. Hans Peters
(Chairman of the Board of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director of the Institut Bauen und Umwelt e.V.)

Matthias Schulz
Independent verifier appointed by the SVR

2. Product

2.1 Product description / Product definition

This EPD contains a description of bitumen compatible EVAC - ethylene vinyl acetate terpolymer/copolymer - (EVA in Germany) roofing and waterproofing membrane systems. The declared products consist of a high polymer alloy of EVA terpolymer and PVC (polyvinyl chloride) including additives. EVALON® membranes are equipped with a polyester fleece backing (additionally with glass fleece, where applicable). Self-adhesive membranes are additionally equipped with a self-adhesive coating including release film. EVALON® membranes can also be manufactured with a central polyester scrim. The declared products are manufactured in a calandering process. Seam welding is carried out with hot air or tetrahydrofuran (THF).

The EVALON® product line includes the following varieties:

- EVALON® V with polyester fleece backing (effective thickness 1.2/1.5 mm; total thickness 2.1/2.4 mm)
- EVALON® VG with polyester/glass fleece backing (effective thickness 1.2/1.5 mm; total thickness 2.1/2.4 mm)
- EVALON® VSK with polyester fleece backing and self-adhesive coating (effective thickness 1.2/1.5 mm; total thickness 2.2/2.5 mm)
- EVALON® VGSK with polyester/glass fleece backing and self-adhesive coating (effective thickness 1.2/1.5 mm; total thickness 2.2/2.5 mm)
- EVALON® dual with middle reinforcement, effective thickness/total thickness 1.5 mm

For placing the product on the market in the EU/EFTA (except Switzerland), Regulation (EU) No 305/2011 (CPR) shall apply. The product requires a Declaration of Performance in accordance with DIN EN
13956:2013-03, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics and DIN EN 13967: 2017-08, Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics, as well as CE marking. For application, the corresponding national regulations shall apply.

2.2 Application
The intended use of the declared product is as follows:

**Roof waterproofing**
Single-ply waterproofing of non-used and used flat and low slope roofs. Depending on specification, the membranes are applied as follows:

**EVALON® V and EVALON® VG**
- loose laid under ballast
- mechanically fastened
- adhesive bonding with system adhesive

**EVALON® VSK**
- adhesive bonding (self-adhesive coating) to various standard substrates with alwitra wash primer SK or SK-L.

**EVALON® VGSK**
- with its integrated fire retarding layer bonded directly to unbacked EPS insulation boards without any wash primer. Like EVALON® VSK, they can also be bonded with alwitra wash primer

**EVALON® dual**
- loose laid under ballast
- mechanically fastened

**Waterproofing of foundations**
Single-ply waterproofing of non-waterproof foundations or constructional parts against ground moisture and non-pressing water. The membranes are bonded or loose laid according to requirements as described above. When applying, the manufacturer installation instructions must be adhered to.

2.3 Technical data

### 2.3.1 For membranes with backing
**EVALON® V, VG, VSK, VGSK roofing and waterproofing membrane**

#### Constructional data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watertightness acc. to EN 1928 (roofing membranes)</td>
<td>400</td>
<td>kPa</td>
</tr>
<tr>
<td>Elongation at max. tensile force acc. to EN 12311-2 (roofing membranes)</td>
<td>60</td>
<td>%</td>
</tr>
<tr>
<td>Peel resistance of the seam joint acc. to EN 12316-2 (roofing membranes)</td>
<td>150</td>
<td>N/50mm</td>
</tr>
<tr>
<td>Shear resistance of the seam joint acc. to EN 12317-2 (roofing membranes)</td>
<td>400</td>
<td>N/50mm</td>
</tr>
<tr>
<td>Tear propagation resistance acc. to EN 12310-1 (roofing membranes)</td>
<td>300</td>
<td>N</td>
</tr>
<tr>
<td>Artificial ageing acc. to EN 1297 (roofing membranes)</td>
<td>class 0</td>
<td>-</td>
</tr>
<tr>
<td>Dimensional stability acc. to EN 1107-2 (roofing membranes)</td>
<td>0.5</td>
<td>%</td>
</tr>
<tr>
<td>Folding in the cold acc. to EN 495-5 (roofing membranes)</td>
<td>-30</td>
<td>°C</td>
</tr>
</tbody>
</table>

Bitumen compatibility acc. to EN 1548 (roofing membranes) | passed | -          |
Resistance to root penetration (for green roofs) acc. to EN 13948 or FLL (roofing membranes) | passed | -          |
Ozone resistance (for EPDM/IIR) acc. to EN 1844 (roofing membranes) | passed | -          |
Watertightness acc. to EN 1928 (waterproofing membranes) | 400   | -          |
Elongation at max. tensile force acc. to EN 12311-2 (waterproofing membranes) | 60    | %          |
Resistance to impact loads acc. to EN 12691 (waterproofing membranes) | 300   | mm         |
Shear resistance of the seam joint acc. to EN 12317-2 (waterproofing membranes) | 400   | N/50mm     |
Tear propagation resistance acc. to EN 12310-1 (waterproofing membranes) | 300   | N          |

### 2.3.2 For reinforced membranes

**EVALON® dual roofing and waterproofing membrane**

#### Constructional data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. tensile force acc. to EN 12311-2 (A)</td>
<td>1000</td>
<td>N/50mm</td>
</tr>
<tr>
<td>Elongation at max. tensile force acc. to EN 12311-2 (A)</td>
<td>15</td>
<td>%</td>
</tr>
<tr>
<td>Peel resistance of the seam joint acc. to EN 12316-2</td>
<td>150</td>
<td>N/50mm</td>
</tr>
<tr>
<td>Shear resistance of the seam joint acc. to EN 12317-2</td>
<td>400</td>
<td>N/50mm</td>
</tr>
<tr>
<td>Tear propagation resistance acc. to EN 12310-1</td>
<td>200</td>
<td>N</td>
</tr>
<tr>
<td>Resistance to static load acc. to EN 12730 (B)</td>
<td>20</td>
<td>kg</td>
</tr>
<tr>
<td>Watertightness acc. to EN 1928</td>
<td>400</td>
<td>kPa</td>
</tr>
<tr>
<td>Artificial ageing acc. to EN 1297</td>
<td>class 0</td>
<td>-</td>
</tr>
<tr>
<td>Folding in the cold acc. to EN 495-5</td>
<td>-30</td>
<td>°C</td>
</tr>
<tr>
<td>Bitumen compatibility acc. to EN 1548</td>
<td>passed</td>
<td>-</td>
</tr>
<tr>
<td>Resistance to root penetration (for green roofs) acc. to EN 13948 or FLL (roofing membranes)</td>
<td>passed</td>
<td>-</td>
</tr>
</tbody>
</table>

Performance values of the product according to the Declaration of Performance in relation to its essential characteristics in accordance with DIN EN 13956:2013-03 or DIN EN 13967:2017-08.

For application, the respective national regulations shall apply; in Germany, application standard DIN SPEC 20000-201 or DIN SPEC 20000-202 shall apply.

**Roofing membranes** according to DIN EN 13956 and application standard DIN SPEC 20000-201

Description/marking:
**EVALON® V**
**DE/E1 EVA-BV-K-PV-1,2 (1,5)**
**EVALON® VG**
**DE/E1 EVA-BV-K-GV/PV-1,2 (1,5)**
**EVALON® VSK**
**DE/E1 EVA-BV-K-PV-1,2 (1,5)-SK**
**EVALON® VGSK**
**DE/E1 EVA-BV-K-GV/PV-1,2 (1,5)-SK**
**EVALON® dual**
**DE/E1 EVA-BV-V-PG-1,5**

Environmental Product Declaration alwitra GmbH – EVA roofing and waterproofing membranes EVALON®V, VG, VSK, dual
Waterproofing membranes according to DIN EN 13967 and application standard DIN SPEC 20000-202

Description/marking
EVALON® V
BA EVA-BV-K-PV-1,5
EVALON® VG
BA EVA-BV-K-GV/PV-1,2 (1,5)
EVALON® VSK
BA EVA-BV-K-PV-1,5-SK
EVALON® VGSK
BA EVA-BV-K-GV/PV-1,5-SK

FPC (Factory Production Control) Certificate No.: 1343 - BPR - 06-1432

2.4 Delivery status
Standard sizes
EVALON® V (1.2/1.5)
Length: 25 m
Width: 1.05/1.55/2.05 m

EVALON® VG (1.2/1.5)
Length: 25 m
Width: 1.05/1.55 m

EVALON® VSK/VGSK (1.2/1.5)
Length: 25 m
Width: 1.05 m

EVALON® dual
Length: 20 m
Width: 1.50 m

Standard colours
white, light grey, slate grey

2.5 Base materials / Ancillary materials
EVALON® roofing and waterproofing membranes consist of:
Ethylene vinyl acetate terpolymer EVAC 25 - 50 %
Polyvinyl chloride PVC 25 - 40 %
Mineral flame retardant 12 - 18 %
Stabiliser 1 - 2 %
Epoxidised soybean oil 2.5 - 7.5 %
Additives, carbon black, pigments - depending on colour 8 - 20 %
Titanium dioxide 0 - 7.5 %

Backed and self-adhesive coating.
1) The product contains substances of the ECHA Candidate List of Substances of Very High Concern (16.07.2019) above 0.1 mass-%, relevant for approval: no
2) The product contains other CMR substances of category 1A or 1B, which are not on the candidate list, above 0.1 mass-% in at least one part of the product: no
3) Biocidal products have been added to this construction product or it has been treated with biocidal products (it is therefore a treated product within the meaning of the Biocidal Products Regulation (EU) No 528/2012): no

2.6 Manufacture
The basic materials and the pre-products (except the backing and the self-adhesive coating) are pre-mixed in a mixing machine and subsequently plastified in an extruder together with the other formulation ingredients. The plastics composition as an intermediate is fed over a mixing mill into a calander, where it is rolled out into a homogeneous membrane, and (depending on the membrane type) an underside backing layer (with self-adhesive coating and separation foil, where applicable) is applied. The finished membrane is cooled down over special chill rolls and subsequently cut to its final size and fabricated into rolls. At the reinforced type of membrane, a polyester scrim is applied in the middle. All unbacked production residues (cut-off edge strips) are recycled, i.e. directly refed into the production process.

Manufacture is subject to the established Quality Management System according to /ISO 9001/. Further external quality controls (external monitoring) are carried out by the Staatliche Materialprüfungsanstalt Darmstadt, Germany

2.7 Environment and health during manufacturing
Compliance with the national and system-specific environmental protection requirements during the manufacturing process is guaranteed. Emissions produced in the calander do not exceed the limits stipulated in the Technical Instructions on Air Pollution Control (TA Luft) and are released to the environment without any filtering.

Manufacture is also subject to the established Environmental Management System according to ISO 14001 and the Energy Management System according to ISO 50001.

2.8 Product processing / Installation
Due to their thermoplastic properties EVALON® roofing and waterproofing membranes are easy to handle and to process. Usually, the overlap welding is carried out with hot air (warm gas). On the roof, no specific health protection measures for staff are required.

When joining the seam with solvent-welding agent or cleaning seams with roofing membrane cleaner, the following must be observed:
- avoid skin and eye contact,
- wear gloves,
- no smoking, no open fire, avoid sparking,
- do not inhale vapours, use only outdoors or in well ventilated spaces.

Homogeneous seam welding is advantageous for a permanent waterproof functionality of the parts/membranes to be connected. When applying, the pertinent standards as well as the installation instructions and manufacturer information must be adhered to.

The following application methods are possible depending on the type of membrane:

Loose laying with ballast
(advantage: unproblematic removal of unmixed material)
The membranes are rolled out on a suitable substrate (on a protection layer, if required), aligned and welded in the overlap area.

Example of green roof:
The declared product is used for green roofs as a waterproofing and, at the same time, as a protection against root penetration, as the corresponding certificate is available (resistant to root/rhizome penetration according to FLL testing - also without application of biocides).

Mechanical fastening
(advantage: unproblematic removal of unmixed material)
The membranes are rolled out on a suitable substrate (on a protection layer, if required), aligned and usually fastened with approved fastening systems on the supporting structure according to the manufacturer’s specification. Usually, the fastening is carried out in the membrane overlap (seam area). After installation of the fasteners, the membranes are welded together. Fastening can also be carried out outside the seam overlap. These fastenings must then be waterproofed according to the system. With mechanical fastening, the complete layer build-up is fixed (incl. thermal insulation, vapour control layer, etc.)

Bonding
If membranes are to be bonded, for environmental reasons, self-adhesive membranes should be applied. The declared products are bitumen-free and solvent-free. After rolling out and aligning the membranes on a suitable substrate (clean, even, solid, with wash primer, if required), the release film is removed from one end of the membrane (approx. 80 - 100 cm). The end of the membrane is bonded to the substrate, the release film is pulled out flat to the side from under the membrane and the membrane is simultaneously pressed on (bonded) over the full size with a broom in a single operation. Subsequently, the laps are welded.

Usage of system adhesives and processing aids
The handling instructions and information on container labels and Safety Data Sheets for adhesives and processing aids such as solvent-welding agent, primer or solvent-containing adhesives must be followed, e.g.
- ensure proper ventilation at the workplace
- keep away ignition sources - no smoking
- using skin protection lotion for preventive skin protection is recommended.

2.10 Condition of use
Due to the material composition, for the usage period of the declared products no toxic substances (fungicides/biocides) for the elimination of pest biota (fungi, plants, bacteria) or special root control additives (e.g. when used as root-resistant waterproofing) are used in the declared products.

2.11 Environment and health during use
There is no evidence of any possible emission of substances during the service life of any type of EVALON® membranes.

2.12 Reference service life
The declared roofing and waterproofing membranes have been in use for approx. 35 years. If exposed to standard load, professionally installed and applied in accordance with the intended use in compliance with the generally accepted engineering standards, the declared products can reach a service life of 35 years and more.
If professionally applied under an ecological protection/wearing layer (e.g. green roof) this service life can be still extended. The in-use conditions will be significantly enhanced when installed with alwitra system parts as the system parts used in the waterproofing such as rainwater outlets, vents, coated metal sheets or rooflights are flashed against the declared membranes in a homogeneous, waterproof connection. The waterproofing of adjacent constructional elements is complemented by additional components of the product system, e.g. roof edge trim and wall connection profiles.

If the waterproofing consists of the declared products, it will not be necessary to remove it in case of restoration/refurbishment. In fact, the old waterproofing usually can serve as a substrate for the new refurbishment layer.

2.13 Extraordinary effects

Fire

<table>
<thead>
<tr>
<th>Fire protection</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Building material class - reaction to fire</td>
<td>class E / passed</td>
</tr>
<tr>
<td></td>
<td>to fire EN11925-2 / EN 13501</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External fire performance CEN TS 1187 /</td>
<td>B_orf(t1) passed</td>
</tr>
<tr>
<td></td>
<td>EN 13501</td>
<td></td>
</tr>
</tbody>
</table>

Note:
The test results for B_orf(t1) are valid for the roof build-ups tested by alwitra.

Water
The substances of the sealing layer used for EVALON® membranes are not water-soluble.

Mechanical destruction
In case of an unexpected mechanical destruction of EVALON® membranes, no adverse environmental impacts have been reported.

2.9 Packaging
The packing materials used made of wood, paper/cardboard, polyethylene (PE foil) and PP strapping are recyclable.

If sorted [RS1], collection is carried out by INTERSEROH (INTERSEROH certificate 25288). Upon request of the sites, INTERSEROH collects the packing materials at the sites of waste generation in containers taking into account legal requirements.
- strapping: PP
- returnable / non-returnable pallets, wood
- boxes, cardboard/paper
- plastic foil (polyethylene foils - LDPE - recyclable)
2.14 Re-use phase
EVALON® membranes are not re-used in their original form after their service life. When sorted, EVALON® membranes can be collected by the "ROOFCOLLECT" system (recycling system for synthetic roofing and waterproofing membranes). The recycled materials gained from the old roofing membranes can be reintroduced into the cycle of materials, e.g., usage in inspection walkway tiles. These inspection walkway tiles are used to protect the waterproofing and to mark the maintenance walkways on flat roofs. The textured surface provides a strong grip, even on sloped and wet areas.

At the end of service life thermal utilisation is also possible. The energy contained in the declared products is recovered, thus saving on additional back-up firing in the waste incineration plant.

2.15 Disposal
If possible, recycling of the declared products, or at least their thermal utilisation should be used as a way of disposal. See also 2.14. Roofing and waterproofing membranes or residues thereof can be classified as AVV No. 170904 or No. 200139.

2.16 Further information
For further information on the EVALON® product system, e.g., brochures, Declaration of Performance, installation instructions, see the alwitra web page (www.alwitra.de).
Product specific accessories are also available online.

3. LCA: Calculation rules

3.1 Declared unit
The declared unit is 1 m² of average produced, installed and disposed of/recycled EVALON® roofing and waterproofing membrane system with a thickness of 1.5 mm. The averaging was based on annual production data (total inputs and outputs per year). The values calculated in this way were scaled to a representative thickness and correspond to approx. 90% market share of the delivered products. The approximate calculation of other thicknesses can be done by the following formula:

\[ d_{\text{new}} = \frac{d_{\text{old}} \times \text{decl}}{1.2} \]

where
- \( d_{\text{old}} \): indicator result in relation to a new thickness
- \( d_{\text{new}} \): indicator result of the respective life cycle phase
- \( \text{decl} \): thickness to be calculated in mm

The life cycle assessment deviations within the produced product varieties can be classified as low (< 5 %). The deviations are due to e.g., different backings and/or self-adhesive coatings of low mass.

## Declared unit

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>m²</td>
</tr>
<tr>
<td>Weight per unit area</td>
<td>2</td>
<td>kg/m²</td>
</tr>
<tr>
<td>Conversion factor to 1 kg</td>
<td>0.5</td>
<td>-</td>
</tr>
</tbody>
</table>

3.2 System boundary
In addition to the life cycle stages of the product manufacture (cradle to gate), this life cycle assessment also addresses further options as listed below:
- extraction and supply of raw materials (A1)
- transport of basic materials (A2)
- backing, if applicable (A1)
- membrane manufacture (A3)
- membrane packaging (including transport of the packing materials and end of life)
- transport to site (A4)
- installation on site (fixing with adhesives and seam welding) (A5)
- end of life of the membranes (incl. transport) - material and thermal utilisation (module C2, C3 and D)

3.3 Estimates and assumptions
Scenarios have been designed for the respective modules. Unless otherwise indicated, estimates of these scenarios have been provided by alwitra GmbH for calculation purposes.

- Module A4: Transport to site, (on average 361 km), Module A5: Transport distance and quantities of packing materials (50 km)
- Module C2: Transport after removal from the roof for scenario 2 360 km classified as "worst case" (C2/1 50 km to waste incineration plant and C2/2 737 to material EoL recycling)
- Module C3: In scenario 1 100% thermal utilisation and in scenario 2 100% material recycling of the membranes after removal from the roof (current percentage of scenario 1: 70% of the overall quantity, percentage of scenario 2: 30% of the overall quantity)
- Module D: In the case of thermal utilisation of old roofing membranes, power and steam is generated. Credits for these two energy flows have been indicated by the German data sets „DE: Electricity Mx PE” and „DE: Process Steam from Natural Gas PE”. Material recycling is to be understood as the manufacture of inspection walkway tiles.

3.4 Cut-off criteria
In the LCA, all collected operational data, i.e., all raw materials used according to the formulation, the thermal energy used as well as the power and the water consumption, have been taken into account. Transportation expenditures for all inputs and outputs have been considered. Thus, according to PCR Part A also material and energy flows with a percentage of less than 1 percent of the total mass of the product have been taken into account.

3.5 Background data
The primary data has been provided by alwitra GmbH. The background data has been taken from the data base of the GaBi software from PE INTERNATIONAL (GaBi 9 (SP39)). The German electricity mix has been applied. The last revision of the used data has been carried out less than 3 years ago.
3.6 Data quality
The used data originates from the data collection performed by the manufacturer. In addition to the primary data on the manufacture of roofing and waterproofing membranes at alwitra GmbH, necessary background data on the used basic materials has been specifically modelled or taken from the GaBi database. Production data of the manufacturer has been measured or calculated (power consumption, thermal energy, amounts of basic materials used), transport distances, however, have been partly estimated. For modelling the product stage of synthetic roofing membranes, the data collected by alwitra GmbH during the production year 2018 for the different membrane types have been used. All other relevant background data sets have been taken from the GaBi 9 software database and are not older than 6 years. The representativeness can be rated very good. For the basic material of zinc borate data sets had to be modelled.

3.7 Period under review
The data base of this LCA refers to data collected in 2018. The quantities used of raw materials, energy as well as auxiliary and operating materials are taken into account as average values from 12 months of production at the production plant in Hermeskeil, Germany.

4. LCA: Scenarios and additional technical information

The following technical information provides the basis for the declared modules or can be used for the design of specific scenarios within the context of a building assessment, if modules are not declared (MND).

Transportation to site (A4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litres of fuel</td>
<td>0.002</td>
<td>l/100 km</td>
</tr>
<tr>
<td>Transport distance</td>
<td>361</td>
<td>km</td>
</tr>
<tr>
<td>Capacity utilisation (including empty runs)</td>
<td>85</td>
<td>%</td>
</tr>
<tr>
<td>Gross density of products transported</td>
<td>1293</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Capacity utilisation volume factor</td>
<td>100</td>
<td>-</td>
</tr>
</tbody>
</table>

Integration into the building (A5)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption</td>
<td>0.013</td>
<td>kWh</td>
</tr>
<tr>
<td>VOC into the air</td>
<td>0.015</td>
<td>kg</td>
</tr>
<tr>
<td>Loss of material (due to overlaps)</td>
<td>5</td>
<td>%</td>
</tr>
</tbody>
</table>

Reference service life

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference service life depending on the local conditions and in combination with a maintenance service contract</td>
<td>35</td>
<td>a</td>
</tr>
</tbody>
</table>
5. **LCA: Results**

**DESCRIPTION OF SYSTEM BOUNDARIES (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)**

<table>
<thead>
<tr>
<th>Product stage</th>
<th>Construction process stage</th>
<th>Use stage</th>
<th>End-of-life stage</th>
<th>Benefits and loads beyond the system boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material supply</td>
<td>Transport</td>
<td>Manufacturing</td>
<td>Assembly</td>
<td>Use</td>
</tr>
</tbody>
</table>

### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 m² of average produced and installed EVALON

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>A5</th>
<th>C1/2</th>
<th>C2/2</th>
<th>C3/1</th>
<th>C3/2</th>
<th>D1</th>
<th>D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP</td>
<td>[kg CO₂eq.]</td>
<td>6.76E+0</td>
<td>3.37E+2</td>
<td>5.99E-1</td>
<td>4.56E+3</td>
<td>6.76E-2</td>
<td>3.60E+0</td>
<td>8.35E-1</td>
<td>-2.20E+0</td>
<td>-4.79E-0</td>
<td></td>
</tr>
<tr>
<td>OP = Opacity</td>
<td>[kg CO₂eq.]</td>
<td>1.51E-0</td>
<td>1.31E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>1.31E+0</td>
<td>1.51E-0</td>
<td>1.31E+0</td>
<td>-2.20E-0</td>
<td>-4.79E-0</td>
<td></td>
</tr>
<tr>
<td>AP = Acidification Potential</td>
<td>[kg SO₂eq.]</td>
<td>3.09E-1</td>
<td>3.96E-1</td>
<td>9.50E-1</td>
<td>3.48E-1</td>
<td>9.28E-1</td>
<td>1.38E-1</td>
<td>-3.23E-1</td>
<td>-1.15E-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP = Eutrophication Potential</td>
<td>[kg PO₄³⁻eq.]</td>
<td>3.20E-1</td>
<td>2.36E-1</td>
<td>6.81E-1</td>
<td>3.48E-1</td>
<td>6.81E-1</td>
<td>1.38E-1</td>
<td>-3.23E-1</td>
<td>-1.15E-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POCP = Photochemical Oxidation Creation Potential</td>
<td>[kg SO₂eq.]</td>
<td>3.34E-1</td>
<td>3.16E-1</td>
<td>1.67E-1</td>
<td>4.33E-1</td>
<td>6.98E-1</td>
<td>5.33E-1</td>
<td>3.27E-1</td>
<td>-5.18E-1</td>
<td>-2.24E-1</td>
<td></td>
</tr>
<tr>
<td>ADPE = Abiotic depletion potential for non-fossil resources</td>
<td>[kg Sh⁻eq.]</td>
<td>1.45E+2</td>
<td>4.50E-1</td>
<td>7.51E+0</td>
<td>9.01E-1</td>
<td>1.50E+0</td>
<td>8.38E-0</td>
<td>-2.81E+1</td>
<td>-9.98E-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS OF THE LCA - RESOURCE USE according to EN 15804+A1: 1 m² of average produced and installed EVALON**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>A5</th>
<th>C1/2</th>
<th>C2/2</th>
<th>C3/1</th>
<th>C3/2</th>
<th>D1</th>
<th>D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials</td>
<td>[MJ]</td>
<td>2.38E+1</td>
<td>2.75E-2</td>
<td>2.62E+0</td>
<td>3.73E-3</td>
<td>5.50E-2</td>
<td>4.20E-1</td>
<td>5.35E+0</td>
<td>7.38E+0</td>
<td>-1.61E+1</td>
<td></td>
</tr>
<tr>
<td>PERM = Use of renewable primary energy resources used as raw materials</td>
<td>[MJ]</td>
<td>1.31E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>PERT = Total use of renewable primary energy resources</td>
<td>[MJ]</td>
<td>2.51E+1</td>
<td>2.75E-2</td>
<td>1.31E+0</td>
<td>3.73E-3</td>
<td>5.50E-2</td>
<td>4.20E-1</td>
<td>5.35E+0</td>
<td>7.38E+0</td>
<td>-1.61E+1</td>
<td></td>
</tr>
<tr>
<td>PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials</td>
<td>[MJ]</td>
<td>1.20E+2</td>
<td>4.51E-1</td>
<td>8.07E-1</td>
<td>6.33E-2</td>
<td>9.04E-1</td>
<td>1.36E+0</td>
<td>1.07E+1</td>
<td>-3.21E+1</td>
<td>-1.07E+2</td>
<td></td>
</tr>
<tr>
<td>PENRM = Use of non-renewable primary energy resources used as raw materials</td>
<td>[MJ]</td>
<td>5.26E+1</td>
<td>0.00E+0</td>
<td>-3.57E+1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>-5.22E+1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>PENRT = Total use of non-renewable primary energy resources</td>
<td>[MJ]</td>
<td>1.55E+2</td>
<td>4.51E-1</td>
<td>8.07E-1</td>
<td>6.33E-2</td>
<td>9.04E-1</td>
<td>1.36E+0</td>
<td>1.07E+1</td>
<td>-3.21E+1</td>
<td>-1.07E+2</td>
<td></td>
</tr>
<tr>
<td>SM = Substances</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>RSF = Renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>RFW = Renewable fuel</td>
<td>[MJ]</td>
<td>7.63E+2</td>
<td>3.10E+0</td>
<td>4.37E+2</td>
<td>4.26E-6</td>
<td>4.51E+2</td>
<td>6.84E-3</td>
<td>2.82E+3</td>
<td>-4.01E+3</td>
<td>-5.23E+2</td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES according to EN 15804+A1: 1 m² of average produced and installed EVALON**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>A5</th>
<th>C1/2</th>
<th>C2/2</th>
<th>C3/1</th>
<th>C3/2</th>
<th>D1</th>
<th>D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWDD = Hazardous waste disposed</td>
<td>[kg]</td>
<td>8.82E-7</td>
<td>2.57E-8</td>
<td>4.68E-8</td>
<td>3.49E-9</td>
<td>5.15E-8</td>
<td>9.27E-9</td>
<td>5.91E-9</td>
<td>-1.80E-9</td>
<td>-5.94E-7</td>
<td></td>
</tr>
<tr>
<td>NHWD = Non-hazardous waste disposed</td>
<td>[kg]</td>
<td>5.10E-1</td>
<td>3.03E-5</td>
<td>2.78E-2</td>
<td>4.12E-6</td>
<td>6.07E-5</td>
<td>3.76E-1</td>
<td>1.02E-2</td>
<td>-1.69E-2</td>
<td>-3.51E-1</td>
<td></td>
</tr>
<tr>
<td>MFR = Materials for recycling</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>MER = Materials for energy recovery</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>EEE = Export electric energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>2.71E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>6.70E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>EET = Export thermal energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>1.54E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>1.54E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
</tbody>
</table>

6. **LCA: Interpretation**

The supply of raw materials (module A1) shows a significant influence on the overall environmental profile of the roofing membranes. Between approx. 45 and 95% of the environmental impacts are caused by the raw materials used, depending on the indicator. The highest contributions for all indicators are made by the production of the raw materials PVC and aluminium hydroxide (about 25% each in the production phase). Transport (modules A2, A4 and C2), manufacturing (module A3) and assembly (module A5) show an overall low contribution. With few exceptions, the...
relative contributions to the indicator results are well below 10%.
The combustion emissions of the “thermal recovery” scenario contribute to the greenhouse effect to a relevant extent (approx. 25% relative contribution). In all other impact categories, the influence is low. At the end of the product life cycle, the product properties allow a material conversion as inspection walkway tiles. This possibility of “material recycling” can lead to a significant overall reduction in environmental impacts in direct comparison to “thermal recycling” in the disposal phase. In practice, it is therefore preferable to thermal recycling.

7. Requisite evidence

8. References

IBU 2016

IBU 2019

IBU 2017
Part B PCR Instructions for building related products and services - Plastic and rubber roofing and waterproofing membrane systems (11/2017)

ISO 14025
DIN EN /ISO 14025:2011-10/, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

EN 15804
EN 15804:2012-04+A1 2013/, Sustainability of construction works - Environmental product declarations - Core rules for the product category construction products.

EN 495:2013-08
EN 495:2013 -08 Flexible sheets for waterproofing - Determination of foldability at low temperature - Part 5: Plastic and rubber sheets for roof waterproofing

EN 1844
DIN EN 1844: 2013-08 Flexible sheets for waterproofing - Determination of resistance to ozone - Plastic and rubber sheets for roof waterproofing

CEN TS 1187
DIN CEN TS 1187:2012-03, Test methods for external fire exposure to roofs

EN 1297
DIN EN 1297 : 2004-12, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Method of artificial ageing by long term exposure to the combination of UV radiation, elevated temperature and water

En 1548:2007-11
DIN EN 1548: 2007-11, Flexible sheets for roofing and waterproofing - Method for exposure to bitumen

EN 1928
DIN EN 1928: 2000-07, Flexible sheets for roofing and waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of watertightness

ISO 9011
ISO 9001:2015-11, Quality management systems - Requirements

ISO 11925-2
ISO 11925-2: 2011-02, Reaction to fire tests - Ignitability of products subjected to direct impingement of flame

EN 1107-2

EN 12310-2
DIN EN 12310-1: 2000-12, Flexible sheets for roofing and waterproofing - Determination of resistance to tear propagation (nail shaft) - Part 1: Plastic and rubber sheets for roof waterproofing

EN 12311-2
DIN EN 12311-2: 2013-11, Flexible sheets for roofing and waterproofing - Determination of tensile properties - Part 2: Plastic and rubber sheets for roof waterproofing

EN 12316-2
DIN EN 12316-2: 2013-08, Flexible sheets for waterproofing - Determination of peel resistance of joints - Part 2: Plastic and rubber sheets for roof waterproofing

EN 12317-2
DIN EN 12317-2: 2010-12, Flexible sheets for roofing and waterproofing - Determination of shear resistance of joints - Part 2: Plastic and rubber sheets for roof waterproofing
EN 12691
DIN EN 12691:2018-05, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to impact loads; German version EN 12691:2018

EN 12730
DIN EN 12730: 2015-06, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to static loading

EN 13501-1
DIN EN 13501-1, 2010-01: Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests

EN 13948
DIN EN 13948: 2008-01, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Determination of resistance to root penetration

EN 13956
DIN EN 13956: 2013-03, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics

EN 13967
DIN EN 13967: 2017-08, Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics

DIN SPEC 20000-201
DIN SPEC 20000-201: 2018-08, Use of building products in construction works - Part 201: Adaption standard for flexible sheets for waterproofing according to European standards for the use as waterproofing of roofs

DIN SPEC 20000-202
DIN SPEC 20000-202: 2016-03, Use of building products in construction works - Part 202: Adaption standard for flexible sheets for waterproofing according to European standards for the use as waterproofing of elements in contact with soil, of indoor applications and of tanks and pools

DIN 18531
DIN 18531-1: 2017-07 Waterproofing of roofs, balconies and walkways - Part 1: Non-utilized and utilized roofs - Materials

DIN 18531-2
DIN 18531-2: 2017-07 Waterproofing of roofs, balconies and walkways - Part 3: Non-utilized and utilized roofs - Selection, execution and detailing

DIN 18531-3
DIN 18531-3: 2017-07 Waterproofing of roofs, balconies and walkways - Part 1: Non-utilized and utilized roofs - Repair

DIN 18531-5
DIN 18531-5: 2017-07 Waterproofing of roofs, balconies and walkways - Part 1: Non-utilized and utilized roofs - Balconies, loggias and walkways

ISO 14001
EN ISO 14001: 2015-11, Environmental management systems - Requirements with guidance for use

ISO 50001
EN ISO 50001: 2018-12, Energy management systems - Requirements with guidance for use

AVV
Ordinance on the Implementation of the European Waste Catalogue Waste Catalogue Ordinance (AVV)

FLL
Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. [Landscape Research, Development and Construction Society] "Verfahren zur Untersuchung der Wurzelfestigkeit von Bahnen und Beschichtungen für Dachbegrünungen nach dem FLL-Verfahren" [Testing of root resistance of membranes and coatings for green roofs according to the FLL method]

GaBi 9
GaBi 9 SP39 dataset documentation for the software system and databases, LBP, University of Stuttgart and thinkstep, Leinfelden-Echterdingen, 2019 (http://documentation.gabi-software.com/)