ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**alwitra GmbH & Co. Klaus Göbel**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ALW-20140020-IBA1-EN
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Valid to	05.05.2020

EVALON® V loose laid under ballast or mechanically fastened

alwitra GmbH & Co. Klaus Göbel

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

alwitra
DIE DACHMARKE

1. General Information

alwitra GmbH & Co. Klaus Göbel	EVALON® V
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** alwitra GmbH & Co. Klaus Göbel Am Forst 1 54296 Trier Germany
Declaration number EPD-ALW-20140020-IBA1-EN	**Declared product / Declared unit** 1 m² of manufactured roofing and waterproofing membrane EVALON® V
This Declaration is based on the Product Category Rules: Plastic and elastomer roofing and sealing sheet systems, 07-2012 (PCR tested and approved by the independent expert committee)	**Scope:** EVALON® V roofing and waterproofing membranes from alwitra GmbH & Co. Klaus Göbel are produced 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.
Issue date 6 May 2014	
Valid to 5 May 2020	**Verification** The CEN Norm EN 15804 serves as the core PCR Independent verification of the declaration according to ISO 14025 ☐ internally ☒ externally
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	Matthias Schulz (Independent tester appointed by SVA)
Dr.-Ing. Burkhart Lehmannt (Managing Director IBU)	

2. Product

2.1 Product description

This EPD contains a description of bitumen compatible EVAC - ethylene vinyl acetate copolymer - (EVA in Germany) roofing and waterproofing membrane systems. The declared products consist of a high polymer alloy of EVA terpolymer and PVC including additives. The roofing and waterproofing membranes are manufactured with a polyester fleece backing in a calandering process. The herein declared product EVALON® V (with polyester fleece backing) is also the basis for the multifunctional roofing membranes EVALON® Solar. In this case, on their upper side additional photovoltaic (PV) modules are factory-integrated to be connected via factory-mounted waterproof connection boxes and cables on the underside. The PV modules do not constitute part of this EPD.
Seam welding is carried out with hot air or solvent welding agent.

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:
- loose laid under ballast (*e. g.* gravel, tiles, vegetation)
- mechanically fastened or
- bonded

Waterproofing of foundations
Single-ply waterproofing of non-waterproof foundations or constructional parts against ground moisture and non-pressing water. Depending on specification, the membranes can be applied as follows:
- loose laid under ballast
- bonded

When applying, the manufacturer installation instructions must be adhered to.

2.3 Technical Data

EVALON® V roofing and waterproofing membrane
Constructional data

Name	Value	Unit
Max. tensile force acc. to EN 12311-2 (A)	500	N/50mm
Elongation at max. tensile force acc. to EN 12311-2 (A)	60	%
Peel resistance of the seam joint acc. to EN 12316-2	150	N/50mm
Shear resistance of the seam joint acc. to EN12317-2	400	N/50mm

Tear propagation resistance acc. to EN 12310-1	300	N
Resistance to static load acc. to EN 12730 (B)	20	kg
Water tightness acc. to EN 1928	400	kPa
Artificial ageing acc. to EN 1297	class 0	-
Folding in the cold acc. to EN 495-5	-30	°C
Bitumen compatibility acc. to EN 1548	passed	-
Resistance to root penetration (for green roofs) acc. to EN 13948 or FLL (roofing membranes)	passed	-

2.4 Placing on the market / Application rules

For the placing on the market in the EU/EFTA Regulation (EU) No. 305/2011 of 9 March 2011 shall apply. A Declaration of Performance for the products is available, taking into account /EN 13956:2012 - Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics/ or EN 13967:2012 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; in Germany, application standard DIN V 20000-201 or DIN V 20000-202 shall apply.

Roofing membranes according to EN 13956:2012 and application standard DIN V 20000-201 description/marking: *e. g.* DE/E1 EVA-BV-K-PV 1,5 (*e. g.* EVALON® V)
Waterproofing membranes according to EN 13967: 2012 and application standard DIN V 20000-202 description/marking: *e. g.* BA EVA-BV-K-PV 1,5
FPC (Factory Production Control) Certificate No.: 1343 - BPR - 06-1432

2.5 Delivery status

Standard sizes (length x width x thickness)
25 m x 2.05/1.55/1.05/0.79/0.54 m x 1.5 mm (thickness without backing)
or 25 m x 2.05/1.55/1.05/0.79/0.54 m x 1.2 mm (thickness without backing)

2.6 Base materials / Ancillary materials

EVALON® roofing and waterproofing membranes consist of (25 - 50%) ethylene vinyl acetate terpolymer - EVA; (25 - 40%) polyvinyl chloride PVC; (10 - 15%) mineral fire proofing; (1 - 2%) Ca/Zn stabiliser; (3 - 6%) epoxidised soybean oil; (5 - 10%) carbon black and additives; (0 - 12%) titanium dioxide; (0 - 25%) pigments - depending on colour; backing.

2.7 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 roofing or waterproofing membrane; (depending on the membrane type) an underside backing layer is applied. The finished membrane is cooled down over special chill rolls and subsequently cut to its final size and fabricated into rolls. 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 (Certificate No. 01 100 5463). The Certification Body is TÜV Rheinland, Cert GmbH.

Further external quality controls are carried out by the Staatliche Materialprüfungsanstalt Darmstadt, Germany, as well as the BBA (British Board of Agrément) und FM (Factory Mutual Approvals).

2.8 Environment and health during manufacturing

Compliance with the national and system-specific environmental protection requirements during the manufacturing process is guaranteed. Besides, dust emitted while emptying big bags containing powder pre-products (*e. g.* EVA and PVC) is collected in filters and partially re-used. 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.

2.9 Product processing/Installation

Due to their thermoplastic properties EVALON® V 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, 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 and guidelines as well as the Technical Rules of the German Roofing Trade Association - (Instructions for Flat Roofs) - and the installation instructions and manufacturer information must be adhered to.

EVALON® V roofing and waterproofing membranes are applied with mechanical fastening and also loose laid under ballast, *e. g.* gravel or paving slabs, and under vegetation layers. Also in the area of waterproofing of foundations according to DIN 18195-5.

Loose laying under ballast
(Advantage: unproblematic removal of sorted material)

The membranes are rolled out on a suitable substrate (clean, even, solid, on a protection layer, if required), aligned and welded in the overlap.
Example: green roofs
The declared product is used for green roofs as a waterproofing and, at the same time, as a protection against root penetration, as a corresponding certificate

is available (resistant to root/rhizome penetration according to FLL testing - also without application of biocides).

Mechanical fastening
(Advantage: unproblematic removal of sorted material)
The membranes are rolled out on a suitable substrate (clean, even, solid, 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, seam overlaps are welded for waterproofing. Fastening can also be carried out outside the seam overlap These fastenings must then be waterproofed according to the system.
With mechanical fastening of the roofing membranes, the complete roof build-up is fixed (incl. thermal insulation, vapour control layer etc.).

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 Packaging

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

2.11 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.

2.12 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.

2.13 Reference service life

The declared roofing and waterproofing membranes have been in use for more than 35 years - exposed to standard load and professionally installed. If applied in accordance with the intended use in compliance with the generally accepted engineering standards, the declared product 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. As for adjacent constructional elements, additional system parts, *e. g.* roof edge trim and wall connection profiles complement the product system
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.
Influences on ageing when applied in accordance with the rules of technology.

2.14 Extraordinary effects

Fire

EVALON® V

Name	Value
Building material class - reaction to fire EN 11925-2 / EN 13501	class E / passed
Burning droplets	-
External fire performance ENV 1187 / EN 13501-5	B roof (t1) and (t3) passed
Smoke gas development	-

The test results for B roof (t1) and (t3) 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.

2.15 Re-use phase

EVALON® membranes are not re-used in their original form after their service life. If 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. The energy of 1 kg EVA roofing and waterproofing membrane (*e. g.* EVALON® V with polyester fleece backing) equals the energy of approx. 0.57 litres of fuel oil.

2.16 Disposal

If possible, recycling of the declared products, or at least their thermal utilisation, should be used as a way of disposal. See also 2.15.

Roofing and waterproofing membranes or residues thereof can be classified as AVV No. 170904 or No. 200139.

2.17 Further information

For further information on EVALON® V, *e. g.* brochures, Declaration of Performance, installation instructions, see the alwitra web page (www.alwitra.de).

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² of installed EVALON® roofing and waterproofing membrane system.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	2	kg/m^2
Type of sealing	thermal welding or solvent welding	-
Conversion factor to 1 kg	0.5	-
Thickness (without backing)	1.5	mm

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) – recycling 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 & Co. 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 C2 360 km classified as “worst case” (C2/1 50 km to waste incineration plant and C2/2 737 km to EoL recycling)
Module C3: In scenario 1 100% thermal utilisation and in scenario 2 100% 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 Mix PE” and “DE: Process Steam from Natural Gas PE”. 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 the company alwitra GmbH & Co. Klaus Göbel. The background data has been taken from the data base of the GaBi software of PE INTERNATIONAL (/GaBiI 6 2013B/). 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 & Co. Klaus Göbel, 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 during the production year 2012 for the different membrane types have been used. All other relevant background data sets have been taken from the GaBi 6 software database, which are less than 6 years old. 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 2012. 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.

3.8 Allocation

In modules A1-A3, internally re-used production residues (edge strips cut off during production) are modelled as closed-loop recycling.
Within the defined system boundaries, in the manufacturing process production data for the product was determined with respect to the overall produced area. During production no further by-products occur.
In case of thermal utilisation in a waste incineration plant, depending on the specific input and considering the elementary composition as well as the calorific value, credits for electricity and thermal energy from module A5 and C3 are taken into account in module D. Considering the locations of the production sites, the processes credited refer to the territory of Germany. In Module D there is also a credit for the recycling of the roofing membranes.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

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)

Name	Value	Unit
Litres of fuel	0.0015	l/100km
Transport distance	361	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1.333	kg/m^3
Capacity utilisation volume factor	100	-

Integration into the building (A5)

Name	Value	Unit
Auxiliary material solvent-welding agent	0.0008	kg
Electricity consumption	0.012	kWh
VOC in the air	0.0008	kg
Loss of material (due to overlaps)	5	%
	-	

Reference service life

Name	Value	Unit
Reference service life depending on the local conditions and in combination with a maintenance service contract	approx. 35	a

End of life (C1-C4)

Name	Value	Unit
Recycling (in scenario 2)	2.1	kg
Energy recovery (in scenario 1)	2.1	kg

5. LCA: Results

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed.

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

PRODUCT STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Re-use 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	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² of roofing and waterproofing membrane

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	6.75E+0	3.25E-2	5.1E-1	3.25E-2	3.85E+0	9.51E-1	-2.56E+0	-3.04E+0
ODP	[kg CFC11 eq.]	1.41E-8	6.78E-13	7.11E-10	6.78E-13	5.54E-11	5.12E-10	-7.56E-10	-7.24E-9
AP	[kg SO_2 eq.]	2.51E-2	8.47E-5	1.3E-3	8.47E-5	9.3E-4	1.77E-3	-3.52E-3	-1.14E-2
EP	[kg $(PO_4)^{3-}$ eq.]	2.98E-3	1.92E-5	1.55E-4	1.92E-5	7.24E-5	2.14E-4	-3.96E-4	-1.38E-3
POCP	[kg Ethen eq.]	7.87E-3	-2.42E-5	3.96E-4	-2.42E-5	5.26E-5	6.01E-5	-3.25E-4	-4.06E-3
ADPE	[kg Sb eq.]	1.2E-5	1.5E-9	6.04E-7	1.5E-9	5.51E-7	1.42E-7	-2.61E-7	-6.18E-6
ADPF	[MJ]	1.45E+2	4.44E-1	7.54E+0	4.44E-1	1.81E+0	9.92E+0	-3.39E+1	-6.9E+1

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² of roofing and waterproofing membrane

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PERM	[MJ]	0.0E+0	-	-	-	-	-	-	-
PERT	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PENRE	[MJ]	1.05E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
PENRM	[MJ]	5.22E+1	-	-	-	-	-	-	-
PENRT	[MJ]	1.57E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
SM	[kg]	0.0E+0	-	-	-	-	-	-	-
RSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
NRSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
FW	[m^3]	9.52E-2	2.54E-5	5.26E-3	2.54E-5	9.46E-3	3.7E-3	-5.68E-3	-4.9E-2

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 = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² of roofing and waterproofing membrane

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.26E-2	0.0E+0	1.25E-3	0.0E+0	9.92E-2	0.0E+0	0.0E+0	-5.35E-3
NHWD	[kg]	4.46E-1	8.8E-5	2.24E-2	8.8E-5	7.85E-4	8.24E-3	-1.43E-2	-2.29E-1
RWD	[kg]	4.83E-3	6.39E-7	2.55E-4	6.39E-7	9.89E-5	1.48E-3	-2.17E-3	-2.12E-3
CRU	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
MFR	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	-	-
MER	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	0.0E+0	-	-
EEE	[MJ]	-	-	-	-	-	-	7.63E+0	2.12E-1
EET	[MJ]	-	-	-	-	-	-	1.83E+1	5.11E-1

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

For verified LCA results of other product variants, please refer to the Annex.

6. LCA: Interpretation

In this EPD for all assessment values the product stage (A1-A3) plays the most important role. Only for the global warming potential (GWP) in the thermal utilisation scenario module C3 also considerably contributes to the total result (approx. one third). The transportation to site (A4) as well as transportation within the EOLs (C2) have only a negligibly small impact on the environment. The values are identical, as for both types of transport the same assumptions apply. From the two EOL scenarios the material recycling shows significantly more favourable outcomes, as the environmental loads of the recycling (module C3) are considerably less severe compared to thermal utilisation (approx. 4 times less) and the credits (module D) are slightly higher.

Product stage (module A1-A3): In all impact categories the raw materials provide the largest contribution to the impacts of the product stage. The largest contribution to GWP results from the manufacture of PVC, EVA and aluminium hydroxide. Merely 10% of the greenhouse gas emission are caused by the production process itself and can be attributed to the energy used (power, gas, oil).

The ozone depletion potential (ODP) results almost entirely from the production of aluminium hydroxide. The greatest impact of the acidification potential (AP) results from the production of the aluminium hydroxide (approx. 30%), EVA, PVC and TiO_2. The largest contribution to the eutrophication potential (EP) is made by the epoxidised soyabean oil (approx. 30%). The potential for producing tropospheric ozone (POCP) is, for the larger part, to be attributed to the epoxidised soyabean oil. The abiotic depletion potential - elements (ADPE) is mainly dominated by the PVC. The abiotic depletion potential - fossil fuels (ADPF) results mainly from the contribution of the EVA and the PVC.
The total use of renewable primary energy resources (PERT), in particular, results from the aluminium hydroxide and the epoxidised soyabean oil. The production process itself (A3) causes only a small impact, whereby packaging in the form of cardboard and wood pallets account for approximately half of it. The total use of non-renewable primary energy resources (PENRT) is, for the larger part, to be attributed to the EVA and the PVC. The manufacture itself accounts for only a very small percentage.

7. Requisite evidence

No evidence required.

8. References

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Institut Bauen und Umwelt e.V., Berlin (pub.): Generation of Environmental Product Declarations (EPDs);

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www.bau-umwelt.de

PCR Part A
Institut Bauen und Umwelt e.V., Königswinter (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. April 2013
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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 of construction products

PCR 2012, part B: PCR Instructions for building related products and services - Plastic and rubber roofing and waterproofing membrane systems (2012).

DIN EN 495-5: 2012-10 Flexible sheets for waterproofing - Determination of foldability at low temperature - Part 5: Plastic and rubber sheets for roof waterproofing

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

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

DIN EN 1548: 200711, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Method for exposure to bitumen

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

ISO 9001: 2008-12, Quality management systems - Requirements

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

DIN EN 12310-1: 1999-11, Flexible sheets for waterproofing - Determination of resistance to tearing (nail shank) - Part 1: Bitumen sheets for roof waterproofing

DIN EN 12311-2: 2010-12, Flexible sheets for waterproofing - Determination of tensile properties

Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12316-2: 2012-10, Flexible sheets for waterproofing - Determination of peel resistance of joints - Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12317-2: 2010-12, Flexible sheets for waterproofing - Determination of shear resistance of joints Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12730: 2001-04, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to static loading; German version EN 12730:2001

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

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

DIN EN 13956: 2012-05, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics

DIN EN 13967: 2012-07, Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics

DIN V 20000-201: 2006-11, 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 V 20000-202: 2007-12, 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

EN ISO 14001: 2009-11, Environmental management systems - Requirements with guidance for use

EN ISO 50001: 2011-12, Energy management systems - Requirements with guidance for use

AVV Abfallverbrennungsverordnung des Bundesumweltamtes [Waste Incineration Ordinance of the Federal Environment Agency]

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]

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GaBi 6 2013B: Documentation of GaBi 6 data sets of the database for holistic balancing. Copyright, TM. Stuttgart, Leinfelden-Echterdingen, 1992-2013. http://documentation.gabi-software.com/

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Complementary data to the LCA: Results of alwitra EPD-ALW-20140020-IBA1-EN Different installation methods of EVALON® V

1.1 EVALON® V 1.2 mm, mechanically fastened or loose laid under ballast

Table 1-1: Resource input during individual life cycle stages of 1m² EVALON® V 1.2 mm - mechanically fastened or loose laid under ballast

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

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

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: EVALON V 1.2 – mech. fastened – loose laid u. b.

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	5.56E+00	2.65E-02	4.22E-01	2.65E-02	3.13E+00	7.75E-01	-2.09E+00	-2.47E+00
ODP	[kg CFC11 eq.]	1.13E-08	5.52E-13	5.71E-10	5.52E-13	4.51E-11	4.17E-10	-6.16E-10	-5.89E-09
AP	[kg SO_2 eq.]	2.03E-02	6.90E-05	1.06E-03	6.90E-05	7.57E-04	1.44E-03	-2.87E-03	-9.26E-03
EP	[kg $(PO_4)^{3-}$ eq.]	2.41E-03	1.57E-05	1.26E-04	1.57E-05	5.89E-05	1.74E-04	-3.22E-04	-1.12E-03
POCP	[kg Ethen eq.]	6.36E-03	-1.97E-05	3.20E-04	-1.97E-05	4.28E-05	4.89E-05	-2.65E-04	-3.31E-03
ADPE	[kg Sb eq.]	9.64E-06	1.22E-09	4.86E-07	1.22E-09	4.49E-07	1.16E-07	-2.13E-07	-5.04E-06
ADPF	[MJ]	1.20E+02	3.62E-01	6.25E+00	3.62E-01	1.47E+00	8.08E+00	-2.76E+01	-5.62E+01

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.2 – mech. fastened – loose laid under ballast

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.19E+01	2.15E-02	6.20E-01	2.15E-02	1.40E-01	2.1E+00	-2.96E+00	-5.3E+00
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	1.19E+01	2.15E-02	6.20E-01	2.15E-02	1.40E-01	2.1E+00	-2.96E+00	-5.3E+00
PENRE	[MJ]	8.64E+01	3.63E-01	6.77E+00	3.63E-01	1.67E+00	1.1E+01	-3.19E+01	-6.1E+01
PENRM	[MJ]	4.26E+01	-	-	-	-	-	-	-
PENRT	[MJ]	1.29E+02	3.63E-01	6.77E+00	3.63E-01	1.67E+00	1.1E+01	-3.19E+01	-6.1E+01
SM	[kg]	0	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m³]	7.79E-02	2.07E-05	4.26E-03	2.07E-05	7.70E-03	3.0E-03	-4.62E-03	-4.0E-02

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.2 – mech. fastened – loose laid under ballast

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.06E-02	0.00E+00	1.04E-03	0.00E+00	8.08E-02	0.00E+00	0.00E+00	-4.35E-03
NHWD	[kg]	3.58E-01	7.18E-05	1.80E-02	7.18E-05	6.40E-04	6.71E-03	-1.16E-02	-1.87E-01
RWD	[kg]	3.97E-03	5.21E-07	2.12E-04	5.21E-07	8.05E-05	1.20E-03	-1.77E-03	-1.73E-03
CRU	[kg]	0	0	0	0	0	0	-	-
MFR	[kg]	0	0	0	0	0.00E+00	1.71E+00	-	-
MER	[kg]	0	0	0	0	1.71E+00	0.00E+00	-	-
EEE	[MJ]	-	-	-	-	-	-	6.21E+00	1.73E-01
EET	[MJ]	-	-	-	-	-	-	1.49E+01	4.17E-01

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

1.2 EVALON® V 1.5 mm, mechanically fastened or loose laid under ballast

Table 1-2: Resource input during individual life cycle stages of 1m² EVALON® V 1.5 mm - mechanically fastened or loose laid under ballast

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

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

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: EVALON V 1.5 – mech. fastened – loose laid under ballast

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	6.75E+0	3.25E-2	5.1E-1	3.25E-2	3.85E+0	9.51E-1	-2.56E+0	-3.04E+0
ODP	[kg CFC11 eq.]	1.41E-8	6.78E-13	7.11E-10	6.78E-13	5.54E-11	5.12E-10	-7.56E-10	-7.24E-9
AP	[kg SO_2 eq.]	2.51E-2	8.47E-5	1.3E-3	8.47E-5	9.3E-4	1.77E-3	-3.52E-3	-1.14E-2
EP	[kg $(PO_4)^3$- eq.]	2.98E-3	1.92E-5	1.55E-4	1.92E-5	7.24E-5	2.14E-4	-3.96E-4	-1.38E-3
POCP	[kg Ethen eq.]	7.87E-3	-2.42E-5	3.96E-4	-2.42E-5	5.26E-5	6.01E-5	-3.25E-4	-4.06E-3
ADPE	[kg Sb eq.]	1.2E-5	1.5E-9	6.04E-7	1.5E-9	5.51E-7	1.42E-7	-2.61E-7	-6.18E-6
ADPF	[MJ]	1.45E+2	4.44E-1	7.54E+0	4.44E-1	1.81E+0	9.92E+0	-3.39E+1	-6.9E+1

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.5 – mech. fastened – loose laid under ballast

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PERM	[MJ]	0.0E+0	-	-	-	-	-	-	-
PERT	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PENRE	[MJ]	1.05E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
PENRM	[MJ]	5.22E+1	-	-	-	-	-	-	-
PENRT	[MJ]	1.57E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
SM	[kg]	0.0E+0	-	-	-	-	-	-	-
RSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
NRSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
FW	[m^3]	9.52E-2	2.54E-5	5.26E-3	2.54E-5	9.46E-3	3.7E-3	-5.68E-3	-4.9E-2

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.5 – mech. fastened – loose laid under ballast

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.26E-2	0.0E+0	1.25E-3	0.0E+0	9.92E-2	0.0E+0	0.0E+0	-5.35E-3
NHWD	[kg]	4.46E-1	8.8E-5	2.24E-2	8.8E-5	7.85E-4	8.24E-3	-1.43E-2	-2.29E-1
RWD	[kg]	4.83E-3	6.39E-7	2.55E-4	6.39E-7	9.89E-5	1.48E-3	-2.17E-3	-2.12E-3
CRU	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
MFR	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	-	-
MER	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	0.0E+0	-	-
EEE	[MJ]	-	-	-	-	-	-	7.63E+0	2.12E-1
EET	[MJ]	-	-	-	-	-	-	1.83E+1	5.11E-1

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

2.1 EVALON® V 1.2 mm, bonded with L 40

Table 2-1: Resource input during individual life cycle stages of 1m² EVALON® V 1.2 mm - bonded with alwitra adhesive L 40

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

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

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: EVALON V 1.2 – L 40

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	6.75E+0	3.25E-2	5.1E-1	3.25E-2	3.85E+0	9.51E-1	-2.56E+0	-3.04E+0
ODP	[kg CFC11 eq.]	1.41E-8	6.78E-13	7.11E-10	6.78E-13	5.54E-11	5.12E-10	-7.56E-10	-7.24E-9
AP	[kg SO_2 eq.]	2.51E-2	8.47E-5	1.3E-3	8.47E-5	9.3E-4	1.77E-3	-3.52E-3	-1.14E-2
EP	[kg $(PO_4)^3$ eq.]	2.98E-3	1.92E-5	1.55E-4	1.92E-5	7.24E-5	2.14E-4	-3.96E-4	-1.38E-3
POCP	[kg Ethen eq.]	7.87E-3	-2.42E-5	3.96E-4	-2.42E-5	5.26E-5	6.01E-5	-3.25E-4	-4.06E-3
ADPE	[kg Sb eq.]	1.2E-5	1.5E-9	6.04E-7	1.5E-9	5.51E-7	1.42E-7	-2.61E-7	-6.18E-6
ADPF	[MJ]	1.45E+2	4.44E-1	7.54E+0	4.44E-1	1.81E+0	9.92E+0	-3.39E+1	-6.9E+1

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.2 – L 40

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PERM	[MJ]	0.0E+0	-	-	-	-	-	-	-
PERT	[MJ]	1.47E+1	2.64E-2	7.62E-1	2.64E-2	1.73E-1	2.5E+0	-3.64E+0	-6.6E+0
PENRE	[MJ]	1.05E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
PENRM	[MJ]	5.22E+1	-	-	-	-	-	-	-
PENRT	[MJ]	1.57E+2	4.45E-1	8.18E+0	4.45E-1	2.05E+0	1.4E+1	-3.92E+1	-7.4E+1
SM	[kg]	0.0E+0	-	-	-	-	-	-	-
RSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
NRSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
FW	[m^3]	9.52E-2	2.54E-5	5.26E-3	2.54E-5	9.46E-3	3.7E-3	-5.68E-3	-4.9E-2

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.2 – L 40

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.26E-2	0.0E+0	1.25E-3	0.0E+0	9.92E-2	0.0E+0	0.0E+0	-5.35E-3
NHWD	[kg]	4.46E-1	8.8E-5	2.24E-2	8.8E-5	7.85E-4	8.24E-3	-1.43E-2	-2.29E-1
RWD	[kg]	4.83E-3	6.39E-7	2.55E-4	6.39E-7	9.89E-5	1.48E-3	-2.17E-3	-2.12E-3
CRU	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
MFR	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	-	-
MER	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.1E+0	0.0E+0	-	-
EEE	[MJ]	-	-	-	-	-	-	7.63E+0	2.12E-1
EET	[MJ]	-	-	-	-	-	-	1.83E+1	5.11E-1

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

2.2 EVALON® V 1.5 mm, bonded with L 40

Table 2-2: Resource input during individual life cycle stages of 1m² EVALON® V 1.5 mm - bonded with alwitra adhesive L 40

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

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

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: EVALON V 1.5 – L 40

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	6.75E+00	3.25E-02	1.07E+00	3.25E-02	3.85E+00	9.51E-01	-2.56E+00	-3.04E+00
ODP	[kg CFC11 eq.]	1.41E-08	6.78E-13	7.51E-10	6.78E-13	5.54E-11	5.12E-10	-7.56E-10	-7.24E-09
AP	[kg SO_2 eq.]	2.51E-02	8.47E-05	2.62E-03	8.47E-05	9.30E-04	1.77E-03	-3.52E-03	-1.14E-02
EP	[kg $(PO_4)^3$ eq.]	3.01E-03	1.92E-05	2.65E-04	1.92E-05	7.24E-05	2.14E-04	-3.96E-04	-1.38E-03
POCP	[kg Ethen eq.]	8.00E-03	-2.42E-05	1.41E-01	-2.42E-05	5.26E-05	6.01E-05	-3.25E-04	-4.06E-03
ADPE	[kg Sb eq.]	1.20E-05	1.50E-09	2.74E-05	1.50E-09	5.51E-07	1.42E-07	-2.61E-07	-6.18E-06
ADPF	[MJ]	1.45E+02	4.44E-01	2.71E+01	4.44E-01	1.81E+00	9.92E+00	-3.39E+01	-6.90E+01

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.5 – L 40

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.47E+01	2.64E-02	9.71E-01	2.64E-02	1.73E-01	2.5E+00	-3.64E+00	-6.6E+00
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	1.47E+01	2.64E-02	9.71E-01	2.64E-02	1.73E-01	2.5E+00	-3.64E+00	-6.6E+00
PENRE	[MJ]	1.05E+02	4.45E-01	2.80E+01	4.45E-01	2.05E+00	1.4E+01	-3.92E+01	-7.4E+01
PENRM	[MJ]	5.22E+01	-	-	-	-	-	-	-
PENRT	[MJ]	1.57E+02	4.45E-01	2.80E+01	4.45E-01	2.05E+00	1.4E+01	-3.92E+01	-7.4E+01
SM	[kg]	0	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m³]	9.52E-02	2.54E-05	6.71E-03	2.54E-05	9.46E-03	3.7E-03	-5.68E-03	-4.9E-02

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.5 – L 40

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.26E-02	0.00E+00	1.73E-03	0.00E+00	9.92E-02	0.00E+00	0.00E+00	-5.35E-03
NHWD	[kg]	4.46E-01	8.80E-05	2.44E-02	8.80E-05	7.85E-04	8.24E-03	-1.43E-02	-2.29E-01
RWD	[kg]	4.83E-03	6.39E-07	3.69E-04	6.39E-07	9.89E-05	1.48E-03	-2.17E-03	-2.12E-03
CRU	[kg]	0	0	0	0	0	0	-	-
MFR	[kg]	0	0	0	0	0.00E+00	2.10E+00	-	-
MER	[kg]	0	0	0	0	2.10E+00	0.00E+00	-	-
EEE	[MJ]	-	-	-	-	-	-	7.63E+00	2.12E-01
EET	[MJ]	-	-	-	-	-	-	1.83E+01	5.11E-01

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

3.1 EVALON® V 1.2 mm, bonded with PUR D

Table 3-1: Resource input during individual life cycle stages of 1m² EVALON® V 1.2 mm - bonded with alwitra adhesive PUR D

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

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

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT:EVALON V 1.2 – PUR D

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	5.56E+00	2.65E-02	1.07E+00	2.65E-02	3.13E+00	7.75E-01	-2.09E+00	-2.47E+00
ODP	[kg CFC11 eq.]	1.13E-08	5.52E-13	6.79E-10	5.52E-13	4.51E-11	4.17E-10	-6.16E-10	-5.89E-09
AP	[kg SO_2 eq.]	2.03E-02	6.90E-05	2.21E-03	6.90E-05	7.57E-04	1.44E-03	-2.87E-03	-9.26E-03
EP	[kg $(PO_4)^3$ eq.]	2.43E-03	1.57E-05	2.85E-04	1.57E-05	5.89E-05	1.74E-04	-3.22E-04	-1.12E-03
POCP	[kg Ethen eq.]	6.46E-03	-1.97E-05	3.99E-03	-1.97E-05	4.28E-05	4.89E-05	-2.65E-04	-3.31E-03
ADPE	[kg Sb eq.]	9.64E-06	1.22E-09	2.58E-06	1.22E-09	4.49E-07	1.16E-07	-2.13E-07	-5.04E-06
ADPF	[MJ]	1.20E+02	3.62E-01	1.95E+01	3.62E-01	1.47E+00	8.08E+00	-2.76E+01	-5.62E+01

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.2 – PUR D

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.19E+01	2.15E-02	1.13E+00	2.15E-02	7.27E-02	2.1E+00	-7.19E-01	-5.3E+00
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	1.19E+01	2.15E-02	1.13E+00	2.15E-02	1.40E-01	2.1E+00	-2.96E+00	-5.3E+00
PENRE	[MJ]	8.64E+01	3.63E-01	2.07E+01	3.63E-01	1.67E+00	1.1E+01	-3.19E+01	-6.1E+01
PENRM	[MJ]	4.26E+01	-	-	-	-	-	-	-
PENRT	[MJ]	1.29E+02	3.63E-01	2.07E+01	3.63E-01	1.67E+00	1.1E+01	-3.19E+01	-6.1E+01
SM	[kg]	0	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m³]	7.68E-02	2.07E-05	7.42E-03	2.07E-05	7.70E-03	3.0E-03	-4.62E-03	-4.0E-02

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.2 – PUR D

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.06E-02	0.00E+00	2.48E-03	0.00E+00	8.08E-02	0.00E+00	0.00E+00	-4.35E-03
NHWD	[kg]	3.58E-01	7.18E-05	2.46E-02	7.18E-05	6.40E-04	6.71E-03	-1.16E-02	-1.87E-01
RWD	[kg]	3.97E-03	5.21E-07	5.17E-04	5.21E-07	8.05E-05	1.20E-03	-1.77E-03	-1.73E-03
CRU	[kg]	0	0	0	0	0	0	-	-
MFR	[kg]	0	0	0	0	0.00E+00	1.71E+00	-	-
MER	[kg]	0	0	0	0	1.71E+00	0.00E+00	-	-
EEE	[MJ]	-	-	-	-	-	-	6.21E+00	1.73E-01
EET	[MJ]	-	-	-	-	-	-	1.49E+01	4.17E-01

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

3.2 EVALON® V 1.5 mm, bonded with PUR D

Table 3-2: Resource input during individual life cycle stages of 1m² EVALON® V 1.5 mm - bonded with alwitra adhesive PUR D

Following, the resulting indicators of the life cycle impact assessment, of the resource input as well as of residues and other output flows for 1 m² of roofing and waterproofing membrane are displayed

DESCRIPTION OF SYSTEM BOUNDARIES (X = INCLUDED; MND = MODULE NOT DECLARED)

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 the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: EVALON V 1.5 – PUR D

Para-meter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2 eq.]	6.74E+00	3.25E-02	1.15E+00	3.25E-02	3.85E+00	9.51E-01	-2.56E+00	-3.04E+00
ODP	[kg CFC11 eq.]	1.41E-08	6.78E-13	8.19E-10	6.78E-13	5.54E-11	5.12E-10	-7.56E-10	-7.24E-09
AP	[kg SO_2 eq.]	2.51E-02	8.47E-05	2.45E-03	8.47E-05	9.30E-04	1.77E-03	-3.52E-03	-1.14E-02
EP	[kg $(PO_4)^3$ eq.]	3.01E-03	1.92E-05	3.14E-04	1.92E-05	7.24E-05	2.14E-04	-3.96E-04	-1.38E-03
POCP	[kg Ethen eq.]	8.00E-03	-2.42E-05	4.07E-03	-2.42E-05	5.26E-05	6.01E-05	-3.25E-04	-4.06E-03
ADPE	[kg Sb eq.]	1.20E-05	1.50E-09	2.70E-06	1.50E-09	5.51E-07	1.42E-07	-2.61E-07	-6.18E-06
ADPF	[MJ]	1.45E+02	4.44E-01	2.08E+01	4.44E-01	1.81E+00	9.92E+00	-3.39E+01	-6.90E+01

Caption	GWP = Global warming potential; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels

RESULTS OF THE LCA - RESOURCE USE: EVALON V 1.5 – PUR D

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	1.47E+01	2.64E-02	1.27E+00	2.64E-02	1.73E-01	2.5E+00	-3.64E+00	-6.6E+00
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	1.47E+01	2.64E-02	1.27E+00	2.64E-02	1.73E-01	2.5E+00	-3.64E+00	-6.6E+00
PENRE	[MJ]	1.05E+02	4.45E-01	2.21E+01	4.45E-01	2.05E+00	1.4E+01	-3.92E+01	-7.4E+01
PENRM	[MJ]	5.22E+01	-	-	-	-	-	-	-
PENRT	[MJ]	1.57E+02	4.45E-01	2.21E+01	4.45E-01	2.05E+00	1.4E+01	-3.92E+01	-7.4E+01
SM	[kg]	0	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m³]	9.67E-02	2.54E-05	8.48E-03	2.54E-05	9.46E-03	3.7E-03	-5.68E-03	-4.9E-02

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 = Use of net fresh water

RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: EVALON V 1.5 – PUR D

Parameter	Unit	A1 - A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	1.26E-02	0.00E+00	1.73E-03	0.00E+00	9.92E-02	0.00E+00	0.00E+00	-5.35E-03
NHWD	[kg]	4.46E-01	8.80E-05	2.44E-02	8.80E-05	7.85E-04	8.24E-03	-1.43E-02	-2.29E-01
RWD	[kg]	4.83E-03	6.39E-07	3.69E-04	6.39E-07	9.89E-05	1.48E-03	-2.17E-03	-2.12E-03
CRU	[kg]	0	0	0	0	0	0	-	-
MFR	[kg]	0	0	0	0	0.00E+00	2.10E+00	-	-
MER	[kg]	0	0	0	0	2.10E+00	0.00E+00	-	-
EEE	[MJ]	-	-	-	-	-	-	7.63E+00	2.12E-01
EET	[MJ]	-	-	-	-	-	-	1.83E+01	5.11E-01

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Export electric energy; EET = Export thermal energy

✧ ✧ ✧ End of translation ✧ ✧ ✧

I, Christina Baumeyer, certified translator for the English language, certify that the translation of this document is true, correct and complete.

Schwetzingen, 25 July 2014