ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	SaarGummi Construction Deutschland GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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EPDM roofing and waterproofing membranes NovoProof® DA, FA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK

SaarGummi Construction Deutschland GmbH

Institut Bauen und Umwelt e.V.

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1. General Information

SaarGummi Construction Deutschland GmbH

EPDM roofing and waterproofing membranes NovoProof® DA, FA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK

Programme holder
IBU - Institut Bauen und Umwelt e.V.
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Owner of the declaration
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Declaration number
EPD-DUR-20180034-IBD1-EN

Declared product / declared unit
The declared unit is one (1) square metre (m^2) average roofing and waterproofing membrane. The DA, FA, DA-F, DA-K, DA-G, DA-S, DA-FG and DA-SK variants are considered for forming averages. The roofing and waterproofing membrane comprises:

- the actual roofing and waterproofing membrane
- the fastening materials
- the respective packaging materials.

The average was established on the basis of production-related weights.

This declaration is based on the product category rules:
Plastic and elastomer roofing and sealing sheet systems, 07.2014
(PCR checked and approved by the SVR)

Scope:
This EPD refers to the entire life cycle of an average roofing and waterproofing membrane produced by SaarGummi Construction Deutschland in the DA, FA, DA-F, DA-K, DA-G, DA-S, DA-FG and DA-SK variants. The various technical characteristics are depicted in section 2.3.

The products are manufactured at the production facility in Wadern-Büschfeld, Germany.

Issue date
06.12.2018

Valid to
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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.

Verification

The standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/
☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dipl. Ing. Hans Peters
(Head of Board IBU)

Juliane Franze
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

NovoProof® waterproofing systems comprise fully crosslinked elastomer sheets based on EPDM (ethylene propylene diene monomer rubber).

The NovoProof® family comprises numerous variants:

NovoProof® FA
Homogenous EPDM waterproofing sheet
NovoProof® DA
Homogenous roof waterproofing membrane
NovoProof® DA-F
Flame-retardant roofing membrane
NovoProof® DA-K
Flame-retardant roofing membrane with fleece backing
NovoProof® DA-S
Flame-retardant roofing membrane with thick fleece backing
NovoProof® DA-G
Light grey, flame-retardant roofing membrane with fleece backing
NovoProof® DA-FG
Flame-retardant roofing membrane with glass fabric backing
NovoProof® DA-SK
Flame-retardant roofing membrane with glass fabric backing and self-adhesive layer

The average for these products was formed on the basis of sales figures in 2017.
Directive (EU) No. 305/2011 /CPR/ applies for placing the product on the market in the EU/EFTA. The product requires a Declaration of Performance taking consideration of the
- /DIN EN 13956:2012/ - waterproofing membranes or
- /DIN EN 13859-2:2014/ waterproofing membranes
- and CE marking.

2.2 Application

NovoProof® surface sealing systems are suitable for all single-ply laying systems on flat roofs.
Use is governed by the respective national regulations.

NovoProof® DA is supplied as prefabricated sealing membranes and loosely laid under ballast (gravel, tiles) or green roofs.
NovoProof® DA-F is supplied as prefabricated sealing membranes. Ballast is not necessary on account of the flame-retardant compound.
NovoProof® DA-K/S/G/FG sheets are mechanically fastened without ballast or partly adhered.
NovoProof® DA SK sheets are fully adhered across the surface without ballast.
NovoProof® FA is used for establishing permanently resilient, air- and waterproof sealing of window and facade connections. The sheet is adhered to the external wall and/or window.

2.3 Technical Data

The information provided in the Declaration of Performance applies for the technical data.

Designation	DA	DA-F/DA-K	DA-G	DA-S	DA-FG/DA-SK	Unit
Water tightness to EN 1928	400	400	400	400	400	kPa
Tensile strength to EN 12311-2	≥ 8.5	≥ 6	≥ 6	≥ 700	≥ 700	N/mm²
Elongation to EN 12311-2	≥ 350	≥ 400	≥ 400	≥ 580	≥ 3	%
Seam peel resistance to EN 12316-2 (roofing membranes)	≥ 230	≥ 190	≥ 170	≥ 190	≥ 190	N/50 mm
Joint shear resistance to EN 12317-2	≥ 350	≥ 250	≥ 190	≥ 250	≥ 250	N/50 mm
Seam strength to 12317-2	N.A.	N.A.	N.A.	N.A.	N.A.	
Tear resistance to EN 12310-2	≥ 35	≥ 35	≥ 45	≥ 220	≥ 100	N
Tear resistance to EN 12310-1	≥ 130	≥ 100	N.A.	≥ 220	N.A.	N
Artificial ageing to EN 1297 (1000 h UV)	passed	passed	passed	passed	passed	-
Dimensional stability, EN 1107-2	≤ 0.3	≤ 0.3	≤ 0.3	≤ 0.3	≤ 0.3	%
Folding at low temperatures to EN 495-5	-40	-40	-40	-40	-40	°C
Exposure to bitumen to EN 1548	passed	passed	passed	passed	passed	-
Resistance to impact to EN 12691 (B)	> 2000	> 2000	> 2000	> 2000	> 2000	mm
Resistance to static loading to EN 12730 (B)	> 20	> 20	> 20	> 20	> 20	kg
Ozone resistance to EN 1844	passed	passed	passed	passed	passed	-
Resistance to root penetration (on green roofs) to EN 13948 and FLL	passed	NPD	passed	NPD	NPD	-

Designation	FA	Unit
Seam peel resistance to EN 12316-2 (roofing membranes)	n.a.	N/50mm
Seam strength to EN 12317-2	n.a.	-
Artificial ageing to EN 1297 (roofing membranes)	passed	-
Dimensional stability, EN 1107-02	≤ 0.5	%
Folding at low temperatures to EN 495-5	-30	°C
Exposure to bitumen to EN 1548 (roofing membranes)	n.a.	-
Resistance to root penetration (on green roofs) to EN 13948 and FLL (roofing membranes)	n.a.	-
Ozone resistance (for EPDM/IIR) to EN 1844 (roofing membranes)	n.a.	-
Elongation to EN 12311-2	≥ 400	%
Resistance to impact to EN 12691 (waterproofing membranes)	n.a.	mm
Joint shear resistance to EN 12317-2	n.a.	N/50mm
Tear resistance to EN 12310-1	≥ 80	N
Tear resistance to EN 12310-2	≥ 35	N
Water tightness to EN 1928 A	W1	-
Tensile strength to EN 12311-1	≥ 210	N/50mm
Air permeability of building components and building elements to EN 12114	≥ 0.1	m3/(m2 xhx50Pa)

n.a. = not applicable; data can be requested from the manufacturer
n.r. = not of relevance
The product's performance values correspond with the Declaration of Performance in terms of its essential properties in accordance with /DIN EN 13956:2012/ - waterproofing membranes /DIN EN 13859-2:2014/ - waterproofing membranes

2.4 Delivery status

NovoProof® waterproofing membranes are wound on cardboard rolls and wrapped in black protective foil for delivery ex works. A separating foil is also wound on non-backed NovoProof® DA, DA-F and FA membranes. NovoProof® sheets are available in various strengths. The roofing membranes are max. 1.4 m wide; lengths vary between 20 and 650 metres depending on the thickness of the roofing membrane. Density varies between 1370 and 1250 kg/m³ and is 1334 kg/m³ on average. The long sides feature a Thermofast coating which is 37 mm wide for connecting the sheets. The NovoProof® family is available in the following strengths:

- NovoProof® DA (1.3 / 1.5 / 2.0 mm thick)
- NovoProof® DA-F (1.3 / 1.5 / 2.0 mm thick)
- NovoProof® DA-K (1.3 / 1.5 mm thick)
- NovoProof® DA-S (2.5 mm thick)
- NovoProof® DA-G (1.5 mm thick)
- NovoProof® DA-FG (1.3 mm thick)
- NovoProof® DA-SK (1.3 mm thick)
- NovoProof® FA (0.60 / 0.75 / 1.00 / 1.30 / 1.50 / 2.0 mm thick)

2.5 Base materials / Ancillary materials

NovoProof® sheets are based on EPDM rubber. The individual variants contain the following percentages of various materials (excl. packaging).
Depending on the product variant (black or grey, flame-retardant or non-flame-retardant), the compounds contain various percentages of raw materials:

Material	Mass percentage
EPDM synthetic rubber	25-30%
Carbon black	0-35%
Mineral oil	10-20%
Flame retardant (metal hydroxide)	0-35%
Filler	4-32%
Crosslinking system and processing aids	5-6%

The product contains substances on the /List of Candidates/ (date: 27.06.2018) exceeding 0.1% by mass: **no**

The product contains other /CMR/ substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass in at least one partial product: **no**

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the Ordinance on Biocide Products No. /(EU) 528/2012/): **no**

2.6 Manufacture

The production of rubber compounds as a material for manufacturing EPDM roofing and waterproofing membranes is based on a formula which specifies the quality and quantity of raw materials used.
The manufacturing process in Wadern-Büschfeld is a classic batch process. The requisite raw materials are portioned in accordance with the formula calculator into automatic weighing machines and conveyed to an internal mixer using suitable conveying equipment. The mixing process results in a homogenous rubber compound. During production, quality characteristics such as strength, elasticity, hardness, density and rheometer curve are tested on all finished compounds. The rubber compound is then processed on a roller-head plant.
The continuous production process commences with extrusion, whereby the material achieves the desired thickness (0.6-2.5 mm) and width (max. 1400 mm) using a wide extrusion die and calender. Depending on the product, this is followed by adding Thermofast tapes and possibly fleece to the DA-K, DA-G and DA-S products or glass fabric to the DA-FG and DA-SK products with subsequent surface embossing.
Then the moulded membranes are vulcanised (crosslinked) in a continuous hot-channel process resulting in a permanent connection between the EPDM layer and the Thermofast® welding edge. After vulcanisation, the sheets are cooled down to room temperature over a cooling conveyor zone and wound onto rolls. If necessary, the sheets can be pre-assembled. Development and manufacturing are in line with the requirements of the quality management system according to /DIN EN ISO 9001:2008/.

The quality of the finished products is regularly assured in the form of in-plant production inspections and external quality monitoring.

2.7 Environment and health during manufacturing

In addition to general occupational safety measures for commercial operations, preventive measures are also offered and implemented.
The company is certified to the Environment Management system in accordance with /DIN EN ISO 14001/.

2.8 Product processing/Installation

4 different laying systems can be applied for processing EPDM roofing and waterproofing membranes:

Laid loose with ballast (NovoProof® DA)
The pre-assembled sheets comprising NovoProof® DA membranes are laid loose on the roof and secured against wind suction with ballast, e.g. green roof, gravel or tiles.

Mechanical fastening (NovoProof® DA-F/DA-K/DA-G/DA-S/DA-FG)
The EPDM sheets are laid loose and mechanically fastened using suitable fastening elements in the seam areas. Overlapping seams are hot air-welded.

Adhesion NovoProof® DA-K/DA-G/DA-S:
The fleece-backed sheets are partially adhered (in strips) to the roof using PU-based NovoProof® surface adhesive. Overlapping seams are hot air-welded.

NovoProof® DA-SK:
Overlapping seams are hot air-welded. The glass fabric-backed sheets are adhered across the surface of the roof. Overlapping seams are hot air-welded.

NovoProof® FA:
NovoProof® sheets enable permanently airtight, waterproof and vapour-tight window and facade connections displaying the requisite permanent resilience in accordance with /DIN 4108/ and RAL quality guidelines.

All installation systems must be carried out in accordance with the corresponding standards and guidelines as well as the installation specifications and manufacturers' instructions.

2.9 Packaging

The EPDM roofing and waterproofing membranes are wound on cardboard/plastic rolls and wrapped in black protective foil. A separating foil is also wound on non-backed (NovoProof® DA/DA-F/FA) roofing and waterproofing membranes.
The packed rolls are delivered ex works on wooden pallets.
The pallets are recyclable and re-usable.

2.10 Condition of use

When installed professionally, EPDM sheets are practically maintenance-free. Over the period of use, NovoProof® EPDM roofing and waterproofing membranes remain resilient and functional.

2.11 Environment and health during use

During use, EPDM roofing and waterproofing membranes do not have any negative impact on the environment or user health.

2.12 Reference service life

When used and installed as designated, NovoProof® EPDM has an anticipated service life of more than 50 years (according to final report SKZ-TeConA No. 37236/99X and the long-term resistance test report by DEKRA, No. 0607/1891215981/15).

2.13 Extraordinary effects

Fire
The roofing membranes meet the requirements governing performance in case of external fire exposure in accordance with /DIN EN 13501-5/. Fire performance in accordance with /EN ISO 11925-2/ and /DIN EN 13501-1/ leads to classification of the roofing membranes in class E.

Fire protection

Name	Value
Building material class	E
Burning droplets	-
Smoke gas development	-

Water
When used as designated, the declared EPDM roofing and waterproofing membranes are insoluble in water and resistant to exposure to water. Water tightness has been tested in accordance with /DIN EN 1928/.

Mechanical destruction
No environmental hazards are anticipated on mechanical destruction of NovoProof® EPDM.

2.14 Re-use phase

NovoProof® EPDM roofing and waterproofing membranes are de-constructed once the use phase has expired. Thermal utilisation is possible. Energy contained in the declared products can be recovered by incineration in waste incineration plants. Material utilisation is also possible. Roof structures laid loosely are suitable for single-variety de-construction. Adhesive and fleece residue is inevitable for adhered roof structures. After thorough cleaning, material recycling can take the form of crushing and separation.

2.15 Disposal

The waste key codes in accordance with the European Waste Catalogue and the List of Wastes Directive /AVV/ are listed below for the individual product components.

Packaging
Packaging waste incurred during installation in the building is disposed of in line with the following waste codes:

- /EWC 15 01 01/ Paper and cardboard packaging
- /EWC 15 01 02/ Plastic packaging
- /EWC 15 01 03/ Wooden packaging

End of life
Roofing and waterproofing membrane residue can be

disposed of as mixed construction site waste and rubble under waste code

· /AVV 17 09 04/

As a general rule, material recycling should take preference over energetic utilisation (waste incineration route).

2.16 Further information

Our contact data is available on the back of this Declaration. Further information on NovoProof® EPDM is available for downloading (www.novoproof.de).

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² of the weighted average according to production volume for mechanically fastened, secured or adhered under ballast, hot air-welded NovoProof® roofing and waterproofing membranes (DA, DA-F, DA-K, DA-G, DA-S, DA-FG, DA-SK, FA), including packaging and fastening materials.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage (roll)	1.54	kg/m^2
Basis weight (overlapping)	1,61	kg/m^2
Fastening aids	0,06	kg/m^2
Conversion factor to 1 kg	0.6	-
Packaging	0,04	kg/m^2
Total	1,71	kg/m^2
Type of sealing (DA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK	Thermal welding	-
Sealing method (FA)	Sealing with rubber-based adhesive	-
Layer thickness	0,002	m

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

3.2 System boundary

Type of EPD: cradle to gate – with options

Modules A1-A3

The manufacturing stage involves production of the requisite raw materials including all of the upstream chains as well as the requisite procurement transport. Production of the declared unit also considered the requisite electrical and thermal energy as well as auxiliaries and consumables, including their upstream chains. Waste and waste water incurred are considered until full disposal thereof.

Module A4

This module considers the ecological impact of transporting the declared unit from the plant gate to the construction site.

Module A5

The environmental impacts incurred during the disposal of product packaging materials were taken into consideration here. Average efforts associated with installation (welding, mechanical fastening, adhesion) are also considered here.

Modules C2-3

These modules include the environmental impacts of waste treatment at the end of life and the associated transports. In scenario 1, the efforts associated with processing are modelled while scenario 2 involves the efforts associated with incineration of the waterproofing membranes.

Module D

The value streams arising from waste treatment (from A5 and C3) which can serve as energetic (incineration with energy recovery) or material input (recycling) for a downstream product system are indicated as benefits outside the system boundaries here.

3.3 Estimates and assumptions

· A5: 1% cuttings are assumed during installation of the roofing membrane at the construction site. 5.3% overlapping is also assumed during installation of the roofing membranes.

· C3-1: On account of the non-reusable materials in the roofing membranes, 70% of the EPDM compound is recovered by means of recycling after deducting losses in the regranulation process and collection of the roofing membranes on the construction site.

· D1: The recyclate is subject to depreciation accounting for 20% in line with the prices of fresh goods and recyclate on the commodity exchange (€1/kg for fresh goods, €0.8/kg for recyclate).

3.4 Cut-off criteria

The manufacture of machinery, plants and other infrastructure required for production as well as secondary and tertiary packaging was not taken into consideration in the LCAs. All other material and energy flows were analysed. Accordingly, the model displays a very high degree of integrity; no specific cut-off criteria were applied.

3.5 Background data

The latest version 8.1 of the /GaBi 8/ software system for comprehensive analysis (“GaBi”) was applied. All background data sets were taken from various GaBi data bases and the ecoinvent data base (version 2.2) /ecoinvent/.

For Modules A1-A3, German (production processes in Germany) data sets were used where possible; distribution transports (A4) and disposal processes (A5, C Modules) availed of the corresponding European data sets.

3.6 Data quality

The overall data quality is regarded as good. The background data from the GaBi data bases used for the analysis largely concerns the reference year 2013; data used from the ecoinvent data base originates

from the period 1995 to 2005. These individual data sets account for less than 1% and together account for less than 5% (in terms of mass). The cut-off criteria would, therefore, apply. However, as they are incorporated, they represent a conservative analysis. Furthermore, these low percentages mean that there is no risk of obsolete data having a significant influence on the overall result. The data on the products under review was recorded using analyses of internal production and environmental data, and LCA-relevant information within the supplier chain. The data recorded has been examined for plausibility and consistency with the result that good representativity can be assumed.

3.7 Period under review

The material input and output flows were recorded on the basis of the corresponding production volumes in 2017. The energetic input and output flows were taken into consideration using the corresponding overall quantities from 2011. According to the manufacturer, there have been no changes since then with the result that these energy requirements can also be assumed for 2017.

3.8 Allocation

The energy required by production was allocated to individual products on the basis of consumption measurements. The benefits outside the system boundaries from Modules A5 and C3-1 are indicated in Module D1 while benefits from Modules A5 and C3-2 can be seen in Module D2.

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.

The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

This section outlines the scenarios considered in accordance with life cycles A1-A3 in this Life Cycle Assessment.

Transport to construction site (A4)
All of the distribution countries were recorded proportionately in establishing the transport distance. Transport to the site is depicted using a European fuel data record.

Name	Value	Unit
Litres of fuel	0.003	l/100km
Transport distance	470	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1250-1370	kg/m³
Capacity utilisation volume factor	1	-

Construction installation process (A5)
Consideration of the effort associated with installation as well as transport of packaging waste

Name	Value	Unit
Auxiliary	0.06	kg
Water consumption	0	m³
Other resources	0	kg
Electricity consumption	0.0475	kWh
Other energy carriers	0	MJ
Material loss during installation	1	%
Overlapping	5,3	%
Output substances following waste treatment on site	0	kg
Dust in the air	NA	kg
VOC in the air	NA	kg
Transport distance to waste treatment plant (packaging)	75	km
Truck capacity utilisation (incl. empty runs)	85	%

End of life (C2-C3)
Two different scenarios were calculated for modelling the *EoL* which, although both represent a 100% route, also permit proportional calculation (e.g. Scenario 1 = 30% / Scenario 2 = 70%). This is of interest in order to calculate the individual possibilities offered by the disposal routes currently available on the market, i.e. in line with a real situation. Even if product disposal is currently largely by means of thermal utilisation, recycling options are meanwhile available which permit a 100% recycling route. A general collection loss of 5% is assumed between deconstruction of the product and disposal thereof.

Data sets were used which represent a European average.

Name	Value	Unit
Collected separately	0	kg
Collected as mixed construction waste	1.67	kg
Reuse	0	kg
Recycling C3-1	1.67	kg
Energy recovery C3-2	1.67	kg
Landfilling	0	kg
Transport distance to waste treatment plant C2	75	km
Truck capacity utilisation	85	%

5. LCA: Results

The following tables depict the results of the indicators concerning the estimated impact, use of resources as well as waste and other output flows in relation to 1 m² roofing membrane installed. C3-1 and D1 represent the impacts of the recycling scenario, C3-2 and D2 describe thermal utilisation of the roofing membranes at the end of the use phase.

DESCRIPTION OF THE SYSTEM BOUNDARY (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	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² EPDM roofing and waterproofing membranes NovoProof® DA, FA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK

Parameter	Unit	A1-A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
GWP	[kg CO_2-Eq.]	4.79E+0	3.52E-2	6.90E-1	7.08E-3	1.06E-2	3.16E+0	-2.82E+0	-2.03E+0
ODP	[kg CFC11-Eq.]	2.91E-7	1.18E-14	1.65E-8	2.38E-15	4.70E-13	8.98E-10	-3.34E-11	-3.97E-12
AP	[kg SO_2-Eq.]	9.86E-3	1.47E-4	1.09E-3	4.31E-5	3.03E-5	2.45E-4	-3.60E-3	-2.21E-3
EP	[kg $(PO_4)^{3-}$-Eq.]	1.17E-3	3.66E-5	1.19E-4	1.09E-5	2.74E-6	5.46E-5	-4.34E-4	-3.49E-4
POCP	[kg ethene-Eq.]	9.36E-4	-5.40E-5	1.25E-4	-1.92E-5	1.93E-6	2.24E-5	-5.25E-4	-2.26E-4
ADPE	[kg Sb-Eq.]	1.53E-5	2.83E-9	3.18E-6	5.70E-10	4.23E-9	-4.36E-8	-2.09E-6	-5.75E-7
ADPF	[MJ]	1.10E+2	4.86E-1	1.19E+1	9.78E-2	1.13E-1	5.98E-1	-7.66E+1	-2.60E+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 EPDM roofing and waterproofing membranes NovoProof® DA, FA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK

Parameter	Unit	A1-A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
PERE	[MJ]	9.61E+0	2.45E-2	9.24E-1	4.93E-3	6.33E-2	8.48E-2	-2.63E+0	-5.76E+0
PERM	[MJ]	9.72E-2	0.00E+0	-9.72E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	9.71E+0	2.45E-2	8.27E-1	4.93E-3	6.33E-2	8.48E-2	-2.63E+0	-5.76E+0
PENRE	[MJ]	8.88E+1	4.88E-1	1.41E+1	9.82E-2	1.86E-1	2.54E+1	-7.82E+1	-2.91E+1
PENRM	[MJ]	2.62E+1	0.00E+0	-1.50E+0	0.00E+0	-2.47E+1	-2.47E+1	0.00E+0	0.00E+0
PENRT	[MJ]	1.15E+2	4.88E-1	1.26E+1	9.82E-2	-2.45E+1	7.01E-1	-7.82E+1	-2.91E+1
SM	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.00E-1	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	5.35E-1	4.53E-5	3.01E-2	9.12E-6	9.03E-5	8.43E-3	-9.35E-3	0.00E+0

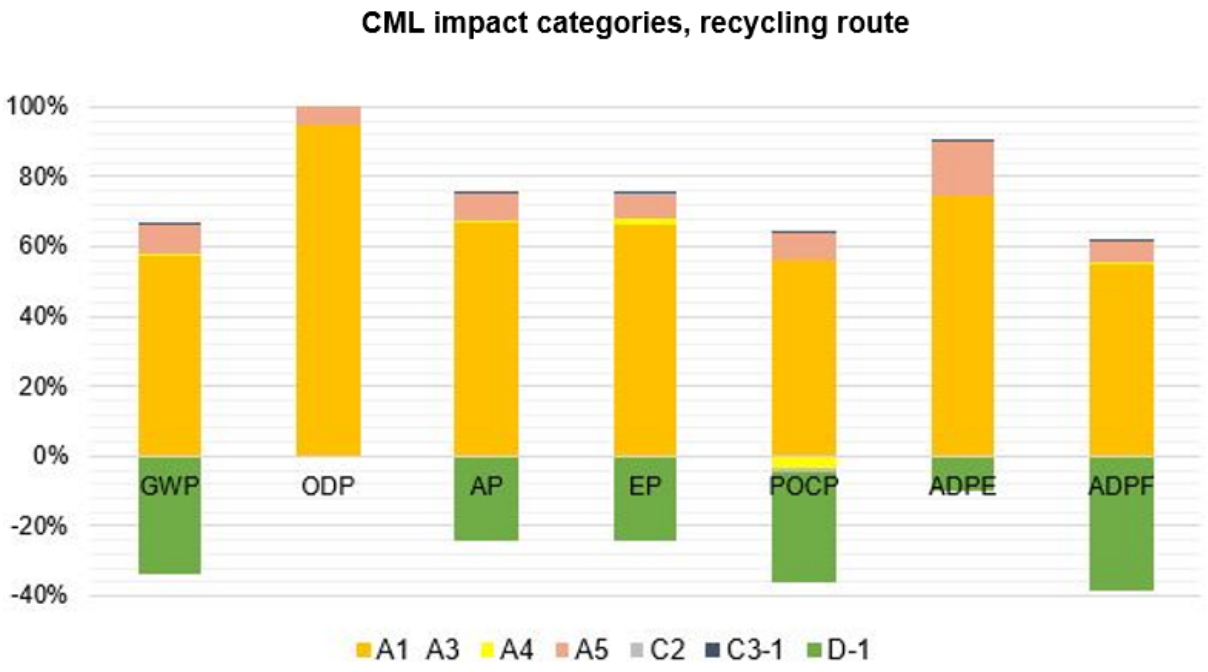
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable 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

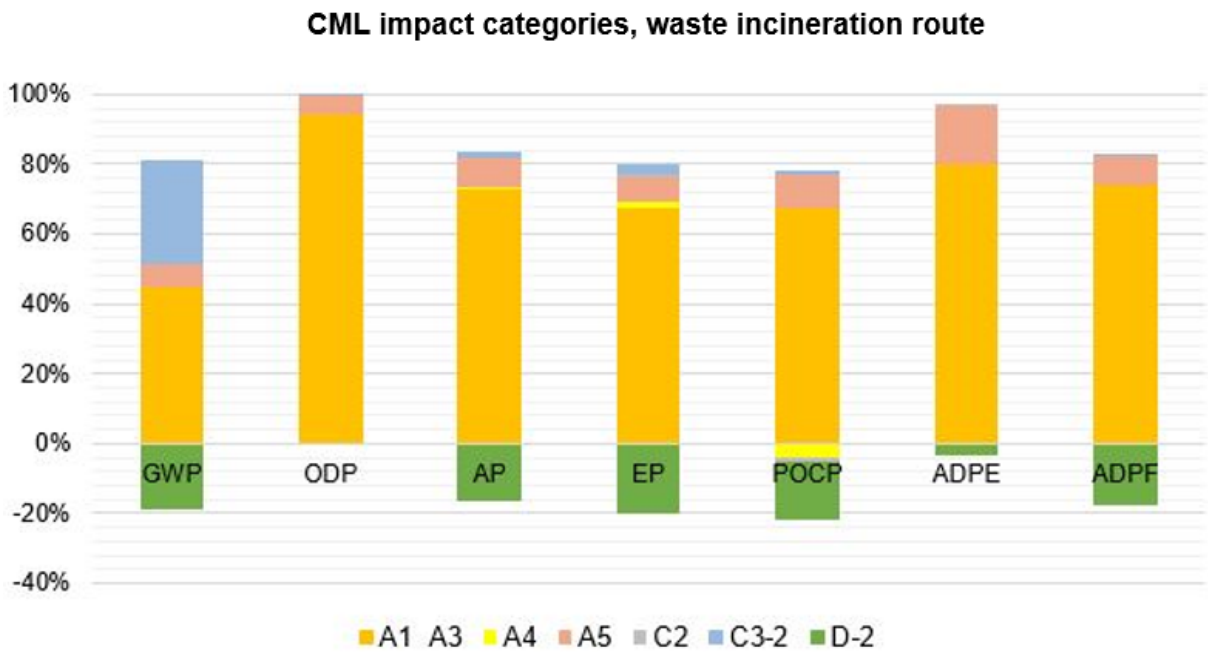
RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² EPDM roofing and waterproofing membranes NovoProof® DA, FA, DA-F, DA-K, DA-S, DA-G, DA-FG, DA-SK

Parameter	Unit	A1-A3	A4	A5	C2	C3/1	C3/2	D/1	D/2
HWD	[kg]	2.51E-7	2.56E-8	1.59E-8	5.15E-9	7.53E-11	1.10E-9	-3.82E-7	-3.92E-3
NHWD	[kg]	4.60E-2	3.73E-5	5.95E-3	7.50E-6	1.22E-4	2.06E-2	-3.22E-2	0.00E+0
RWD	[kg]	2.09E-3	6.66E-7	2.57E-4	1.34E-7	2.89E-5	3.70E-5	-6.21E-4	0.00E+0
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.59E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	2.63E-1	0.00E+0	0.00E+0	5.93E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	6.11E-1	0.00E+0	0.00E+0	1.43E+1	0.00E+0	0.00E+0

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; EEE = Exported thermal energy

6. LCA: Interpretation





Module A1-A3 has a dominant influence on all environmental impacts. It contributes more than 50% (waste incineration route, approx. 90% for recycling) to the overall **Global Warming Potential (GWP)**. The manufactured EPDM mixture, carbon black and electricity generation account for the greatest share of overall emissions in the module, i.e. 30%, 24% and 22%, respectively, whereby lamination and packaging play equally minor roles. Transport to the customer does not display any major environmental relevance (**A4**) while product installation at the building site (**A5**) makes a minor, yet noteworthy, contribution of 12% (without consideration of the D Module) on account of the rubber-based adhesive and plastic securing plates.

Transport associated with disposal (**C2**) has hardly any influence on the result. Likewise, recycling the product at the EoL implies hardly any environmental impacts (**C3-1**) while the emissions associated with the waste incineration plants (**C3-2**) make a significantly high contribution to the overall results (approx. 37%, without consideration of the D Module). The manufacturing process makes an 87% contribution to the Eutrophication Potential (**EP**) which is, in turn, dominated by accelerators (25%), EPDM rubber (19%) and electricity generation (21%).

In the recycling route, **Module D** generally generates consistent values (generally somewhat lower in the waste incineration route) for potentials and avoided

loads beyond the system boundary across all environmental impact categories accounting for approx. 30-50% of total emissions. Exceptions are represented by the **ODP** (Ozone Depletion Potential) where Module D does not have any visible impact and **ADPE** (Abiotic Depletion Potential non-fossil resources) where the value is approx. 10% compared to emissions incurred.

7. Requisite evidence

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