**Environmental Product Declaration (EPD)**
According to ISO 14025 and EN 15804

# Divoroll Standard +


| | |
|---|---|
| Registration number: | EPD-Kiwa-EE-187723-EN |
| Issue date: | 17-12-2024 |
| Valid until: | 17-12-2029 |
| Declaration owner: | BMI Group Holdings UK Limited |
| Publisher: | Kiwa-Ecobility Experts |
| Programme operator: | Kiwa-Ecobility Experts |
| Status: | verified |

# 1 General information

## 1.1 PRODUCT

Divoroll Standard +

## 1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-187723-EN

## 1.3 VALIDITY

**Issue date:** 17-12-2024

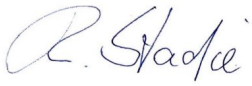
**Valid until:** 17-12-2029

## 1.4 PROGRAMME OPERATOR

Kiwa-Ecobility Experts
Wattstraße 11-13
13355 Berlin
DE

Raoul Mancke

*(Head of programme operations, Kiwa-Ecobility Experts)*



Dr. Ronny Stadie

*(Verification body, Kiwa-Ecobility Experts)*

## 1.5 OWNER OF THE DECLARATION

**Manufacturer:** BMI Group Holdings UK Limited

**Address:** Thames Tower, Station Road, UK, RG1 1LX Reading, UK

**E-mail:** info.group@bmigroup.com

**Website:** https://bmigroupinternational.com/

**Production location:** BMI Ennepetal

**Address production location:** Scharpenberger Str. 72-90, 58256 Ennepetal, Germany

## 1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804:2012+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Anne Kees Jeeninga, Advieslab

## 1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

## 1.8 PRODUCT CATEGORY RULES

Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14).

Product category rules EN 15804 +A2 NPCR 022 Part B for roof waterproofing version 2.0 Issue date: 31.03.2022 Valid to: 06.06.2023 validity extended to 31.12.2024 (PCR EPD Norge)

## 1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804+A2. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data,

# 1 General information

background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPD program operators may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

## 1.10 CALCULATION BASIS

**LCA method R<THINK:** Ecobility Experts | EN15804+A2

**LCA software*:** Simapro 9.1

**Characterization method:** EN 15804 +A2 Method v1.0

**LCA database profiles:** EcoInvent version 3.6

**Version database:** v3.17 (2024-05-22)

** Simapro is used for calculating the characterized results of the Environmental profiles within R<THINK.*

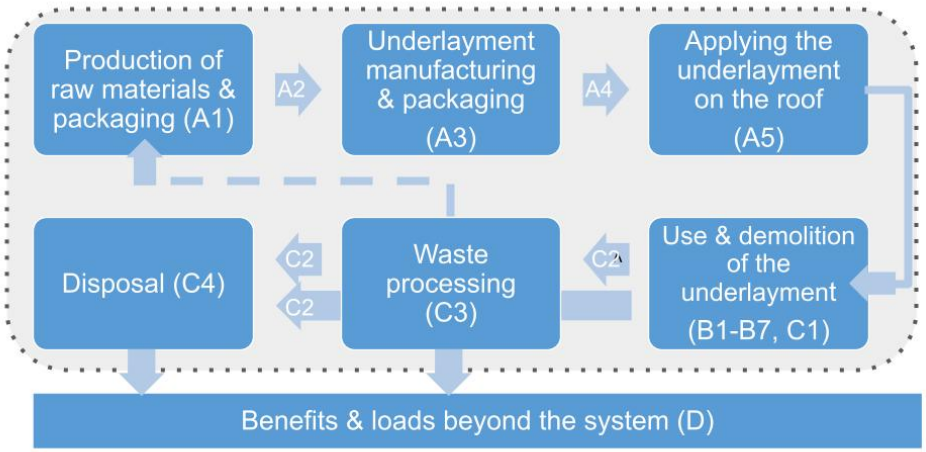
## 1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'Divoroll Standard +' with the calculation identifier ReTHiNK-87723.

# 2 Product

## 2.1 PRODUCT DESCRIPTION

3-layer underlay and roofing membranes are used as an additional rain protection measure under the roof covering. Quality requirements: Generally all permeables must comply with the EN 13859-1:2010 and most non permeables with the EN 13984:2013. There are a lot of other requirements, but this is product specific and country-specific.




## 2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

Depending on the requirements of the roof, underlay membranes are installed on a dimensionally stable base (formwork or insulation) or freely stretched underlay membranes as additional protection for the building against penetrating moisture, drifting snow and dust. They also improve the windproofness of the construction. The respective national regulations apply to their use. These include the generally recognized rules of technology, such as the technical regulations of the Central Association of German Roofing Trades, which normally guarantee flawless technical execution. The manufacturer's processing instructions implement these specifications in a product-related manner and must therefore also be taken into account.

## 2.3 REFERENCE SERVICE LIFE

**RSL PRODUCT**

Under normal conditions and when installed professionally, BMI underlayments have the same life expectancy as the product that goes on top of it being the pitched roofing.

The minimum RSL for pitched roofing is 60 years, based on the PCR of EPD Norge: 'Product category rules EN 15804 +A2 NPCR 022 Part B for roof waterproofing version 2.0 Issue date: 31.03.2022 Valid to: 06.06.2023 validity extended to 31.12.2024'. In this document expected life times are mentioned of
- 30 years for plastic and rubber sheets (like PP based underlays)
- 60 years for concrete and clay tiles
So, according to this document, the *minimum* expected lifetime for PP based underlays is 30 years. This is in line for instance with the BBA certificate valid for two Divoroll underlays https://tinyurl.com/aktzxfrz where it is stated that 'The products will be virtually unaffected by the normal conditions found in a roof space and will have a life comparable with that of a traditional roof tile underlay, provided they are not exposed to sunlight for long periods' . NB: the BBA certificate is about guarantees not about RSLs.

However, as explained before, it is more logical to use an expected lifetime of 60 years for PP based underlays from BMI, like the one covered by this EPD, based on the lifetime of the product that goes on top of it, being the pitched roofing. Otherwise, if clients of BMI make calculations for a building (with a minimum lifetime of 60 years), they have to calculate (in the tools that calculate the environmental load of the building) with a replacement of the underlayment after 30 years. However, BMI has not received any information from the market where that after 30 years the roof is taken off, including battens and counter battens. It doesn't seem to happen.

**USED RSL (YR) IN THIS LCA CALCULATION:**

60

**RSL PARTS**

same as product

## 2.4 TECHNICAL DATA

BMI underlayments are manufactured exclusively in the BMI factory in Ennepetal, Germany and subjected to controls in the BMI laboratory facilities. With these products, BMI offers the right solution for every requirement: The underlay and roofing membranes are easy to lay and are characterized by high safety, special resistance and long durability. More information: https://www.bmigroup.com/de/unterdeckbahnen-und-zubehor/

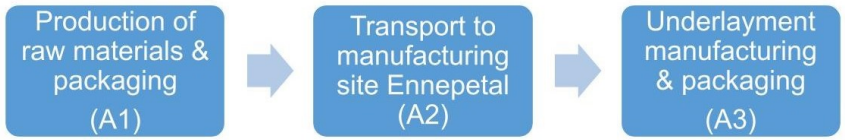
# 2 Product

## 2.5 SUBSTANCES OF VERY HIGH CONCERN

None of the substances contained in the product are listed in the "Candidate List of Substances of Very High Concern for authorisation", or they do not exceed the threshold with the European Chemicals Agency

## 2.6 DESCRIPTION PRODUCTION PROCESS

The preliminary products of the upper and lower fleece are already being manufactured delivered as a finished product. The upper fleece differs from the base fleece in the thickness of the fleece. The fleeces are delivered via unwinding systems supplied to the laminating station. The adhesive for lamination is melted in extruders and applied to the fleeces via wide slot nozzles in order to bond the functional membrane and the reinforcing grid. A special coating is also applied to the surface. During assembly, the tracks are made with a Logo printed and tailored. If necessary self-adhesive adhesive strips on the side edges of the Strips applied lengthwise (These strips are not included in the calculation, they hardly contribute to the environmental load). To conclude the web rolls are stacked on reusable pallets and packed in foil. All raw materials/auxiliary materials used are introduced into the production facility without any harmful effects on the environment. Contamination of the environment through exhaust air, wastewater or waste is excluded when the system is operating properly. There are no dust emissions that need to be cleaned during production and packaging. The production personnel are not exposed to any health risks at any time during the production of the tracks. Residual production materials that arise, such as start-up goods or production transitions, are disposed of professionally. During the entire manufacturing process, no measures beyond the legally stipulated occupational safety and environmental protection measures for commercial operations are required. The whole production of underlays is without solvents. Even in the printing of the underlays water based colours are used.




## 2.7 CONSTRUCTION DESCRIPTION

The underlayments are attached to the roof using nails/ staples, Depending on the requirements of the roof, underlays are installed on a dimensionally stable base (formwork or insulation) or underlays are freely stretched. The minimum overlap is 100 mm. The attachment takes place in the overlap area above the adhesive strip.

# 3 Calculation rules

## 3.1 FUNCTIONAL UNIT

**m2**

1 m2 average breathable underlay and roofing membrane, 3 layers, including overlaps, and attached to the roof (with staples)

Reference unit: square meter (m2)

## 3.2 CONVERSION FACTORS

| Description | Value | Unit |
|---|---|---|
| Reference unit | 1 | m2 |
| Weight per reference unit | 0.153 | kg |
| Conversion factor to 1 kg | 6.545756 | m2 |

## 3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to gate with options, modules C1-C4 and module D EPD. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | X | X | X | X | X | X | X | ND | ND | X | X | X | X | X | X | X |

The modules of the EN15804 contain the following:

| | |
|---|---|
| Module A1 = Raw material supply | Module B5 = Refurbishment |
| Module A2 = Transport | Module B6 = Operational energy use |
| Module A3 = Manufacturing | Module B7 = Operational water use |
| Module A4 = Transport | Module C1 = De-construction / Demolition |
| Module A5 = Construction - Installation process | Module C2 = Transport |
| Module B1 = Use | Module C3 = Waste Processing |
| Module B2 = Maintenance | Module C4 = Disposal |
| Module B3 = Repair | Module D = Benefits and loads beyond the product system boundaries |
| Module B4 = Replacement | |

## 3.4 REPRESENTATIVENESS

This EPD is representative for Divoroll Standard +, a product of BMI Group Holdings UK Limited. The results of this EPD are representative for European Union.

## 3.5 CUT-OFF CRITERIA

**Product stage (A1-A3)**
All input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. production waste) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass. Capital goods were excluded (packaging box factory: 0,008 kg GWP. Stretching: 0,4 GWP, both less than 5%)

# 3 Calculation rules

**Construction process stage (A4-A5)**
All input flows (e.g. transportation to the construction site, additional raw material use for construction, installation energy (use)of energy use for assembly , etc.) and output flows (e.g. construction waste, packaging waste, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

**Use stage (B1-B3)**
All (known) input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. emissions to soil, air and water, construction waste, packaging waste, end-of-life waste, etc.) related to the building fabric are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

**Operational energy & water use (B6-B7)**
There is no operational energy or water use involved (so no effects, zero score in B6 and B7)

**End of life stage (C1-C4)**
All input flows (e.g. energy use for demolition or disassembly, transport to waste processing, etc.) and output flows (e.g. end-of-life waste processing of the product, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

**Benefits and loads beyond the system boundary (Module D)**
All benefits and loads beyond the system boundary resulting from reusable products, recyclable materials and/or useful energy carriers leaving the product system are considered in this LCA.

## 3.6 ALLOCATION

Allocation has not been applied in this LCA.

## 3.7 DATA COLLECTION & REFERENCE PERIOD

Data gathering: From 2nd of July, 2021 till 14th of December 2023. Reference period: 2022

## 3.8 ESTIMATES AND ASSUMPTIONS

For areas where accurate data was not available, such as transport or end-of-life scenarios, default values like for transport Lorry (Truck), unspecified (default) | market group for (GLO), EcoInvent 3.6 (2019) and for eol polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57) for the main product and different eols for the packaging have been used.

## 3.9 DATA QUALITY

The data quality is based on the principle that the data quality of the data of the processes that take place at the producer of the product must be higher than that of the other processes. For the processes at the producer, so at the factory in Ennepetal, average product data have been used, retrieved from/ based on the ERP system. In addition to that as much as possible specific data from suppliers has been used. Every supplier was contacted. If no data were submitted background data was used.

## 3.10 POWER MIX

The power mix that was used is the power mix for Germany since the underlayments are produced in Ennepetal, Germany (Electricity (DE) - low voltage (max 1kV), EcoInvent 3.6 (2019), GWP of 0.6 kg CO2 per kWh

# 4 Scenarios and additional technical information

## 4.1 TRANSPORT TO CONSTRUCTION SITE (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD.

| | Value and unit |
|---|---|
| Vehicle type used for transport | Lorry (Truck), unspecified (default) \| market group for (GLO) |
| Fuel type and consumption of vehicle | not available |
| Distance | 750 km |
| Capacity utilisation (including empty returns) | 50 % (loaded up and return empty) |
| Bulk density of transported products | inapplicable |
| Volume capacity utilisation factor | 1 |

## 4.2 ASSEMBLY (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

### FLOWS ENTERING THE SYSTEM

There are no significant environment impacts as a result of materials or energy used in the construction stage (A5).

### FLOWS LEAVING THE SYSTEM

The following output flows leaving the system at module A5 are assumed.

| Description | Value | Unit |
|---|---|---|
| Output materials as result of loss during construction | 3 | % |
| Output materials as result of waste processing of materials used for installation/assembly at the building site | 0.000 | kg |
| Output materials as result of waste processing of used packaging | 0.016 | kg |

## 4.3 USE STAGE (B1)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water.

## 4.4 MAINTENANCE (B2)

For maintenance no input or output flows are moddeled.

# 4 Scenarios and additional technical information

## 4.5 REPAIR (B3)

Repairs are not applicable within the functional unit and to achieve the reference service life.

## 4.6 OPERATIONAL ENERGY USE (B6)

| Description | Service cycle (yr) | Number of cycles (n) | Amount per cycle | Total Amount | Unit |
|---|---|---|---|---|---|

## 4.7 OPERATIONAL WATER USE (B7)

| Description | Service cycle (yr) | Number of cycles (n) | Amount per cycle | Total Amount | Unit |
|---|---|---|---|---|---|

## 4.8 DE-CONSTRUCTION, DEMOLITION (C1)

No inputs are needed for the product at the de-construction / demolition phase

## 4.9 TRANSPORT END-OF-LIFE (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing.

| Waste Scenario | Transport conveyance | Not removed (stays in work) [km] | Landfill [km] | Incineration [km] | Recycling [km] | Re-use [km] |
|---|---|---|---|---|---|---|
| polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57) | Lorry (Truck), unspecified (default) \| market group for (GLO) | 0 | 100 | 150 | 50 | 0 |
| finishes (adhered to wood, plastic, metal) (NMD ID 2) | Lorry (Truck), unspecified (default) \| market group for (GLO) | 0 | 100 | 150 | 50 | 0 |

The transport conveyance(s) used in the scenario(s) for transport during end of life has the following characteristics.

| | Value and unit |
|---|---|
| Vehicle type used for transport | Lorry (Truck), unspecified (default) \| market group for (GLO) |

# 4 Scenarios and additional technical information

| | |
|---|---|
| Fuel type and consumption of vehicle | not available |
| Capacity utilisation (including empty returns) | 50 % (loaded up and return empty) |
| Bulk density of transported products | inapplicable |
| Volume capacity utilisation factor | 1 |

## 4.10 END OF LIFE (C3, C4)

The scenario(s) assumed for end of life of the product are given in the following tables. First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts.

| Waste Scenario | Region | Not removed (stays in work) [%] | Landfill [%] | Incineration [%] | Recycling [%] | Re-use [%] |
|---|---|---|---|---|---|---|
| polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57) | NL | 0 | 10 | 85 | 5 | 0 |
| finishes (adhered to wood, plastic, metal) (NMD ID 2) | NL | 0 | 0 | 100 | 0 | 0 |

| Waste Scenario | Not removed (stays in work) [kg] | Landfill [kg] | Incineration [kg] | Recycling [kg] | Re-use [kg] |
|---|---|---|---|---|---|
| **Total** | **0.000** | **0.000** | **0.000** | **0.000** | **0.000** |

## 4.11 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The presented Benefits and loads beyond the system boundary in this EPD are based on the following calculated Net output flows in kilograms and Energy recovery displayed in MJ Lower Heating Value.

| Waste Scenario | Net output flow [kg] | Energy recovery [MJ] |
|---|---|---|
| polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57) | 0.000 | 0.000 |
| finishes (adhered to wood, plastic, metal) (NMD ID 2) | 0.000 | 0.000 |
| **Total** | **0.000** | **0.000** |

# 5 Results

For the impact assessment, the characterization factors of the LCIA method EN 15804 +A2 Method v1.0 are used. Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

## 5.1 ENVIRONMENTAL IMPACT INDICATORS PER SQUARE METER

### CORE ENVIRONMENTAL IMPACT INDICATORS EN15804+A2

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | mol H+ eqv. | 1.36E-3 | 3.31E-4 | 2.83E-4 | 1.98E-3 | 9.92E-5 | 7.93E-5 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.68E-5 | 1.50E-4 | 1.35E-6 | -2.01E-4 |
| GWP-total | kg CO2 eqv. | 3.54E-1 | 1.16E-2 | 6.00E-2 | 4.26E-1 | 1.71E-2 | 5.68E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.90E-3 | 3.49E-1 | 2.17E-3 | -2.04E-1 |
| GWP-b | kg CO2 eqv. | -1.06E-2 | -5.41E-6 | -1.33E-2 | -2.39E-2 | 7.90E-6 | 1.49E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.34E-6 | 5.12E-5 | 1.66E-6 | -5.51E-5 |
| GWP-f | kg CO2 eqv. | 3.64E-1 | 1.16E-2 | 7.31E-2 | 4.49E-1 | 1.71E-2 | 4.19E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.90E-3 | 3.49E-1 | 2.16E-3 | -2.03E-1 |
| GWP-luluc | kg CO2 eqv. | 2.06E-4 | 9.79E-6 | 1.79E-4 | 3.95E-4 | 6.27E-6 | 1.44E-5 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.06E-6 | 2.68E-5 | 7.65E-8 | -1.42E-5 |
| EP-m | kg N eqv. | 2.21E-4 | 7.47E-5 | 5.39E-5 | 3.50E-4 | 3.50E-5 | 1.67E-5 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 5.92E-6 | 4.12E-5 | 8.18E-7 | -5.56E-5 |
| EP-fw | kg P eq | 9.28E-6 | 5.66E-8 | 6.89E-6 | 1.62E-5 | 1.73E-7 | 5.82E-7 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.92E-8 | 9.96E-7 | 2.77E-9 | -4.26E-7 |
| EP-T | mol N eqv. | 2.50E-3 | 8.33E-4 | 6.55E-4 | 3.99E-3 | 3.85E-4 | 1.88E-4 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 6.52E-5 | 4.59E-4 | 4.96E-6 | -6.18E-4 |
| ODP | | 1.04E-8 | 2.31E-9 | 3.58E-9 | 1.63E-8 | 3.78E-9 | 1.56E-9 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 6.39E-10 | 1.02E-8 | 4.79E-11 | -2.54E-8 |

**AP**=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

# 5 Results

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kg CFC 11 eqv. | | | | | | | | | | | | | | | | |
| POCP | kg NMVOC eqv. | 1.08E-3 | 2.20E-4 | 1.85E-4 | 1.48E-3 | 1.10E-4 | 6.38E-5 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.86E-5 | 1.23E-4 | 1.90E-6 | -2.13E-4 |
| ADP-f | MJ | 1.20E+1 | 1.49E-1 | 1.36E+0 | 1.35E+1 | 2.58E-1 | 4.45E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 4.37E-2 | 2.55E-1 | 3.66E-3 | -3.60E+0 |
| ADP-mm | kg Sb-eqv. | 3.50E-6 | 1.11E-7 | 6.86E-7 | 4.30E-6 | 4.33E-7 | 1.98E-7 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 7.34E-8 | 4.22E-7 | 1.65E-9 | -1.51E-7 |
| WDP | m3 world eqv. | 3.35E-1 | 2.74E-4 | 4.09E-2 | 3.76E-1 | 9.23E-4 | 1.27E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.56E-4 | 1.68E-2 | 1.57E-4 | -2.25E-2 |

**AP**=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

**ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN15804+A2**

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ETP-fw | CTUe | 2.24E+0 | 1.01E-1 | 1.03E+0 | 3.37E+0 | 2.30E-1 | 4.54E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 3.89E-2 | 4.18E+0 | 3.90E-3 | -2.95E-1 |
| PM | disease incidence | 1.08E-8 | 3.73E-10 | 2.25E-9 | 1.35E-8 | 1.54E-9 | 6.24E-10 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.60E-10 | 1.20E-9 | 2.54E-11 | -8.37E-10 |
| | CTUh | 9.46E-11 | 7.58E-12 | 2.52E-11 | 1.27E-10 | 7.46E-12 | 1.13E-11 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.26E-12 | 8.40E-11 | 1.02E-13 | -1.56E-11 |

**ETP-fw**=Ecotoxicity, freshwater (ETP-fw) | **PM**=Particulate Matter (PM) | **HTP-c**=Human toxicity, cancer (HTP-c) | **HTP-nc**=Human toxicity, non-cancer (HTP-nc) | **IR**=Ionising radiation, human health (IR) | **SQP**=Land use (SQP)

# 5 Results

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HTP-c | | | | | | | | | | | | | | | | | |
| HTP-nc | CTUh | 2.41E-9 | 8.52E-11 | 7.21E-10 | 3.21E-9 | 2.52E-10 | 2.26E-10 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 4.26E-11 | 1.38E-9 | 2.54E-12 | -2.60E-10 |
| IR | kBq U235 eqv. | 1.34E-2 | 6.35E-4 | 3.24E-3 | 1.73E-2 | 1.08E-3 | 6.77E-4 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.83E-4 | 1.05E-3 | 1.43E-5 | -1.30E-3 |
| SQP | Pt | 1.67E+0 | 2.38E-2 | 1.78E+0 | 3.47E+0 | 2.24E-1 | 1.25E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 3.79E-2 | 9.16E-2 | 8.66E-3 | -7.21E-1 |

**ETP-fw**=Ecotoxicity, freshwater (ETP-fw) | **PM**=Particulate Matter (PM) | **HTP-c**=Human toxicity, cancer (HTP-c) | **HTP-nc**=Human toxicity, non-cancer (HTP-nc) | **IR**=Ionising radiation, human health (IR) | **SQP**=Land use (SQP)

**CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS**

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| ILCD type / level 1 | Global warming potential (GWP) | None |
| | Depletion potential of the stratospheric ozone layer (ODP) | None |
| | Potential incidence of disease due to PM emissions (PM) | None |
| ILCD type / level 2 | Acidification potential, Accumulated Exceedance (AP) | None |
| | Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater) | None |
| | Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine) | None |
| | Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | None |
| | Formation potential of tropospheric ozone (POCP) | None |
| | Potential Human exposure efficiency relative to U235 (IRP) | 1 |
| ILCD type / level 3 | Abiotic depletion potential for non-fossil resources (ADP-minerals&metals) | 2 |
| | Abiotic depletion potential for fossil resources (ADP-fossil) | 2 |
| | Water (user) deprivation potential, deprivation-weighted water consumption (WDP) | 2 |
| | Potential Comparative Toxic Unit for ecosystems (ETP-fw) | 2 |

# 5 Results

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| | Potential Comparative Toxic Unit for humans (HTP-c) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-nc) | 2 |
| | Potential Soil quality index (SQP) | 2 |

**Disclaimer 1** – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

**Disclaimer 2** – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

## 5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

### PARAMETERS DESCRIBING RESOURCE USE

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 4.86E-1 | 1.18E-3 | 2.70E-1 | 7.57E-1 | 3.23E-3 | 2.51E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 5.47E-4 | 2.60E-2 | 6.48E-5 | -1.34E-1 |
| PERM | MJ | 0.00E+0 | 0.00E+0 | 1.35E-1 | 1.35E-1 | 0.00E+0 | 4.05E-3 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| PERT | MJ | 4.86E-1 | 1.18E-3 | 4.05E-1 | 8.92E-1 | 3.23E-3 | 2.92E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 5.47E-4 | 2.60E-2 | 6.48E-5 | -1.34E-1 |
| PENRE | MJ | 7.90E+0 | 1.58E-1 | 1.22E+0 | 9.28E+0 | 2.74E-1 | 3.21E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 4.64E-2 | 2.71E-1 | 3.89E-3 | -3.75E+0 |
| PENRM | MJ | 4.96E+0 | 0.00E+0 | 2.31E-1 | 5.19E+0 | 0.00E+0 | 1.56E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | -2.24E-1 |
| PENRT | MJ | 1.29E+1 | 1.58E-1 | 1.45E+0 | 1.45E+1 | 2.74E-1 | 4.76E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 4.64E-2 | 2.71E-1 | 3.89E-3 | -3.98E+0 |
| SM | 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 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 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 | 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 | 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 | M3 | 6.54E-3 | 9.39E-6 | 1.16E-3 | 7.71E-3 | 3.14E-5 | 2.75E-4 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 5.32E-6 | 4.97E-4 | 3.82E-6 | -3.15E-4 |

**PERE**=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water

# 5 Results

## OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | Kg | 1.72E-6 | 1.51E-7 | 9.25E-7 | 2.80E-6 | 6.54E-7 | 1.72E-7 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 1.11E-7 | 5.07E-7 | 5.56E-9 | -4.13E-6 |
| NHWD | Kg | 1.58E-2 | 6.81E-4 | 6.57E-3 | 2.30E-2 | 1.64E-2 | 3.25E-3 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.77E-3 | 6.39E-3 | 1.46E-2 | -1.77E-3 |
| RWD | Kg | 1.14E-5 | 1.03E-6 | 3.54E-6 | 1.59E-5 | 1.69E-6 | 6.66E-7 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 2.87E-7 | 9.16E-7 | 2.18E-8 | -1.79E-6 |

**HWD**=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed

## ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

| Abbr. | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 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 | 1.39E-4 | 1.39E-4 | 0.00E+0 | 7.75E-3 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 7.30E-3 | 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 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| EET | MJ | 0.00E+0 | 0.00E+0 | -2.50E-2 | -2.50E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | -1.44E+0 |
| EEE | MJ | 0.00E+0 | 0.00E+0 | -1.45E-2 | -1.45E-2 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | -8.38E-1 |

**CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

# 5 Results

## 5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER SQUARE METER

### BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per square meter:

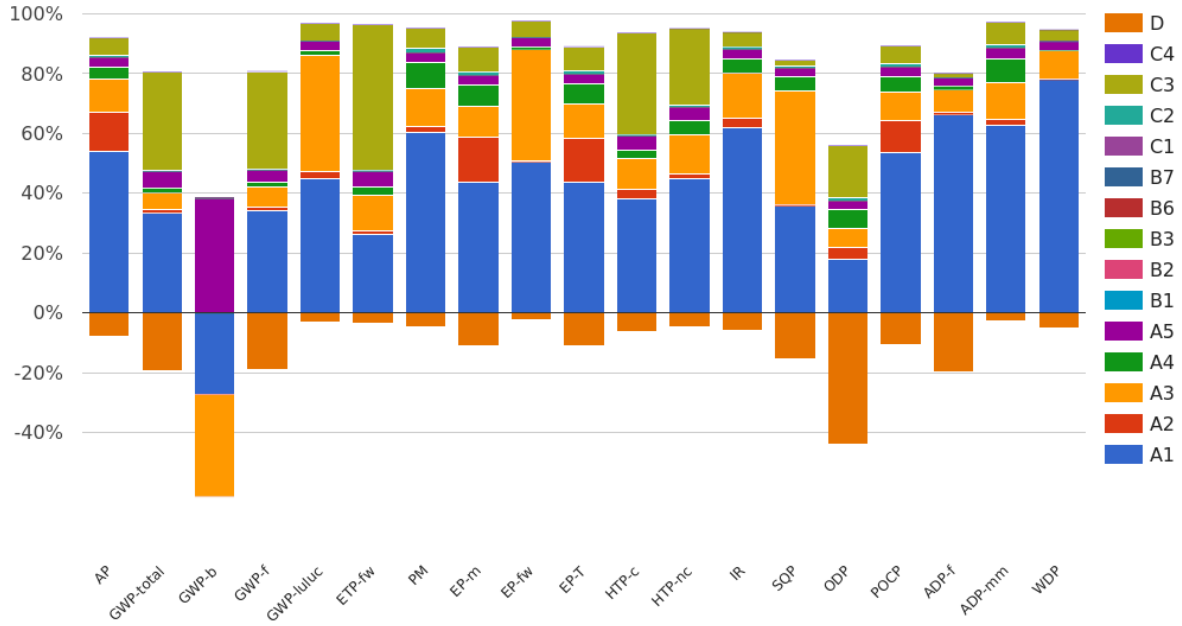
| Biogenic carbon content | Amount | Unit |
|---|---|---|
| Biogenic carbon content in the product | 0 | kg C |
| Biogenic carbon content in accompanying packaging | 0.004139 | kg C |

### UPTAKE OF BIOGENIC CARBON DIOXIDE

The following amount of carbon dioxide uptake is taken into account. Related uptake and release of carbon dioxide in downstream processes are not taken into account in this number although they do appear in the presented results. One kilogram of biogenic Carbon content is equivalent to 44/12 kg of biogenic carbon dioxide uptake.

| Uptake Biogenic Carbon dioxide | Amount | Unit |
|---|---|---|
| Packaging | 0.01518 | kg CO2 (biogenic) |

# 6 Interpretation of results




It has been analysed what the contribution is of the modules to the total GWP per functional unit. In the next table it is shown which phase(s) contribute(s) most and how much (the (high) contribution of module A1-A3 is mainly due to module A1 (raw materials):

| Phase/ module | GWP/ m2 | share |
|---|---|---|
| A1-A3 Production | 0.426 | 66% |
| A4-5 Construction | 0.074 | 11% |
| C1-C4 + D End-of-life | 0.151 | 23% |
| **Total** | **0.65** | **100%** |

# 7 References

**ISO 14040**
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

**ISO 14044**
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14044:2006

**ISO 14025**
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

**EN 15804+A2**
EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

**General PCR Ecobility Experts**
Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14)

**Specific PCR**
Product category rules EN 15804 +A2 NPCR 022 Part B for roof waterproofing version 2.0
Issue date: 31.03.2022 Valid to: 06.06.2023 validity extended to 31.12.2024 (PCR EPD Norge)

**Backgrounddatabase**
Ecoinvent 3.6

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|---|---|---|

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