ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Diadem
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-DIA-20250332-IBC1-EN
Issue date	17.02.2026
Valid to	16.02.2031

Green Roof System

Diadem® APP Kft.

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

Diadem® APP Kft.

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-DIA-20250332-IBC1-EN

This declaration is based on the product category rules:

green roof systems, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

17.02.2026

Valid to

16.02.2031

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

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Green Roof System

Owner of the declaration

Diadem
Fehérvári út 75
9028 Gyor
Hungary

Declared product / declared unit

1 m² Green Roof System (average product)

Scope:

The declared weighted average product represents 1 m² of a Green Roof System produced by Diadem APP Kft, based in Győr, Hungary. This weighted average product is derived from three systems: Diadem® 150, Diadem® 350, and Diadem® 750. The system components are sourced and collected in Hungary. The vegetation layer of the green roof system is not included in this declaration.
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.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Erik Poppe,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The green roof system Diadem® is designed to permanently provide a habitat for specific plant species (vegetation) on flat and slightly sloped roofs. It stores water, drains excess water, and protects the underlying roof structure.

The system is made up of various functional layers (see Figure 1) that are installed on a root-resistant waterproofed roof. The root-resistant waterproofing does not belong to the green roof system but is part of the overall roof structure.

First, a protective mat (1) is laid to shield the waterproofing from mechanical damage and to store rainwater. Above the mat (1), drainage (2) and water storage elements with indentations on their upper surface and channels on their lower surface are placed. These elements are then covered with the filter layer (3), which ensures the drainage function is permanently maintained. On top of the filter layer is added a layer of mineral substrate (4), consisting mainly of crushed mineral materials.

Ultimately, the system's substrate layer is greened (5) through seeding, planting, or the application of pre-grown vegetation mats; however, the plants themselves are not included in this EPD. Layers 1–4, as shown in Figure 1, are included in this EPD.

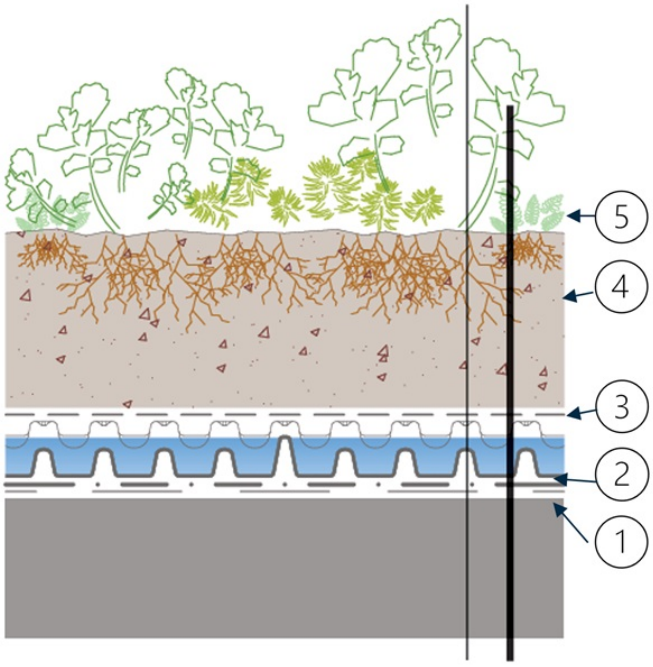


Fig. 1: Layer overview Green rooftop system

The considered product group of this average EPD covers 3 product systems:

- DIADEM® 150
- DIADEM® 350
- DIADEM® 750

The primary difference between these products is in the height of the substrate layer. Depending on the vegetation type, the substrate layer height can range from 4 cm to more than 50 cm. The other components do not differ significantly.

Product according to *CPR* with *ETA*:

The *EU Regulation No. 305/2011 (CPR)* applies to the placing on the market in the European Union/European Free Trade Association EU/EFTA (excluding Switzerland). The product requires a declaration of performance considering the European Technical Assessment *ETA-17/1015* titled 'Kits for Green Roofs' dated October 2, 2018, and a CE marking. The respective national regulations apply for use.

2.2 Application

The Diadem® green roof system is installed on top of the typically root-resistant waterproofing on sufficiently load-bearing flat roofs or slightly sloped roofs, following the sequence of components outlined in the 'Product Description/Product Definition' section. Roofs that are greened with this system provide ecological, urban planning, and constructional advantages. These include the creation of new habitats for flora and fauna, urban gardening, the establishment of buffer areas to improve the microclimate and areas for water retention. Depending on the substrate height, different types of vegetation layers can be planted. These vegetation layers can range from grass to small trees.

- Diadem® 150: extensive green roof
- Diadem® 350: semi-Intensive roof
- Diadem® 750: intensive roof

2.3 Technical Data

Among other standards, the requirements of the European Technical Assessment *ETA-17/1015*, titled '*Kits for Green Roofs*' and dated 2nd October 2018, apply to the green roof system. The performance characteristics specified in this assessment are presented in the following table:

Constructional data

Name	Value	Unit
water storage capacity	36	Vol.-%
Retention (System maximum water retention capacity)	36	l/m^2
pH value of the vegetation support layer	7.6 - 8	-
runoff coefficient C	0.29	-
salt content of the growing media (KCl)	≤140	mS/m
Fire resistance class for growing media (EN 13501-1)	E	-
system sound absorption (EN ISO 10140-1 / EN ISO 10140-2)	n/a	dB
System height	40 to >500	mm
System height Diadem® 150	40-150	mm
System height Diadem® 350	120-350	mm
System height Diadem® 750	>500	mm
System weight saturated	≥ 150-750	kg/m^2
System weight satured Diadem® 150	≥ 150	kg/m²
System weight satured Diadem® 350	≥ 350	kg/m²
System weight satured Diadem® 750	≥ 750	kg/m²

2.4 Delivery status

The scope of delivery of the Green Roof System includes the following components delivered in the following way:
The protection mat is delivered in rolls, the drainage and water storage elements are delivered in panels, and the filter fleeces in rolls. The system substrate is delivered in big bags. All materials are assembled in Diadem´s warehouse and then

transported together customer specific to the construction sites. Depending on the chosen system, 180–650 kg/m² will be delivered. For the weighted average EPD, 185 kg/m² is considered. The average is calculated based on the sales volume of 2023.

2.5 Base materials/Ancillary materials

The Diadem Green roof system consists of the following components (average product):

- Approx. 98 mass % mineral substrate
- Approx. 0,8 mass % drainage panels made from HIPS (1,4-2,2 kg/m²)
- Approx. 0,2 mass % protective fleece made from PES (0,3-0,5 kg/m²)
- Approx. 0,09 mass % filter fleece made from PP (0,15-0,2 kg/m²)

While the fleece layers and the drainage components do not differ significantly between the various delivery forms of the roof system, the substrate layer can vary in height from 4 cm to more than 65 cm, depending on the planned vegetation. The substrate has a bulk density of 1.10–1.20 g/cm³.

The vegetation layer is out of scope of these EPD.

The product contains substances on the *ECHA* list of substances of very high concern (SVHC) (as of April 11, 2022) over 0.1 mass percent: no.

This product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: 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 (EU) Ordinance on *Biocidal Products No. 528/2012):* no.

2.6 Manufacture

The following production steps are carried out by the suppliers from which Diadem APP Kft. sources its components:

- The substrate is produced in a single step. Naturally occurring plant substrate is mixed with specialized substances that enhance vegetation survival.
- Textiles are pneumatically manufactured from PES for the protective fleece and PP for the filter fleece. The fabrics are mechanically reinforced and subsequently processed during tailoring.
- Drainage elements are produced through vacuum forming, using HIPS material.

At Diadem APP Kft., the purchased components are customized to the required sizes and packaged according to the customer's project specifications. This step generates no production waste, and only electricity is required to operate the storage warehouse.
The substrate is delivered to the warehouse in reusable big bags. The fleece layers are supplied on rolls placed on reusable wooden EURO-pallets, without any additional packaging. Due to the reusability of the packaging materials, it is assumed that they have a negligible influence on the results and are therefore excluded from the calculation (cut-off).

2.7 Environment and health during manufacturing

The management at Diadem is *ISO 9001* and I*SO 14001* certified.
The maximum workplace concentrations (MWC) are regularly monitored, and the corresponding limit values are not exceeded in the production process.
The national and plant-specific environmental protection requirements are met during the manufacturing process. The cooling water for product cooling is recirculated. Optimal use of raw materials is achieved through recycling.

2.8 Product processing/Installation

The system elements are stacked in the correct order without using connecting elements or fixtures. The system is manually assembled on the roof. No machinery or tools requiring energy are needed.
The different layers of the system are laid out on the roof one after the other (see fig.1). The fleece layers and drainage panels are individually cut to size during installation. It is assumed that 5 % cutting waste is generated for the fleece materials and drainage panels.

2.9 Packaging

The textiles are rolled up, individually packed, wrapped in plastic film, and then transported on wooden EURO-pallets. The load is secured with plastic film. The substrate is transported in big bags. Drainage panels are stacked and wrapped in film and transported on wooden EURO-pallets. The EURO-pallets and big-bags are reused from APP Kft.. Cardboard and plastic film are considered as waste and will be sent to an incineration plant.

2.10 Condition of use

During the usage period, there may be a slight migration of substances. During the usage period, there is no change in the properties.

2.11 Environment and health during use

The slight weight changes according to various test methods suggest that the ecological impact of the migrating substances is minimal.

2.12 Reference service life

Modules B1-B7 are excluded and, therefore, RSL is not declared.

2.13 Extraordinary effects

Fire

According to *EN 13501:1*: The classes of building products regarding their fire performance are predefined as E.

Fire protection

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

Water

There are no known environmental impacts associated with water exposure from the Diadem® green roof systems.

Mechanical destruction

There are no possible environmental impacts following unforeseeable mechanical destruction.

2.14 Re-use phase

Diadem products are deconstructed and partly recyclable at the end of their service life. The loosely installed drainage panels can be dismantled separately from the other layers and the substrate during deconstruction and are subsequently recyclable. After thorough cleaning, the material is recycled through manual shredding and re-pelletizing.
The remaining layers and packaging materials (except for

EURO-pallets) are not reusable and are sent for incineration with energy recovery.

2.15 Disposal

The following are the waste code numbers according to the *European Waste Catalogue* (EWC) as per the *Waste Catalogue Ordinance* (AVV) for the individual product components.

Packaging
The components of the packaging that arise during installation in the building have the following waste code number:
- 15 01 01: Packaging made of paper and cardboard
- 15 01 02: Packaging made of plastic
- 15 01 03: Packaging made of wood

End of life
The product at the end of its life has the following waste code number:
- 17 09 04: Mixed construction and demolition waste

In general, material recycling is preferable to thermal recovery.

2.16 Further information

More information about the products can be found under:
https://diadem.com/de/

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is one square meter of installed Diadem Green Roof System (without root protection and vegetation layer). An average was built mass-based as a weighted mean from the annual production quantities 2023 of the three delivery forms Diadem® 150, Diadem® 350 and Diadem® 750. Accordingly, the following system layer thickness and grammage per m² is calculated. The overall weight is mainly influenced by the selected substrate height.
The results of the individual delivery forms can be found in the annex. The main difference between these forms is also the system height. Specification can be found in chapter 2.3.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	m^2
Layer thickness Average Product	0.16	m
Grammage (dry) Average Product	186	kg/m^2

3.2 System boundary

The EPD is cradle-to-gate with options (A4, A5), modules C1-C4 and module D.
The following modules were considered for calculating the LCA:

- A1: Raw material supply and processing
- A2: Transport and delivery of the base material
- A3: Production process
- A4: Transporting the system the to client
- A5: Installation and waste product packaging
- C1: deconstruction of the product from the building
- C2: Transport EoL
- C3: Waste processing for reuse, recovery or recycling
- C4: waste disposal
- D: Re-use, recovery and/or recycling

The product stage (A1-A3):
According to *EN 15804+A2*, these modules include the raw material and pre-products supply and processing including product packaging and auxiliary materials, the transport of the components to Diadem APP Kft., and the manufacturing processes for the components at Diadem A.P.P Kft., which in this case only includes the electricity consumption of the storage warehouse. There are no manufacturing losses, as waste only appears at A5 during installation. Inbound packaging of pre-products are excluded since only reusable EURO-pallets are used. BigBags for the transportation of the mineral substrate are included.

Transport to the building site (A4):
The green roof top systems are sold from Hungary across the whole of Europe, including England. As a worst-case scenario, a transport by lorry and then by ship is assumed for transport to the customer.

Installation (A5):
This module covers the installation or assembly of the green roof systems on the respective roof. During installation, approx. 5% plastic cutting waste is produced, which is incinerated with energy recovery. The disposal of plastics and product packaging (cardboard and plastic film, BigBag) in a waste incineration plant is considered in A5. The indicators EEE and EET are considered in A5. Credits in D.

Use phase (B1):
Emissions from the use phase are not declared, since vegetation does not need maintenance.

End of-Life stage (C1-C4):
Deconstruction of the system (C1): According to the manufacturer, all system components of the Green Roof System are properly deconstructed by hand, without the use of machines. Therefore, no loads are considered in this module.

Transport to the EoL treatment (C2): A standard distance of 50 km is assumed; (may be adapted on building level).

According to the requirements of the *PCR Part A, 6.2*, a combination of recycling and waste incineration is assumed for the waste treatment and disposal.

Waste treatment (C3): Both fleece layers (numbers 3 and 1 in Fig. 1) are non-reusable, classified as waste, and processed at a waste incineration plant with energy recovery. A credit for the energy recovery is considered in D and the exported energy is reported (indicator EEE and EET are reported in C3).

The drainage panels can be fully separated by type during dismantling. For this reason, a recycling scenario was calculated in C3/1, where the panels are considered as recycled and the fleece layers are incinerated. A sorting and recycling process is modeled, including an overall loss rate of 5 % during the process. This scenario should be considered a best-case scenario and is highly dependent on individual decisions made during the dismantling of the system. Credits for avoiding primary material production are included in Module D/1.

Waste disposal (C4): Disposal of inert and biodegradable waste (European Scenario) is considered for the mineral substrate.

Beyond the system Boundary:
Benefits & loads beyond the system Boundaries (D): The component Diadrain (drainage panel) can be recycled and the fleece layers are considered as waste and will be incinerated with energy recovery. Therefore, there are benefits considered for these plastic components at the End of Life phase.
For the recycling of the HIPS drainage panels, a substitute dataset with the same raw material from A1 (excluding

component manufacturing) is used. For the energy recovery credit after incineration, the dataset for the European electricity grid mix and thermal energy from natural gas are used as substitutes.

According to *PCR Part A*, the residual mix shall be used for the selection of the electricity mix. As the production site of Diadem APP Kft. is located in Hungary, the residual grid mix for Hungary applies.

3.3 Estimates and assumptions

Primary data was used for the electricity consumption at the storage warehouse. For the production of the materials used in the Green Roof system, generic data was primarily sourced from *Sphera's MLC* database, version 2025.1. For cardboard packaging and PES, an *ecoinvent 3.10* dataset was used since no suitable dataset was available in MLC database.
The assumptions made can be found in the respective modules under chapter 3.2 System boundaries.

3.4 Cut-off criteria

Due to limited and reliable information, a cut-off was defined and applied for the pallets used in inbound packaging, in accordance with PCR Part A. The EURO wooden pallets are reused, and it is assumed that their environmental impact is negligible. No additional cut-offs have been applied.

3.5 Background data

The LCA calculation is performed using the software *LCA for Experts* by *Sphera*. The background data utilized originates from *Sphera*'s *MLC database*, version 2025.1. For cardboard packaging and PES, an *ecoinvent 3.10,* cut-off system model, dataset is used, as no corresponding MLC dataset was available for mapping.

3.6 Data quality

The data sets are based on the current production data (data collection in 2024) and are representative for the reference year 2023. The background data used refers to the years 2021-2024. Accordingly, the temporal representativeness of the foreground and background system can be described as good.

The geographical scope of the study is determined by the production of raw materials in Europe and assembly at Diadem A.P.P. Kft. in Hungary. Therefore, European and Hungarian data sets are preferred for the respective processes. If this was not possible, global data was used. European data sets were also used for product transportation and the end-of-life phase. The geographical representativeness of the background is considered good and for the foreground system it is considered as very good to good, only assumptions for the transport distances are made (A4, A5, C2).

The technological background of the data collected in the foreground system and mapped to database datasets in the background system corresponds to the state of the art and can be considered very good.
The data sets used are complete and comply with the system boundaries and the criteria for the exclusion of inputs and outputs. No long-term emissions (> 100 years) are included in the evaluation as they are not relevant. The software *LCA for Experts from Sphera* with *Sphera´s MLC database* version 2025.1 and *ecoinvent 3.10* were used for the modeling. All background data was taken from the underlying databases. The data quality can be considered good, as suitable data sets were available. Only a few assumptions for transportation distances and cutting waste during installation (5 % od plastics) are included in the calculations.

The LCA results for the average EPD can be considered robust, as they represent mass-weighted average of high-quality and measured activity data.

3.7 Period under review

The period under review for the collection of production data and the resulting averages is the reference year 2023. The collection of this data took place in 2024.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

3.9 Allocation

Allocation of co-production processes: No co-products are created during the production of the green roof systems, so no co-product allocation is necessary.

Allocation in the use of recycled and/or secondary raw materials:
In the end-of-life phase/downstream processes, the benefits of energy recovery (electricity and thermal energy) from the incineration of plastic and paper materials as well as material credits (C3/1) for avoided primary material production (avoided-burden approach) are taken into account.
Since only primary materials in A1-A3 are considered, a net calculation for the recycled material in C3/1 was performed due to material losses/cuttings in modules A5 and C3. The results are accordingly reported under the MFR indicator in C3/1 and the SM indicator in D/1.

3.10 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. *Sphera Managed LCA Content* (MLC) 2025.1 and *ecoinvent 3.10.* with the cut-off system module, are used as background databases.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The product does not contain biogenic carbon content. The vegetation of the green roof system is excluded due to the wide range of plants that can be used. Only the packaging used for transportation (cardboard) has a biogenic carbon content of 0.46 kg C/kg cardboard.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging (declared product)	0,07	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Information about the electricity mix in A3:

The dataset for the residual grid mix of Hungary from Sphera's MLC database is used. Due to licensing agreements, it is not permitted to share the emission factors.

Transport to the building site (A4)

Name	Value	Unit
Transport distance lorry	750	km
Capacity utilisation (including empty runs)	80	%
Transport distance ship	750	km
Capacity utilisation Including empty runs)	70	%

Installation into the building (A5)

Name	Value	Unit
Material loss: Cuttings fleece layers and drainage panel	5	%
Material loss: Cuttings fleece layers and drainage panel	0,097	kg
Plastic incineration with energy recovery (cuttings and packaging)	0,272	kg
Paper incineration with energy recovery	0,138	kg

End of life (C1-C4)

Name	Value	Unit
Transport distance	100	km
C3 Incineration with energy recovery (average), PP, PES and HIPS	1,84	kg
C3/1 Recycling HIPS (average)	1,39	kg
C3/1 Incineration with energy recovery (average), PP and PES	0,451	kg
Landfill (substrate, average)	184,48	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Energy recovery EEE from plastic incineration in A5	1,05	MJ
Energy recovery EET from plastic incineration in A5	2,4	MJ
Energy recovery EEE from paper incineration in A5	0,296	MJ
Energy recovery EET from paper incineration in A5	0,537	MJ
Energy recovery EEE from plastic incineration in C3	7,1	MJ
Energy recovery EET from plastic incineration in C3	16,45	MJ
Recycling material (HIPS) in C3/1 (net amount)	1,32	kg
Energy recovery EEE from plastic incineration in C3/1	1,74	MJ
Energy recovery EET from plastic incineration in C3/1	4,03	MJ

5. LCA: Results

Characterization model: EN 15804 - 2012+A2 - 2019 (based on EF 3.1).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

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	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² Green Roof System

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	D	D/1
GWP-total	kg CO_2 eq	1.25E+01	1.59E+01	8.47E-01	0	1.92E+00	4.66E+00	1.79E+00	3.14E+00	-2.12E+00	-3.99E+00
GWP-fossil	kg CO_2 eq	1.25E+01	1.57E+01	6.43E-01	0	1.9E+00	4.65E+00	1.79E+00	2.83E+00	-2.11E+00	-3.96E+00
GWP-biogenic	kg CO_2 eq	-3.06E-02	6.36E-02	2.04E-01	0	8.39E-03	7.78E-05	1.06E-03	2.91E-01	-9.8E-03	-1.9E-02
GWP-luluc	kg CO_2 eq	3.8E-02	1.51E-01	7.81E-05	0	2E-02	4.41E-04	4.34E-04	1.16E-02	-2.49E-03	-1.35E-03
ODP	kg CFC11 eq	1.06E-07	2.58E-12	1.46E-13	0	3.23E-13	1.67E-12	8.07E-12	7.89E-12	-1.7E-11	-1.18E-11
AP	mol H^+ eq	3.13E-02	5.68E-02	2.61E-04	0	3.87E-03	8.08E-04	1.13E-03	2E-02	-2.27E-03	-5.55E-03
EP-freshwater	kg P eq	8.81E-04	3.98E-05	3.65E-07	0	5.25E-06	2.21E-07	9.52E-07	4.21E-06	-1.67E-06	-4.85E-06
EP-marine	kg N eq	9.43E-03	2.43E-02	8.7E-05	0	1.68E-03	1.81E-04	3.03E-04	5.24E-03	-6.81E-04	-1.5E-03
EP-terrestrial	mol N eq	9.77E-02	2.63E-01	1.23E-03	0	1.8E-02	3.74E-03	3.71E-03	5.71E-02	-7.6E-03	-1.64E-02
POCP	kg NMVOC eq	3.28E-02	5.83E-02	2.22E-04	0	3.49E-03	4.97E-04	8.42E-04	1.57E-02	-1.87E-03	-6.12E-03
ADPE	kg Sb eq	2.61E-05	1.02E-06	1.84E-09	0	1.29E-07	1.62E-08	5.01E-08	1.75E-07	-1.85E-07	-3.06E-07
ADPF	MJ	2.84E+02	2.05E+02	3.32E-01	0	2.49E+01	2.38E+00	1.23E+01	3.72E+01	-3.67E+01	-1.09E+02
WDP	m^3 world eq deprived	1.44E+00	6.83E-02	1.32E+00	0	8.9E-03	4.35E-01	1.41E-01	3.06E-01	-1.88E-01	-2.61E-01

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; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² Green Roof System

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	D	D/1
PERE	MJ	1.92E+01	1.43E+01	2.01E+00	0	1.88E+00	7.56E-01	2.05E+00	7.17E+00	-1.04E+01	-6.46E+00
PERM	MJ	1.93E+00	0	-1.93E+00	0	0	0	0	0	0	0
PERT	MJ	2.11E+01	1.43E+01	8E-02	0	1.88E+00	7.56E-01	2.05E+00	7.17E+00	-1.04E+01	-6.46E+00
PENRE	MJ	2.84E+02	2.05E+02	2.35E+01	0	2.49E+01	1.49E+02	4.91E+01	3.72E+01	-3.67E+01	-1.09E+02
PENRM	MJ	8.49E+01	0	-1.16E+01	0	0	-7.32E+01	-7.32E+01	0	0	0
PENRT	MJ	3.69E+02	2.05E+02	1.19E+01	0	2.49E+01	2.38E+00	-2.41E+01	3.72E+01	-3.67E+01	-1.09E+02
SM	kg	0	0	0	0	0	0	0	0	0	1.32E+00
RSF	MJ	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0
FW	m^3	4.81E-02	7.07E-03	3.07E-02	0	9.29E-04	1.04E-02	4.77E-03	8.97E-03	-8.12E-03	-1.7E-02

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² Green Roof System

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	D	D/1
HWD	kg	1.08E-01	8.34E-09	1.52E-10	0	1E-09	1.61E-09	2.66E-09	8.13E-09	-2.02E-08	-1.53E-08
NHWD	kg	5.53E-02	2.68E-02	2.82E-02	0	3.48E-03	4.65E-01	1.18E-01	1.86E+02	-1.71E-02	-2.94E-02
RWD	kg	6.76E-03	3.74E-04	9.18E-06	0	4.71E-05	7.44E-05	1.43E-03	3.95E-04	-2.4E-03	-1.21E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	1.39E+00	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	1.34E+00	0	0	7.1E+00	1.74E+00	0	0	0

EET	MJ	0	0	2.94E+00	0	0	1.64E+01	4.03E+00	0	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m² Green Roof System

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	D	D/1
PM	Disease incidence	1.76E-06	9.7E-07	1.54E-09	0	3.15E-08	9.23E-09	1.13E-08	2.49E-07	-1.85E-08	-4.81E-08
IR	kBq U235 eq	8.55E-01	5.29E-02	1.16E-03	0	6.76E-03	7.46E-03	2.34E-01	4.37E-02	-3.96E-01	-1.84E-01
ETP-fw	CTUe	2.54E+02	2.48E+02	1.97E-01	0	3.24E+01	9.17E-01	1.42E+00	2.87E+01	-2.89E+00	-6.07E+01
HTP-c	CTUh	8.1E-08	3.36E-09	1.08E-11	0	4.38E-10	7E-11	8.09E-11	4.95E-10	-3.51E-10	-1.14E-09
HTP-nc	CTUh	1.22E-07	1.86E-07	5.11E-10	0	2.45E-08	5.38E-09	3.12E-09	1.85E-08	-5.48E-09	-1.84E-08
SQP	SQP	3.23E+01	8.31E+01	9.86E-02	0	1.1E+01	6.72E-01	1.14E+00	9.18E+00	-6.11E+00	-3.88E+00

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

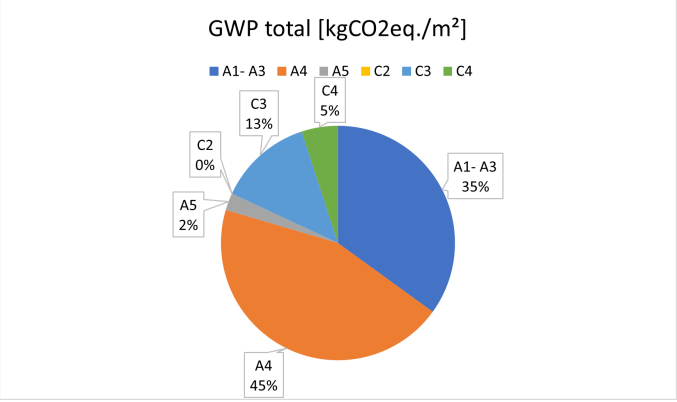
Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

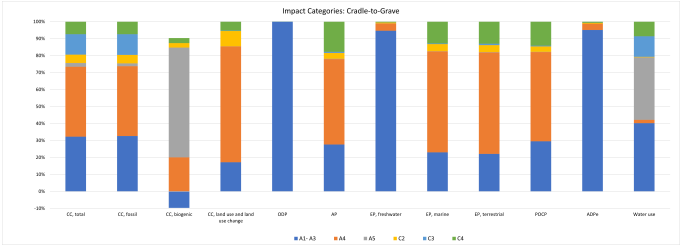
6. LCA: Interpretation

The largest share of the Global Warming Potential total can be attributed to transportation to the customer (A4), accounting for 45 %. For transportation, a worst-case scenario from Hungary to England was calculated. The actual transport distance can vary significantly within Europe and should be assessed on a case-by-case basis.
The second-largest contributor to the GWP total are the cradle-to-gate emissions (A1-A3), which amount to approximately 35 %. Within the A1-A3 system boundaries, the inputs in A1 account for 77 % of the total GWP of the green roof system. Among the inputs in A1, the drainage panels made of HIPS contribute the largest share of emissions, at around 50 %.

The average EPD is based on a weighted average calculated using the 2023 sales volume of the three delivery forms of the green rooftop system. Diadem 150® accounts for 95 % of the potential environmental impacts, Diadem 350® for 4 %, and Diadem 750® for 1 %. The results for the different delivery forms vary due to the specific weight of each system. This weight is primarily influenced by the height of the substrate layer, which can be chosen individually. The substrate accounts for 10 % of the total cradle-to-gate (A1-A3) emissions of the average product. A total of 184.5 kg/m² of substrate was modeled. To provide greater transparency, the results for the three systems are detailed in the ANNEX.



Apart from the categories of Eutrophication – Freshwater, Ozone Depletion, and Resource Use (minerals and metals), transportation to the customer (A4) is also identified as the most significant lifecycle stage. However, it should be noted that a worst-case scenario was assumed for transportation, involving delivery to England (750 km by truck and 750 km by ship). Distribution occurs across Europe, though shorter distances from Hungary are also possible.



When interpreting the results, it should be considered that various assumptions and estimates were made, particularly regarding transportation to the customer.

7. Requisite evidence

According to *PCR Part B* no proofs are required.

8. References

EN 15804
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

EN 13501-1
EN 13501-1:2009, Fire classification of construction products and building elements - Part1: Classification using test data from reaaction to fire tests.

EN ISO 10140
EN ISO 10140-1:2021-09, Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products
EN ISO 10140-2:2021-09, Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation

ISO 9001
DIN EN ISO 9001:2015, Quality management systems–Requirements.

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

CPR Regulation
Regulation (EU) No 305/2011 of the European Parliament and of the Council of March 2011, laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

BPR Regulation
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of the biocidal products (Text with EES relevance)

CLP Regulation
Regulation (EG) no. 1272/2008 of the European Parliament and of the Council of December 16, 2008,on classification, labeling, and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) no. 1907/2006 (Official Journal L 353 dated December 31, 2008, p. 1–1355), last amended by Delegated Regulation (EU)2021/1962 of the Commission dated August 12, 2021 (Official Journal L 400/16).

AVV
Guideline in the Application of the Waste Catalogue Ordinance-December 2002, last amended by Article 2 July 2002

ECHA
European Chemicals Agency: Candidate List of substances of very high concern, 2022

Ecoinvent database
Ecoinvent database version 3.10, 2024

Sphera´s Managed LCA Content (MLC)
Sphera MLC database, 2025.1

ETA-17/1015
European Technical Assessment- ETA-17/1015 of October 2018

EWC
European Waste Catalogue- Comissions decision 200/532/EC2

IBU 2021
Institut Bauen und Umwelt e.V.: General guide for the EPD program of the Institut Bauen und Umwelt e.V.(IBU). Version 2.0, Berlin: Institut Bauen und Umwelte.V., 2021.www.ibuepd.com

PCR part A
Product category rules for building-related productsand services. Part A: Calculation rules for the LCA and requirements for the background report, v. 1.4. Berlin:Institut Bauen und Umwelt e.V. (publisher), 2024.

PCR-Part B:
Requirements on the EPD for Green Roof Systems, Institut Bauen und Umwelt e.V. (IBU), v11;
08/2024

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