Environmental Product Declaration

EPD®

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EPD
VERIFIED

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Extensive Green Roof System:
Veg Tech Sedumbakker med biokul

From Veg Tech AB

Veg Tech

Programme:	The International EPD® System, www.environdec.com
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General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR) CEN standard EN 15804 serves as the Core Product Category Rules (PCR) Product Category Rules (PCR): Construction products, 2019:14, Version 1.2.5 PCR review was conducted by: *The Technical Committee of the International EPD® System.* Claudia A. Peña. *Contact via info@environdec.com*
Life Cycle Assessment (LCA) LCA accountability: *Amy Stockwell, Carbon Zero AB*
Third-party verification Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Vladimír Kočí, LCA Studio, Czech Republic* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes   ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Veg Tech AB

Contact: Mia Frisk mia.frisk@vegtech.se Veg Tech AB, Fagerås 1, 342 52 Vislanda, Sweden

Description of the organisation: Veg Tech is the leading supplier of vegetation technology in the Nordic region and is a part of Nordic Waterproofing Group. Veg Tech grow, develop and supply buildings and cities with multifunctional plant systems that contribute to stormwater management, improve water quality and benefit biodiversity.

Name and location of production site(s): Copenhagen, Denmark

Product information

Product name: Extensive Green Roof System: Veg Tech Sedumbakker med biokul (sedum tray with biochar)

Application:
A green roof can be installed for different purposes; it provides many different benefits. For example, green roofs delay and reduce the amount of stormwater, counteract urban heat islands, benefit biodiversity and add value to residents since greenery has a positive effect on their well-being.

Veg Tech Sedumbakker is installed directly on top of the waterproofing membrane that is a part of the underlying roof construction. If properly installed and maintained, the sedum roof can last as long as the life of the building.

Product description:
Only a brief product description is included in this EPD. For further information and detailed product documentation, please visit www.vegtech.dk.

Veg Tech Sedumbakker is an extensive green roof system that is lightweight, has high water retention capacity and is easy to install.

The product consists of a pre-planted tray with built-in drainage and water reservoir. The tray is filled with a mineral growth media (substrate) that forms the plant bed and is optimized for the conditions prevailing on roofs. The use of biochar in the substrate entails soil-improving properties that are especially important for greenery in urban environments. Biochar is also a potential carbon sink. (See further information in section "Additional information"). The vegetation consists of drought-resistant species from the Crassulaceae family adapted to the Nordic climate. The sedum trays are cultivated in open fields in Denmark.

Constructional data

Name	Value	Unit
System height (tray)	47	mm
System weight unsaturated (dry)	~30	kg/m^2
System weight saturated	~50	kg/m^2
Retention (system maximum water retention capacity)*	~25	l/m^2
Runoff coefficient C**	C_s = 0,6/0,7	-
Fire resistance class for growing media (EN 13501-5:2016)	B_{ROOF}(t2)	-

* Roof slope 1-2°

** According to the FLL Green Roof Guidelines edition 2018 (roof pitch up to/greater than 5°, 4-6 cm substrate)

LCA information

Functional unit / declared unit: 1 m² of Veg Tech Sedumbakker med biokul system.

Reference service life:
If properly mounted and maintained the vegetation is gradually rejuvenated and Veg Tech green roof systems can have the same service life as the building. Thus, a set reference service life cannot be determined.

Time representativeness: The year studied for this EPD is 2022.

Database(s) and LCA software used:
LCA for Experts v 10.7.0.183 (previously called GaBi) with an integrated Ecoinvent database 3.8.

Description of system boundaries:
Cradle to gate with options, modules A1-A5, B2, C1-C4, D.
The maintenance module B2 comprises all maintenance activities required to sustain the useability of the product during its installed lifetime. The B-module is calculated and presented per 1 year in accordance with c-PCR part B. All other parts of the B module are assumed to be 0.

System diagram:
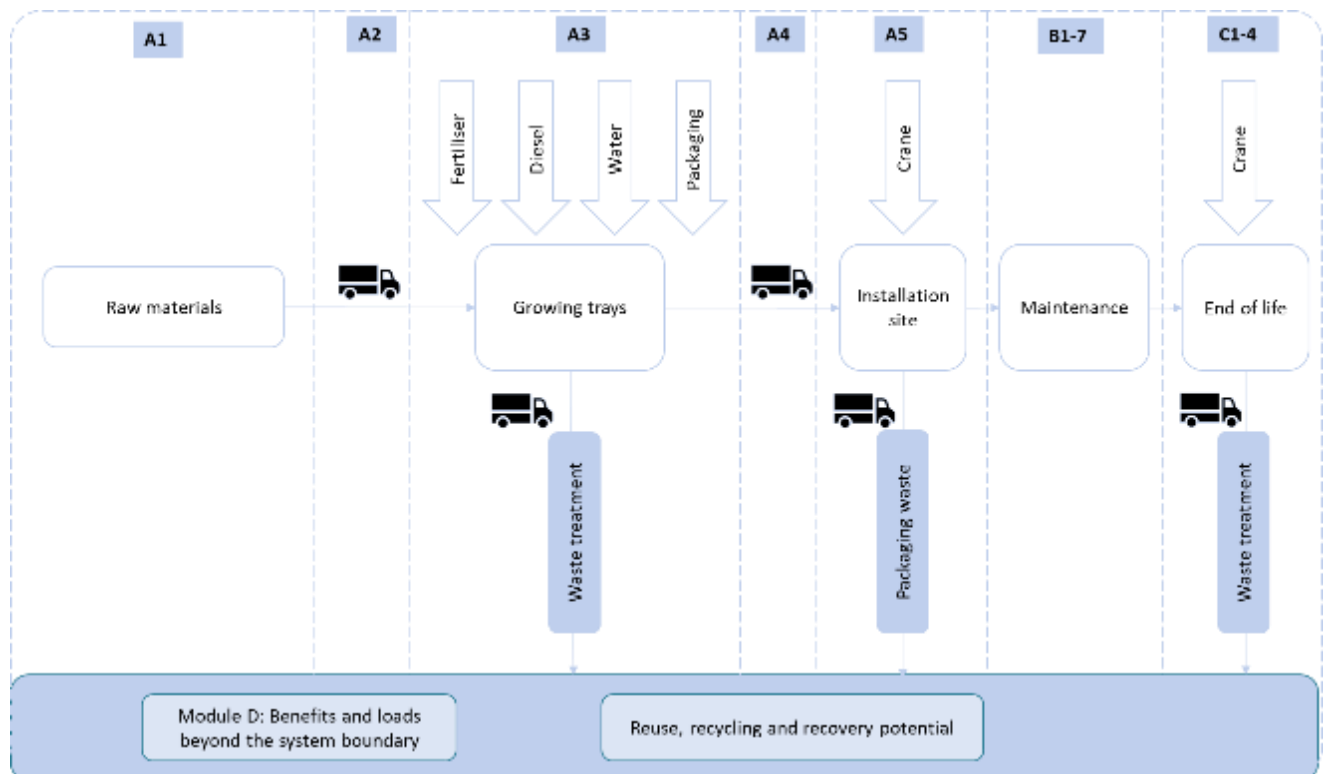
Modines declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	-	X*	-	-	-	-	-	X	X	X	X	X
Geography	EU	EU	DK	DK	DK	-	DK	-	-	-	-	-	DK	DK	DK	DK	DK
Specific data used	Specific data used in modules A1-A3			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0 %			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0 %			-	-	-	-	-	-	-	-	-	-	-	-	-	-

* B2 module is annual

LCA: additional technical information

The following information describes the different modules of the EPD.

Production stage (A1-A3)

The Veg Tech Sedumbakker med biokul is made from a tray, a growing substrate and seeds. These are combined, and the vegetation is grown at the manufacturing site in Denmark. The substrate contains biochar (biokul), which was modelled using data from the supplier.

Transport to user (A4)

The transport scenario is based on an average distance from Copenhagen to major cities in Denmark.

Type	Capacity utilisation	Type of vehicle	Distance	Fuel consumption
Truck	61%	Average truck trailer with a 27 t payload	300 km	1.59 E-02 kg/tkm

Installation (A5)

Module A5 covers the installation of the product at a construction site. The product is lifted to installation altitude using either a crane-truck or an electrical tower crane, depending on the installation site. A scenario where half of each installation method is applied. The A5 module also includes waste from packaging and installation, which is assumed to be incinerated.

Resource	Amount	Unit /m2
Diesel	8.3E-01	kg
Electricity	5.6E-01	MJ
Water	5.0E+00	kg
Waste to incineration	3.1E-01	kg

Maintenance (B2)

The results presented for module B2 refer to one year of usage. This is due to the full B module not being declared and that no reference service life has been determined. For calculating the full life cycle impact, the results in B2 hence need to be multiplied with the assessed time period of interest.

The maintenance module B2 is calculated for one year. Veg Tech sedum tray with biochar only needs to be fertilised every second year; the amount of fertiliser in the table below is the yearly average.

Resource	Amount	Unit /m^2
Fertiliser	1.5E-02	kg
Water	2.5E+00	l

End of life (C1-C3)

Deconstruction of the green roof system is done manually, where crane can be used to bring the waste to ground level if the altitude is high. Materials are separated and sent to composting for compostable material and the rest is treated per Statistics Denmark end of life data (mainly incinerated or recycled), with an assumed transport distance of 100km.

Resource	Amount	Unit /m²
Diesel	4.2E-01	kg
Waste for composting	5.3E+00	kg
Inert waste for composting	2.3E+01	kg
Waste for incineration	1.8E+00	kg
Plastic for recycling	1.2E+00	kg

End of life (C4)

No waste was assumed to be sent to the landfill. Here, the virtual emission of biogenic carbon from the product is included.

Benefits beyond the system boundary (D)

Here, credits for producing energy during incineration and recycled materials in C3 are included. For recycled materials, a 10% loss is assumed, and biomaterials are assumed to be composted.

Content information

Product components	Weight (dry), kg	Post-consumer material, weight-%	Biogenic material	
			weight-%	kg C/m²
Substrate	2.7E+01	0	2.8%	7.84E-01
Tray	1.2E+00	99.5 %	0	0
Plants	4.2E-01	0	44 %	1.8E-01
Other	3.0E-02	0	0	0
TOTAL	2.9E+01	4.1 %	2.8 %	8.12E-01
Packaging materials	**Weight (dry), kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/ m²**	
Pallet	1.2E+00	4.0 %	7.1E-01	
Plastic film	4.6E-03	0.01 %	0	
TOTAL	1.2E+00	4.0 %	7.1E-01	

There are no dangerous substances from the candidate list of SVHC for authorisation.

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	-3.82E+00	6.71E-01	3.08E+00	1.03E-02	1.03E-03	2.27E-01	6.76E+00	1.63E+00	-8.33E+00
GWP-fossil	kg CO_2 eq.	3.93E+00	6.75E-01	5.01E-01	1.02E-02	1.03E-03	2.28E-01	3.19E+00	0	-3.91E+00
GWP-biogenic	kg CO_2 eq.	-7.77E+00	-9.96E-03	2.58E+00	3.63E-05	3.47E-07	-3.36E-03	3.57E+00	1.63E+00	-4.42E+00
GWP- luluc	kg CO_2 eq.	8.44E-03	6.23E-03	4.42E-05	5.45E-06	1.03E-07	2.11E-03	2.26E-04	0	-2.73E-04
ODP	kg CFC 11 eq.	9.41E-08	6.63E-14	1.68E-08	1.88E-14	2.23E-10	2.68E-14	9.46E-13	0	-3.76E-10
AP	mol H^+ eq.	1.09E-02	1.27E-03	1.18E-03	2.59E-05	1.08E-05	4.31E-04	3.31E-03	0	-5.56E-03
EP-freshwater	kg P eq.	2.14E-04	2.46E-06	2.61E-06	2.70E-07	3.23E-08	8.37E-07	-1.05E-06	0	-6.53E-06
EP-marine	kg N eq.	2.67E-03	5.27E-04	4.96E-04	9.23E-06	4.80E-06	1.78E-04	1.19E-03	0	-1.55E-03
EP-terrestrial	mol N eq.	2.90E-02	6.01E-03	5.50E-03	1.15E-04	5.26E-05	2.03E-03	1.68E-02	0	-1.43E-02
POCP	kg NMVOC eq.	8.50E-03	1.13E-03	1.45E-03	1.01E-05	1.45E-05	3.84E-04	3.28E-03	0	-4.82E-03
ADP-minerals & metals*	kg Sb eq.	5.07E-06	4.39E-08	4.45E-08	3.62E-09	5.36E-10	1.50E-08	3.19E-09	0	-2.57E-07
ADP-fossil*	MJ	6.16E+01	9.19E+00	6.27E+00	1.54E-01	1.42E-02	3.13E+00	2.55E+00	0	-7.72E+01
WDP*	m^3	1.60E+00	8.09E-03	2.78E-01	1.08E-02	3.50E-05	2.93E-03	5.83E-01	0	-2.09E-01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption										

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

Resource use indicators

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
PERE	MJ	1.38E+02	6.86E-01	5.62E-01	1.35E-02	8.06E-05	2.55E-01	-5.71E-01	0	-1.41E+01
PERM	MJ	-5.72E+01	0	0	0	0	0	0	0	0
PERT	MJ	8.04E+01	6.86E-01	5.62E-01	1.35E-02	8.06E-05	2.55E-01	-5.71E-01	0	-1.41E+01
PENRE	MJ	9.32E+01	9.22E+00	6.27E+00	1.54E-01	1.42E-02	3.14E+00	2.56E+00	0	-7.72E+01
PENRM	MJ	-3.16E+01	0	0	0	0	0	0	0	0
PENRT	MJ	6.16E+01	9.22E+00	6.27E+00	1.54E-01	1.42E-02	3.14E+00	2.56E+00	0	-7.72E+01
SM	kg	1.84E-01	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	2.43E-01	7.69E-04	6.75E-03	2.40E-03	8.16E-07	2.94E-04	1.38E-02	0	-1.33E-02
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

Waste indicators

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.49E-09	2.58E-11	1.63E-10	1.91E-11	0	3.78E-12	8.74E-11	0	-6.04E-09
Non-hazardous waste disposed	kg	4.20E-01	1.37E-03	2.99E-02	7.20E-04	0	4.94E-04	2.44E-01	0	-3.34E-02
Radioactive waste disposed	kg	4.06E-04	2.64E-05	4.09E-04	3.40E-06	0	1.78E-05	8.65E-05	0	-3.24E-03

Output flow indicators

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
Components for re-use	kg	0	0	1.44E+00	0	0	0	0	0	0
Material for recycling	kg	0	0	0	0	0	0	3.32E-01	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	4.61E-01	0	0	0	9.32E+00	0	0
Exported energy, thermal	MJ	0	0	9.53E-01	0	0	0	1.67E+01	0	0

Additional mandatory and voluntary impact category indicators

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-GHG[1]	kg CO_2 eq.	-3.82E+00	6.61E-01	3.08E+00	1.03E-02	1.03E-03	2.24E-01	6.75E+00	0	-8.30E+00

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[1] This indicator allows comparison to EN15804+A1

Additional environmental information

General information about biochar

Biochar is a porous, carbonaceous material produced by the pyrolysis of plant biomass. If applied in such a way that the contained carbon remains stored long-term, it is a carbon sink. Since 2018, IPCC has recognized biochar as a CDR-method (Carbon Dioxide Removal) that can achieve negative emissions.

Biochar entails many benefits when used in a plant bed; it enhances the water and nutrient retention ability, improves soil structure, increases microbial activity and counteracts compaction.

Biochar contributes to a more efficient use of fertilisers The nutrients can be captured and retained in the growing medium until the plants have had time to absorb them. This minimizes the risk of nutrient leakage.

For further information, please visit www.biokol.org and www.european-biochar.org/en.

Biochar in Veg Tech Sedumbakker med biokul

The PCR 2019:14 construction products does not allow credits due to the permanent storage of biogenic carbon. The sum of the sequestered and emitted biogenic carbon must always be zero over the product's life cycle. If the biogenic carbon content of the product is permanently stored, then a virtual emission of biogenic carbon has to be added. In this EPD, the virtual biogenic carbon emission of the product is included in C4.

The amount of biochar in Veg Tech Sedumbakker corresponds to the following carbon sequestration:

Material	Mass kg/m^2	Biogenic carbon sequestered kg C/m^2	Biogenic CO_2 sequestered kg CO_2e/m^2
Biochar	2.00 E-01	1.78 E-01	6.53 E-01

Veg Tech

References

EN 15804:2012+A2	Sustainability of construction works – Environmental product declaration – Core rules for the product category of constructions products
EPD International (2021)	General Programme Instructions of the International EPD® System, version 4.0
IBU (2019)	PCR Guidance Texts for Building Related Products and Services. Part B: Requirements on the EPD for green roof systems v 1.0 2019-12-09
ISO 14020:2022	International Standard ISO 14020 – Environmental statements and programmes for products – Principles and general requirements
ISO 14025:2006	International Standard ISO 14025 – Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040:2006	International Standard ISO 14040: Environmental Management – Life cycle assessment – Principles and framework. Second edition 2006-07-01.
ISO 14044:2006	International Standard ISO 14044: Environmental Management – Life cycle assessment – Requirements and Guidelines.
PCR 2019:14	PCR 2019:14. v1.2.5. Construction products.
PCR 2021:07	PCR 2021:07 v 1.0 Biochar
Statistics Denmark	https://www.statbank.dk/AFFALD, visited 2023-04-12

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