Environmental Product Declaration Type III ITB No. 144/2021

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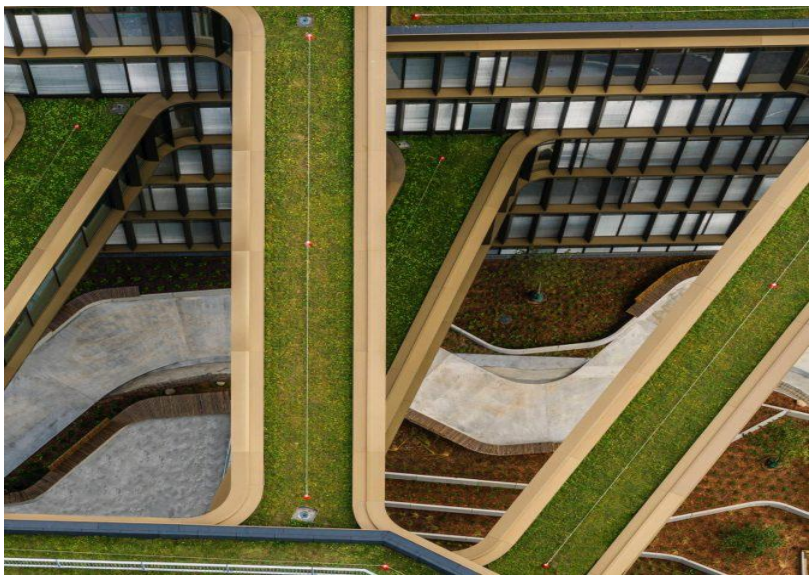
Green roof systems

Nature Roof Standard 60/25



Owner of the EPD

Nature Impact A/S
Address: Sdr Hojrupvejen 130
5750 Ringe, Denmark
Website: www.natureimpact.com
tel.: +45 65 98 22 23

EPD Program Operator

Instytut Techniki Budowlanej (ITB)
Address: Filtrowa 1,
00-611 Warsaw, Poland
Website: www.itb.pl
Contact: Justyna Tomaszewska
j.tomaszewska@itb.pl, energia@itb.pl

ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on PN-EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to PN-EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A3, C3, C4 and D according to PN-EN 15804 (Cradle to Gate with options)
The year of preparing the EPD: 2021
Service Life: 50 years for standard products
Product standard: FLL Green Roof Guidelines
PCR: ITB-PCR A (PCR based on PN-EN 15804)
Functional unit: 1 m^2 of Nature Roof Impact Standard 60/25
Reasons for performing LCA: B2B
Representativeness: Polish, Danish, European

MANUFACTURER

Fig 1. A view of Kompozycje Ozdobne - Karwice Sp. z o.o. in Karwice (Poland).

Nature Impact A/S is a Danish company that produces and delivers concept-based systems solution within green roofs and plant walls. Nature Impact was founded by the Larsen family in 2013. The family has been in the gardening and horticulture industry for 5 generations. Nature Impact A/S's nursery, Kompozycje Ozdobne - Karwice Sp z o. o., is located in north Poland.

PRODUCT DESCRIPTION AND APPLICATION

Fig 2. A view of Nature Roof Standard 60/25 module.

Nature Roof Standard 60/25 consists of plastic trays, substrate and plants – at least 8-12 species of sedum, 4 to 6 of them are naturally occurring species in Danish vegetation. Coverage minimum 90%. Can be applied to roofs with a slope of 0 to 25 degrees (above 14 degrees support profiles should be installed). The characteristics of the Nature Roof Standard 60/25 is presented in Tables 1 and 2.

Table 1. The specification of the Nature Roof Standard 60/25.

Physical properties of the substrare	Value	Reference value FLL
weight when fully saturated with water	1020 kg/m^3	–
weight when dry	554 kg/m^3	–
maximum water capacity	53%	≥ 35 ≤ 65
water permeability	12.1 mm./min.	0.6 – 70
total pore volume	75.5%	–
air volume at saturation with water	22%	≥ 10
organic matter content	61 g/L	≤ 65
PH (CaCl2)	6,9	6.0 – 8.5
EC	513 um/cm	–
salt content	2.04 g/L	≤ 3.5

Table 2. The composition of 1 m^2 of the Nature Roof Standard 60/25.

Component	Value	Unit
plastic trays (polyethylene terephthalate, PET)	4.7	kg/m^2
substrate (soil)	54	L/m^2
sedum cuttings	0.52	kg/m^2

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

The allocation rules used for this EPD are based on product mass basis in accordance with ITB PCR A. Production of the Nature Roof Standard 60/25 is a line process in nursery of Nature Impact A/S - Kompozycje Ozdobne - Karwice Sp. z o.o. in Karwice (Poland). Impacts from the global production of Kompozycje Ozdobne - Karwice Sp. z o.o. were inventoried and 60% was allocated to the production of the green roofs. All impacts from raw materials extraction were allocated in module A1 while electricity and energy resources consumption were allocated in module A3 of the LCA. The packaging materials were included in the system boundaries. Module A2 includes transportation of raw materials from their suppliers to Kompozycje Ozdobne - Karwice Sp. z o.o. in Karwice (Poland). Emissions and municipal wastes were allocated to module A3.

System limits

The life cycle analysis of the declared products covers “Product Stage”, A1-A3, C3, C4 and D modules (Cradle to Gate with options) in accordance with PN-EN 15804+A1:2014-04 and ITB PCR A. The details of the system limits are provided in the backgroud report. Energy and water consumption, emissions to air, soil and water as well as information on generated wastes were inventoried in the nursery and were included in the calculations. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with PN-EN 15804+A1:2014-04, machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 and A2 Modules: Raw materials supply and transport

Substrate (soil), plastic trays (PET), pallets and foil stretch come from both Polish and foreign suppliers. Means of transport include trucks with load: <10t, 10–16t and >16. For calculation purposes Polish and European fuel averages were applied.

A3: Production

The production process of the Nature Roof Standard 60/25 is presented in Fig. 3.

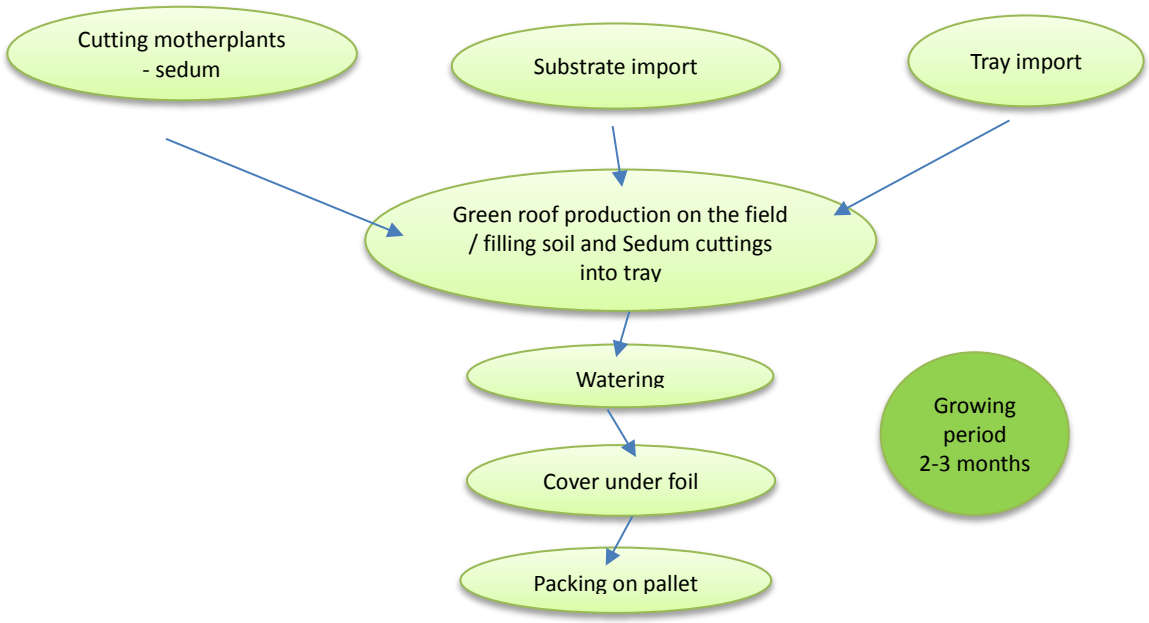


Fig. 3. A scheme of the production process of the Nature Roof Standard 60/25 by Kompozycje Ozdobne - Karwice Sp. z o. o.

C3, C4 and D Modules: End-of-life scenarios

It is assumed that at the end-of-life the Nature Roof Standard 60/25 is deconstructed manually. All recovered plants undergo composting and can be further re-used as a fertilizer. The substrate can be re-used for roads foundation or ballast replacing primary sand or gravel while the plastic trays undergo recycling, energy recovery and landfilling according to the Danish treatment practice of industrial wastes what is presented in Table 3. Module D represents benefits resulting from re-use of the substrate and use of the composted sedum as a fertilizer. For the calculations purposes it was assumed that the compost replaces the ammonium nitrate phosphate in the ratio of 2:1.

Table 3. End-of-life scenario for Nature Roof Standard 60/25.

Component	Material recovery	Re-use	Energy recovery	Landfilling / Composting
Sedum	100%	0%	0%	100%
Substrate	100%	100%	0%	0%
Plastic trays (PET)	100%	0%	98%	2%

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2019 – 31.12.2019 (1 year). The life cycle assessments were prepared for Poland as reference area.

Data quality

The values determined to calculate the LCA originate from verified Kompozycje Ozdobne - Karwice Sp. z o.o. inventory data.

Assumptions and estimates

Impacts of the representatives of the Nature Roof Standard 60/25 were aggregated using weighted average based on mass and the production volume.

Calculation rules

LCA was done in accordance with ITB PCR A document.

Databases

The data for the processes come from the following databases: Ecoinvent v. 3.7.1, specific EPDs, ITB-Data. Specific data quality analysis was a part of external ISO 14001 audit.

LIFE CYCLE ASSESSMENT (LCA) – Results

Functional unit

The declaration refers to functional unit (FU) – 1 m^2 of the Nature Roof Standard 60/25.

Table 4. System boundaries for the environmental characteristic of the Nature Roof Standard 60/25.

Environmental assessment information (MNA – Module not assessed, MD – Module Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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
MD	MD	MD	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MD	MD

Nature Roof Standard 60/25

Environmental impacts: (FU) 1 m^2								
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	8.39E+00	8.49E-01	4.46E+00	1.37E+01	9.57E+00	2.49E-04	-9.34E-01
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	7.91E-07	0.00E+00	1.37E-11	7.91E-07	1.70E-08	3.53E-11	-6.54E-08
Acidification potential of soil and water	kg SO_2 eq.	5.54E-02	6.32E-03	1.23E-02	7.40E-02	1.87E-03	1.81E-06	-7.56E-03
Formation potential of tropospheric ozone	kg Ethene eq.	4.74E-03	4.48E-04	4.82E-04	5.67E-03	2.85E-05	7.19E-08	-1.74E-04
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.61E-02	1.12E-03	4.30E-04	1.77E-02	7.13E-04	4.20E-07	-2.76E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	5.11E-05	0.00E+00	1.65E-05	6.76E-05	3.92E-07	1.02E-10	-2.02E-05
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	1.46E+02	8.31E+00	3.26E+01	1.87E+02	1.78E+00	3.36E-03	-1.61E+01
Environmental aspects on resource use: (FU) 1 m^2								
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	6.48E+01	5.82E-01	2.82E+00	6.82E+01	5.96E-02	5.06E-05	-1.37E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.54E+02	8.73E+00	3.43E+01	1.97E+02	1.78E+00	3.52E-03	-1.54E+01
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	4.36E-01	0.00E+00	4.36E-01	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	2.37E+00	7.89E-02	5.96E-01	3.04E+00	3.09E-01	9.00E-06	-7.10E-01
Other environmental information describing waste categories: (FU) 1 m^2								
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.84E-04	2.82E-05	2.00E-09	2.13E-04	9.98E-06	8.68E-09	-1.79E-05
Non-hazardous waste disposed	kg	1.87E+00	1.26E-02	1.63E-01	2.05E+00	2.07E-01	9.39E-02	-1.30E-01
Radioactive waste disposed	kg	1.04E-04	7.27E-05	3.16E-08	1.77E-04	4.50E-06	2.24E-08	-2.09E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	1.18E-01	1.18E-01	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ per energy carrier	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E+02	0.00E+00	0.00E+00

INTERPRETATION OF THE LCA RESULTS

The total environmental impact of the Nature Roof Standard 60/25, arising from the considered stages of the life cycle is dominated by the burdens occurring at the product stage – modules A1, A2 and A3. Contribution of the module A1 – impacts related to the extraction and the processing of the raw materials used for the production of polyethylene terephthalate (PET) trays, substrate, fertilizer or packaging materials – in the product stage (A1-A3) is ranging from 68.0% up to 99.9%. Usage of the PET trays with no less than 25% allocated content from de-polymerized monomer produced from PET post-consumer waste, contributes to 68.0% of the global warming potential, 38% of the total energy demand and 44.2% of depletion of abiotic resources of total impact of the module A1. The adopted end-of-life scenario is based on Danish treatment practice of industrial wastes and assumes subjection of PET wastes to incineration (98%) and landfilling (2%). Impacts presented in the module A3, associated with the manufacturing stage, contribute up to 27% of each environmental aspect of the product stage and mostly result from the consumption of electricity and water for cultivation of sedum cuttings. Module D includes benefits resulting from the use of compost for fertilizing purposes. The total mass of compost resulting from the organic decomposition of the sedum has been estimated as 60% of the initial plants weight. Sequestration of CO_2 was not included in the calculation.

VERIFICATION

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification. this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years. if the underlying data have not changed significantly.

The basis for LCA analysis was PN-EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Ph.D. Halina Prejzner Input data verification. LCI audit. LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl LCA verification: Ph.D. Eng. Michał Piasecki. m.piasecki@itb.pl

NORMATIVE REFERENCES

- ITB PCR A General Product Category Rules for Construction Products
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- PN-EN 15804+A1:2014-04 - Zrównoważoność obiektów budowlanych -- Deklaracje środowiskowe wyrobu -- Podstawowe zasady kategoryzacji wyrobów budowlanych
- PN-EN 15804+A2:2020-03 Zrównoważenie robót budowlanych – Deklaracje środowiskowe wyrobu – Podstawowe zasady kategoryzacji wyrobów budowlanych
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2020
- FLL – Green Roof Guidelines – Guidelines for the planning. construction and maintenance of green roofs. 2018

Signature Not Verified
Dokument podpisany przez Michał Piasecki; ITB
Data: 2023.02.09 14:36:31 CET

p.o. KIEROWNIKA
Zakładu Fizyki Cieplnej, Akustyki i Środowiska
dr inż. Agnieszka Winkler-Skalna

Instytut Techniki Budowlanej
00-611 Warsaw, Filtrowa 1

Thermal Physics, Acoustics and Environment Department
02-656 Warsaw, Ksawerów 21

CERTIFICATE № 144/2021
of TYPE III ENVIRONMENTAL DECLARATION

Product:
Green roof systems

Manufacturer:
Nature Impact A/S
Sdr Hojrupvejen 130, 5750 Ringe, Denmark

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804+A1

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 5th January 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Acting Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director
for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, January 2021