

Environmental Product Declaration



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

IndiTherm®

from

Industrial Nature UK Ltd



Product recently on the market – Results of this EPD shall be used with care as the LCI data is not yet based on 1 year of production which may result in increased uncertainty

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0020226
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An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com.



General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

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): PCR 2019:14 Construction products, version 1.3.4 (2024-04-30), c-PCR-005 (to PCR 2019:14) Thermal Insulation products (EN 16783:2024) (2024-05-03)
PCR review was conducted by: The International EPD® System, EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. (info@environdec.com)
Life Cycle Assessment (LCA)
LCA accountability: Dr Callum Hill, Renuables [www.renuables.co.uk]
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: Dr Hudai Kara, Metsims Sustainability Consulting, Oxford, U.K., https://metsims.com 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: Industrial Nature UK Ltd, Oxnam Rd, Jedburgh TD8 6NN, United Kingdom

Contact: Scott Simpson

Description of the organisation:

Industrial Nature Ltd (trading as IndiNature) and its subsidiary mill Industrial Nature UK Ltd were founded to develop and manufacture bio-based, circular, healthy and low carbon construction insulation and materials for a range of markets on an industrial scale. IndiNature's driving purpose is to maximise positive local and global impacts on climate, communities and the environment by using natural or recycled materials.

IndiNature's construction insulations including IndiTherm are made from crop fibres such as industrial hemp so they can be carbon negative – this means there is more carbon locked up in the fast-growing bio-based product than the amount needed to manufacture it.

Product-related or management system-related certifications:

Quality Management System ISO 9001, Certificate Number FS 796535

British Board of Agrément, Certificate Number 23/7060

Name and location of production site(s):

The manufacturing subsidiary, Industrial Nature UK Ltd, is located at: IndiNature Mill, Oxnam Rd, Jedburgh, TD8 6NN, Scottish Borders, UK.

Product information

Product name: IndiTherm®

Product description:

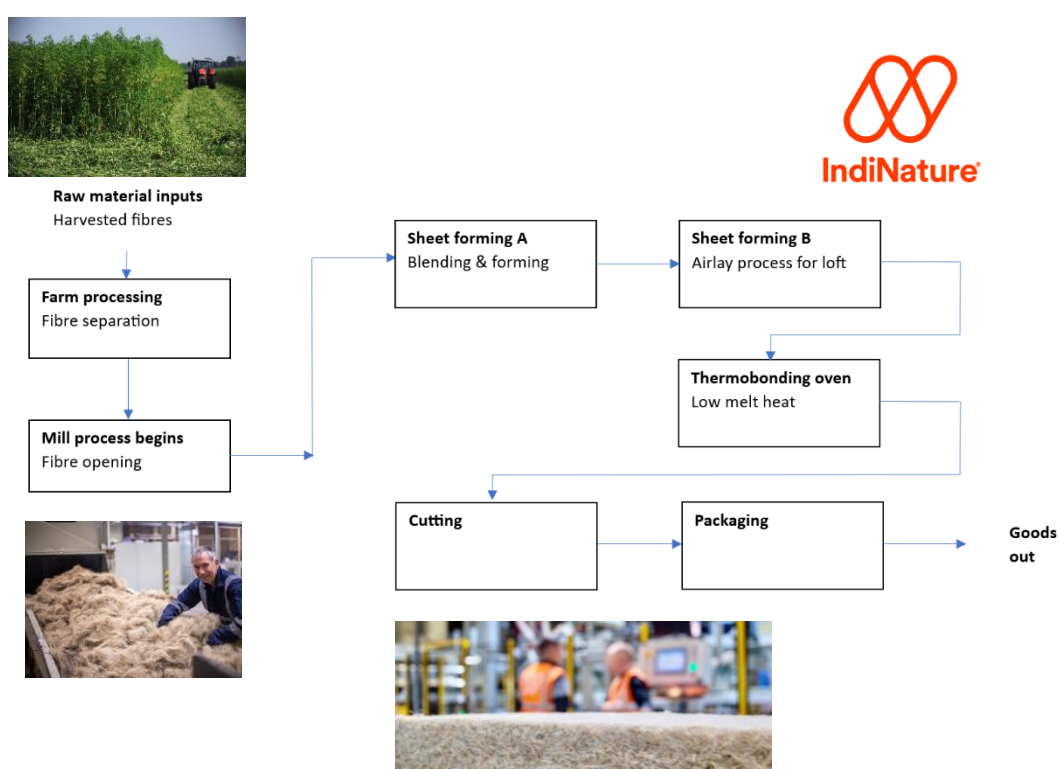
IndiTherm® is a flexible, low density fibre insulation batt made from industrial hemp fibre grown in the UK, with soda salts as a fire protection agent and low melting polymer as a binder. The product has both thermal and acoustic insulation properties and can be applied to roofs, floors and walls in buildings.

IndiTherm has many unique features and benefits for buildings and the environment:

- **Stores carbon** – a net amount of carbon is captured in the product
- **Preserves buildings** – excellent vapour breathability helps to preserve building structures
- **Thermal comfort** – hemp fibres have the 'smart' ability to naturally regulate both temperature and humidity swings due to the decrement delay of slow moving heat and vapour storage
- **Soft to the touch for installers** – no skin irritation
- **Warm in winter, cool in summer** – ability to reduce overheating due to thermal mass
- **Quiet acoustics** – sound dampening surpasses the 40dB reduction threshold
- **Circular** – products can be reprocessed at end of life in the same products again
- **Renewable resources** – made from fast-growing crops grown in the UK
- **Resistance to pests** – hemp fibres do not attract rodents or moths
- **Good for farms** – hemp requires no pesticides or herbicides and suppresses weeds, plus its deep tap root breaks up the soil for good water penetration, making it an excellent rotation crop

The production process is illustrated below. Grown by UK farmers, fast-growing industrial hemp is harvested within 4-5 months of sowing, with no need for herbicides or pesticides and minimal fertiliser inputs. As the plants grow, they capture carbon through photosynthesis – at a much faster rate than timber does. The plant straw is then processed by separating the fibre from the woody stalk or 'shiv' and removing dust and debris before the fibre is baled and shipped to the IndiNature mill. At the mill, the fibre enters an opening, blending process before being consolidated in a very low heat thermobonding oven. Products are then cut, stacked and packaged.

The IndiTherm® product is distributed in packs of batts, ranging from four to eight batts per pack (depending on dimensions).



Product installation:

IndiTherm® is best cut with wavy or 'scalloped' edged insulation saws rather than toothed blades – either with a handsaw, knife, circular saw. Dual-bladed reciprocating saws work well. IndiTherm® can be friction fit between structural framing or against masonry – with excellent rigidity to resist slumping. No measures are required for environmental protection during installation.

Technical data for the product

Thermal Conductivity λ	0.039 W/m.K
Bulk Density ρ	45 kg/m ³
Specific Heat Capacity C	2371 J/(kgK)
Vapour Diffusion Resistance μ	1.3
Sound Reduction	Min 40dB (at 50mm+)
Reaction to Fire BS EN 13501-1:2018	Euroclass: E Smoke Class: s1 Flaming Droplets Class: d0

Product dimensions

Dimensions (mm)	Thicknesses (mm)
370 x 1200	20, 30, 50, 80, 100, 140 mm
440 x 1200	20, 30, 50, 80, 100, 140 mm
570 x 1200	20, 30, 50, 80, 100, 140 mm

The IndiTherm® batts are delivered in packs, ranging from four to eight batts per pack depending on the batt thickness. 50 mm thick batts are delivered in packs of eight, 80 mm thick batts are delivered in packs of five, 100 and 140 mm thick batts are delivered in packs of four.

UN CPC code: 27922 (Textile articles other than apparel – nonwovens)

Geographical scope: UK.

LCA information

Functional unit: 1 m² IndiTherm® insulation (thickness 100 mm), R = 2.56 m²K/W, weight 4.5 kg

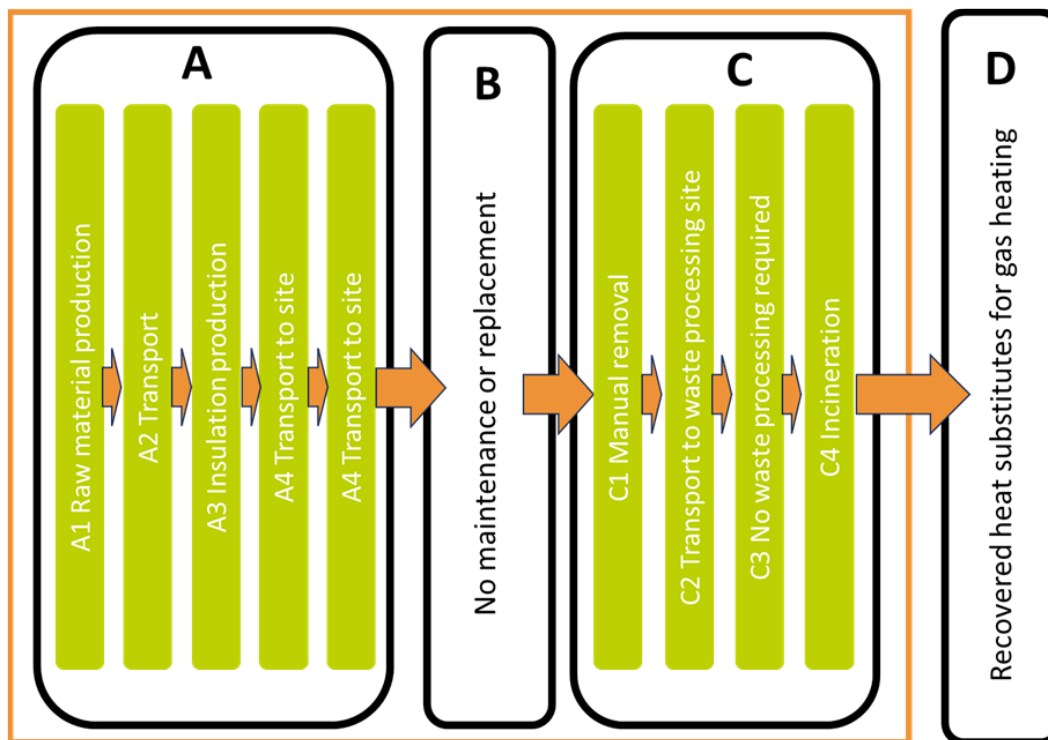
Reference service life: The service life of the product is the same as the service life as the building in which the product is installed, but a default value of 100 years can be assumed. This is based upon data published by the International Association of Certified Home Inspectors® [<https://www.nachi.org/life-expectancy.htm>] – accessed 19/09/2024 (100+ years for cellulose insulation).

Time representativeness: 06/03/2024 to 04/07/2024

Database(s) and LCA software used: Ecoinvent 3.10 Simapro 9.6

Description of system boundaries: Cradle to grave and module D (A + B + C + D).

System diagram:



More information:

The whole product life cycle is considered in this study. All data presented here covers modules A, B, C, D (EN15804). EF3.1 was used for all impact characterisation factors, except: CED for Primary energy resources renewable used as energy carrier (PERE) and primary energy resources non-renewable used as an energy carrier (PENRE) and AWARE for water scarcity potential. Primary energy resources renewable as materials (PERM) and primary energy resources non-renewable material (PENRM) are based on lower heating values with the data accessed from the Phyllis 2 database.

UK electricity grid primary energy mix is based upon 2023-24 average.

Primary energy	%
Gas	32
Wind	29.4
Nuclear	14.2
Biomass	5
Coal	1
Solar	4.9
Imports	10.7
Hydro	1.8
Storage	1
TOTAL	100

GWP = 0.227 kgCO₂e/kWh

Modules A1-A3

Agronomy of hemp was based upon primary data supplied by Industrial Nature UK Ltd. Transport of hemp bales from production site in Yorkshire to IndiTherm manufacturing site in Jedburgh by HGV. Transport of other components (polymer binder and fire retardant and packaging) to Jedburgh included. Use of electricity and gas (LPG) for production for period 06/03/2024 to 04/07/2024. LPG is supplied by tanker from Grangemouth, transport is included in the calculations. Standard UK grid mix is used using 12-month average up to April 2024. Production of pallet used for delivery is included, with the biogenic carbon shown as a negative flow.

Module A4

The product is assumed to be delivered by HGV truck (diesel) under average laden conditions. The transport distance is assumed to be within a 100 km radius, with a weight of 5.512 kg (including packaging) per functional unit (1 m², 100 mm thick, weight 4.5 kg). This is chosen as a default value, impacts for actual delivery distance can be determined by dividing characterisation values (e.g., GWP) by 100 and multiplying by actual delivery distance in km.

Module A5

Manual installation with disposal of packaging to landfill (distance 30 km). Pallet goes to wood recovery facility and exits system, with biogenic carbon shown as a positive flow at this point. No wastage of insulation product. The packaging used is LDPE film, with an average of 0.79 linear meters required per FU. The dimensions of the film are 1150 mm wide and 40 microns thick. This film is considered to be single use and is removed during the installation stage and subsequently disposed of, assumed to be landfilled.

Modules B1-B7

No maintenance is required during the service-life of the product.

Module C1

Manual removal is assumed.

Module C2

Transport to waste incineration facility, distance 30km.

Module C3

No waste processing is required.

Module C4

Incineration of end-of-life material, with biogenic carbon shown as being released in accordance with EN 15804+A2. Thermal energy exported from system.

Module D

It is assumed that the end-of-life material is incinerated (C4) with recovery of the calorific content for heating, substituting for gas as the energy source (80% efficiency). This is one possible scenario. Since the production is recent and a service life of at least 100 years is expected, there is no typical disposal, or recovery scenario. In the future, take-back may be an option, but the environmental merits of this compared with incineration would have to be determined on a case-by-case basis, with transportation being a significant part of the calculation.

Modules 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	X	X	X	X	X	X
Geography	GLO	GLO	UK	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
Specific data used	55%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%					-	-	-	-	-	-	-	-	-	-	-	-

Content declaration of product

(IndiTherm per FU (1 m², 100 mm thick, R = 2.56m²K/W))

Product content	Mass, kg	Post-consumer recycled material, mass-% of product	Biogenic material, mass-% of product	Biogenic material, kg C/product or declared unit
Hemp	4.05	0	41	1.65
Polymer binder	0.405	0	0	0
Fire retardant	0.045	0	0	0
TOTAL	4.50	0	37	1.65

Content declaration of packaging

(IndiTherm per FU (1 m², 100 mm thick, R = 2.56m²K/W))

Packaging materials	Mass, kg	Mass-% (versus the product)	Biogenic material, kg C/product or declared unit
Low density polyethylene	0.034	0.75	0.00
Pallet	0.978	21.7	1.80
TOTAL	1.012	22.5	1.80

The product does not contain any Dangerous substances from the candidate list of SVHC for Authorisation

Environmental information

This EPD contains information about environmental impact, use of resources and waste production in the form of quantitative indicators. The following abbreviations have been used in the tables which quantify environmental performance:

Indicator	Abbreviation
Global warming potential (Fossil, biogenic, land use and transformation (LUT))	GWP
Depletion potential of the stratospheric ozone layer	ODP
Acidification potential	AP
Eutrophication potential	EP
Formation potential of tropospheric ozone	POCP
Abiotic depletion potential – Elements	ADPE
Abiotic depletion potential – Fossil resources	ADPF
Water scarcity potential	WSP
Primary energy resources – Renewable (use as energy carrier)	PERE
Primary energy resources – Renewable (use raw materials)	PERM
Primary energy resources – Renewable (total)	PERT
Primary energy resources – Non-renewable (use as energy carrier)	PENRE
Primary energy resources – Non-renewable (use raw materials)	PENRM
Primary energy resources – Non-renewable (total)	PENRT
Secondary material	SM
Renewable secondary fuels	RSF
Non-renewable secondary fuels	NRSF
Net use of fresh water	NUFW
Hazardous waste disposed	HWD
Non-hazardous waste disposed	NHWD
Radioactive waste disposed	RWD
Components for re-use	CRU
Material for recycling	MFR
Materials for energy recovery	MFER
Exported energy, electricity	EEE
Exported energy, thermal	EET
Particulate Matter emissions	PM
Ionizing radiation, human health	IRP
Eco-toxicity – freshwater	ETP-fw
Human toxicity, cancer effect	HTP-c
Human toxicity, non-cancer effects	HTP-nc
Land use related impacts/Soil quality	SQP

Results of the environmental performance indicators

Potential environmental impact– mandatory indicators according to EN 15804

Results for 1m² of insulation product with 100 mm thickness and R = 2.56 m²K/W.

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
GWP-total	kg CO ₂ eq.	-3.70E+00	5.97E-02	1.80E+00	1.46E-02	6.08E+00	-4.32E+00
GWP-fossil	kg CO ₂ eq.	4.15E+00	5.96E-02	3.40E-03	1.46E-02	1.83E-02	-4.31E+00
GWP-biogenic	kg CO ₂ eq.	-7.86E+00	9.77E-06	1.79E+00	2.39E-06	6.06E+00	-4.82E-04
GWP-luluc	kg CO ₂ eq.	3.12E-03	2.03E-05	1.13E-06	4.97E-06	2.64E-06	-3.76E-04
ODP	kg CFC 11 eq.	6.21E-06	1.21E-09	6.81E-11	2.96E-10	6.56E-10	-1.97E-07
AP	mol H ⁺ eq.	1.72E-02	3.32E-04	1.92E-05	8.13E-05	1.19E-03	-3.41E-03
EP-freshwater	kg P eq.	6.86E-04	4.03E-06	2.35E-07	9.87E-07	1.46E-06	-7.80E-05
EP-marine	kg N eq.	4.20E-03	1.39E-04	8.04E-06	3.40E-05	5.69E-04	-1.23E-03
EP-terrestrial	mol N eq.	4.71E-02	1.51E-03	8.78E-05	3.71E-04	6.63E-03	-1.33E-02
POCP	kg NMVOC eq.	1.78E-02	5.12E-04	2.95E-05	1.25E-04	1.75E-03	-8.10E-03
ADP-minerals&metals*	kg Sb eq.	2.16E-05	1.60E-07	8.84E-09	3.91E-08	2.88E-08	-1.50E-06
ADP-fossil*	MJ	8.00E+01	8.69E-01	4.93E-02	2.13E-01	2.86E-01	-6.36E+01
WDP*	m ³	5.94E-02	0.00E+00	3.69E-03	0.00E+00	0.00E+00	-2.20E-02

* 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.

Note: All modules, are declared, but where there are nil entries, they are not included in the EPD to make the data more legible.

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
GWP-GHG*	kg CO ₂ eq.	4.16E+00	5.97E-02	3.40E-03	1.46E-02	1.83E-02	-4.32E+00

*GWP-GHG - This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO₂ is set to zero

Potential environmental impact – additional mandatory and voluntary indicators

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
PM	Disease incidence	1.80E-07	7.35E-09	4.29E-10	1.80E-09	9.33E-09	-1.81E-08
IRP	kBq U235 eq.	1.16E+00	1.05E-03	5.89E-05	2.56E-04	3.44E-04	-2.39E-02
ETP-fw	CTUe	1.78E+01	2.04E-01	1.19E-02	4.99E-02	3.23E-02	-2.83E+00
HTP-c	CTUh	2.04E-08	1.35E-09	7.49E-11	3.30E-10	1.42E-10	-1.11E-08
HTP-nc	CTUh	2.71E-08	7.53E-10	4.16E-11	1.84E-10	2.50E-09	-1.23E-09
SQP	dimensionless	1.36E+02	8.63E-01	5.49E-02	2.11E-01	1.32E-02	-1.01E+00

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks

Use of resources

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
PERE	MJ	3.19E+01	1.37E-02	7.67E-04	3.35E-03	3.62E-03	-2.67E-01
PERM	MJ	6.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.01E+02	1.37E-02	7.67E-04	3.35E-03	3.62E-03	-2.67E-01
PENRE	MJ	8.58E+01	9.24E-01	5.24E-02	2.26E-01	3.16E-01	-7.05E+01
PENRM	MJ	1.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	9.60E+01	9.24E-01	5.24E-02	2.26E-01	3.16E-01	-7.05E+01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste production and output flows

Waste production

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
HWD	kg	5.34E-04	5.71E-06	3.23E-07	1.40E-06	1.37E-06	-2.82E-04
NHWD	kg	5.43E-01	7.32E-02	3.78E-02	1.79E-02	6.56E-04	-9.12E-02
RWD	kg	1.57E-04	2.59E-07	1.46E-08	6.34E-08	9.08E-08	-6.02E-06

Output flows

Indicator	Unit	A1-A3	A4	A5	C2	C4	D
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.81E+01	0.00E+00

Additional environmental information

The assumed reference service life is 100 years, but depends upon the lifetime of the building in which the products is installed.

The inclusion of sequestered carbon in the calculation involves consideration of the whole life cycle.

The atmospheric carbon stored in the biogenic content of the product remains locked up for the lifetime of the product. At the end of life, various options are possible, including incineration with

energy recovery (resulting in release of the stored atmospheric carbon as carbon dioxide) or re-use of the product (in which case the atmospheric carbon remains in storage).

The rules of EN 15804:2012+A2:2019/AC:2021 state that the release of atmospheric carbon must be considered without time limit, meaning that the storage of the atmospheric carbon sums to zero over the life cycle (or multiple life cycles), irrespective of the length of storage.

Although there is no agreed LCA methodology for dealing with length of storage of atmospheric carbon, it can be readily shown (using materials flow analysis) that increasing the lifetime of biogenic products does result in higher levels of atmospheric carbon storage in product carbon pools. This involves considering a population of products (buildings in this case) and choosing a suitable decay function to model the release of carbon into the environment.

Calculation of biogenic carbon in the product is based upon:

Composition of hemp

Cellulose (%)	Hemicellulose (%)	Lignin (%)	Total (%)
75	19	6	100

Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8911747>

Atomic ratios of each component

Component	C	H	O	Ratio
Cellulose	1	2	1	0.75
Hemicellulose	1	2	1	0.19
Lignin	1	1.3	0.4	0.06
Hemp overall	1.000	1.958	0.964	1.00

Atomic weight of C = 12, H = 1, O = 16. Therefore, the mass proportion of carbon in hemp is: $(1 \times 12) / [(1 \times 12) + (1.958 \times 1) + (0.964 \times 16)] = 0.41$

The weight of hemp in 1 m³ of IndiTherm is 40.5 kg, therefore weight of carbon in 1 m³ of product is $0.41 \times 40.5 = 16.5$ kg, which is equivalent to $16.5 \times (44/12) = 60.6$ kg CO_{2e} / m³ product

Biogenic carbon content 6.06 kg CO_{2e} per FU (1m², 100mm thick)

Calorific content of components (lower heating value):

Material	MJ/kg
Hemp	18.0
Polymer binder	21.9
LDPE	40.2

Calculation of weight of LDPE packaging used per m³ of product:

Length	7.9	m
Width	1.15	m
Thickness	4.00×10^{-5}	m
Volume	3.63×10^{-4}	m ³
Density of LDPE	930	kg/m ³
Weight	0.338	kg

Weight = $7.9 \times 1.15 \times 4 \times 10^{-5} \times 930 = 0.338$ kg per m³ of product

Conversion factors for other thicknesses available compared with FU:

Thickness (mm)	R (m ² K/W)	Weight (kg/m ²)	Multiply environmental data by
20	0.51	0.90	0.2x
30	0.77	1.35	0.3x
50	1.28	2.25	0.5x
80	2.05	3.60	0.8x
100	2.56	4.50	1.0x
140	3.59	6.30	1.4x

Note: Reference product is shown in bold

Additional social and economic information

Not applicable

Differences versus previous versions

Not applicable

References

EPD International: General Programme Instructions for the International EPD System. Version 4.0, dated 2021-03-29. www.environdec.com.

EPD International: PCR 2019:14 Construction products, version 1.3.4 (2024-04-30)

EPD International: PCR 2019:14-c-PCR-005 Thermal Insulation products (EN 16783) (2024-05-03)

EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

EN 16783:2024 Thermal insulation products – Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations - Principles and procedures.

ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework

ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines

2019 An attributional life-cycle assessment to explore the embodied carbon of a hemp-based insulation material for IndiNature. MSc Thesis Edinburgh University.

Phyllis 2 Database [<https://phyllis.nl/>]

