Environmental Product Declaration

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

EKOLUTION® HEMP FIBRE INSULATION

From:
Ekolution AB

The EPD document from seed to finished insulation

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

EKOLUTION

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com 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): Construction products, 2019:14, Version 1.3.1
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: *Fanni Végvári, CarbonZero 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:
Ekolution AB

Description of the company:
Ekolution is a company that design, manufacture and distribute new innovative building materials and technologies for the construction industry. All raw materials, parts and products Ekolution manufactures are developed in close collaboration with the market. The resulting sustainable material and solutions are of the highest quality and with a low carbon footprint possible on the market currently.

Ekolution develops and produces building insulation materials mainly from industrial hemp shives and hemp fibres for the construction industry. All our products are made from renewable, recycled and environmentally friendly materials. Ekolution's building materials are not only carbon-dioxide neutral, but carbon-negative (CO_2-negative; there is more CO_2 sequestered in the industrial hemp than emitted in the production of the final products), which differentiates Ekolution and its products from other conventional building and insulation products.

This is achievable thanks to the exceptional properties of the industrial hemp plant and therefore is the core of many our building products. Ekolution strives to become a leader in sustainable construction, through continuous improvement and innovation.

Product information

This EPD covers the production of insulation from bast fibres derived from the industrial hemp plant. The bast hemp fibres are a soft, woody fibre obtained from the hemp stems and have a very high tensile strength. The hemp fibres are often used as a reinforcement in bio-composites and has very good thermal and acoustic insulating capacity.

Ekolution® Hemp fibre Insulation is thus a bio-composite material that is very suitable for the construction sector. Ekolution® Hemp fibre insulation has several technical and environmental advantages:

- The industrial hemp binds large amounts of CO_2 in a plant during its growth, faster than most other sources of biomass raw materials.
- Low-embodied energy
- High sorption capacity (moisture buffering) and effectively adjusting humidity levels
- High specific heat inertia, means that hemp fibre takes longer to heat and cool, resulting in less temperature variations in the material
- Reducing heat consumption and energy costs
- Breathable with diffusion-open designs and building techniques.
- Very good sound attenuating properties.
- Natural, healthy and anti-bacterial
- Ecological, zero harmful and non-toxic emissions.
- Simplified production process, as the fibre is organic and comfortable against the skin and respiratory tract.
- 100% recyclable and renewable product.

Declaration

This Declaration describes a production volume/weighted average of the Hemp Fibre Insulation materials, which are produced with nonwoven machinery. The Hemp Fibre Insulation materials specified in the Declaration are used as insulating boards and as insulating materials for buildings.

The main raw materials for the manufacturing process of the insulation are hemp fibre, recycled bi-component fibre from the textile industry and caustic soda. The most relevant technical information about the product:

Product name:
Ekolution® Hemp Fibre Insulation

UN CPC code:
31449 Fibreboard of wood or other ligneous materials, other fibreboard

Geographical scope:
Europe

Delivery status:
The following dimensions refer to standardised Ekolution® Hemp Fibre Insulation product:

Steel studs:
- Width 470 x Length 1200. T= 45, 70, 95, 120, 145, 170, 195 and 220 mm
- Width 620 x Length 1200. T= 45, 70, 95, 120, 145, 170, 195 and 220 mm

Wood studs:
- Width 425 x Length 1200. T= 45, 70, 95, 120, 145, 170, 195 and 220 mm
- Width 575 x Length 1200. T= 45, 70, 95, 120, 145, 170, 195 and 220 mm

Information about additional products specified within the scope of this EPD can be viewed at www.ekolution.se.

Application
Ekolution® Hemp Fibre Insulation is highly versatile and can be used for thermal insulation for wall, roof and floor constructions. It can also be used as an acoustic board, insulation against step sound (sub floor insulation), airborne sound and as an insulation element that can be directly used in all construction parts.

Placing on the market / Application rules
Directive (EU) No.305/2011 applies for placing the product on the market in the EU/EFTA (except Switzerland). Ekolution® Hemp Fibre Insulation materials require a Declaration of Performance taking into consideration the harmonised product standard EN 13171:2012 thermal insulation materials for buildings - Factory-made hemp fibre (WF) products - Specification. The relevant national provisions apply for the use of the products, the Centre of building engineering, Joint Stock Company for hemp fibre insulation materials in acc. with EDA 040005-00-1201.

Manufacturing of the product

The manufacturing process of the product consists of the following steps. An infographic of the process can be found in Figure 1.

- Processing of the raw hemp stalk from bale to lose fibre
- Dust separation
- Mixing hemp fibre with binder
- Formation of the board through heating process
- Cutting the board
- Stacking, packaging

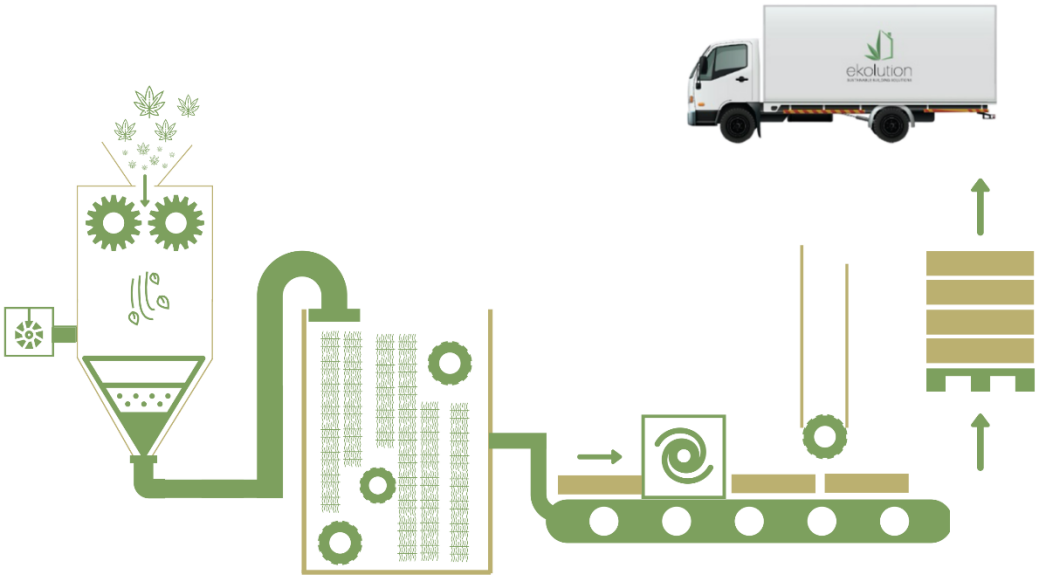


Figure 1 Infographic of the manufacturing process

Environment and health during manufacturing

No other health protection measures are required beyond normal workwear and gloves.

Product installation

Depending on the board thickness and density, Ekolution® Hemp Fibre Insulation materials can be adjusted to desirable fit using an insulation knife with wave cutting blade, alligator saw (recommended), circular saw, band saw or similar tools. Neither the processing nor the installation of Ekolution® Hemp Fibre Insulation materials lead to environmental pollution. As far as environmental protection is concerned, no additional measures are required.

Packaging

For the packaging of Ekolution® Hemp Fibre Insulation materials, foils made of polyethylene, stickers and wood are used. All packing materials are recyclable if unmixed, and/or can be recovered as energy.

Technical Data

The following information refers to the Ekolution's product range. Information about further products specified within the scope of this EPD can be viewed at www.ekolution.se:

- Gross density (in acc. with DIN EN 1602) is 35 kg/m3.
- Thermal conductivity λ = 0.04 W/(m²K)., declared value (in acc. to DIN EN 12667, EN ISO 10456)
- Water vapour diffusion resistance factor (in acc. with DIN EN 12086) is 2.3 m.
- Reaction to fire class (in acc. with /DIN EN 13501-1+A1) is D s1 d0.

Technical properties:

Basic Works Requirement 2: Safety in case of fire (BWR 2)			
1	**Reaction to fire** (EN 13501-1+A1)	Class D-s1, d0	Classification Report No. PK-16-002
Basic Works Requirement 3: Hygiene, health and the environment (BWR 3)*			
10	**Water vapour diffusion resistance μ** (EN 12086)	2.294	Test Report Č. 15/1164/T064-A
11	**Water absorption** (EN 1609, method A)	1.51 kg/m²	Test Report Č. 15/1164/T064-A
Basic Works Requirement 3: Hygiene, health and the environment (BWR 3)			
2	**Biological resistance (Growth of mould fungus)** (ÖNORM B 6010; EAD 040005-00-1201, Annex B); EN ISO 846, method A, B, B')	There is no intensity of fungal growth	Report No. 124009/2016
8	**Sound absorption** (EN ISO 354, EN ISO 11654) - Sound absorption coefficient α_s - Practical sound absorption coefficient α_p	Product thickness 100 mm Frequency [Hz] / α_s / α_p 125 / 0,40 / 0,35 250 / 0,65 / 0,60 500 / 0,82 / 0,80 1000 / 0,81 / 0,85 2000 / 0,89 / 0,90 4000 / 1,03 / 1,00	Test Report Č. 15/086/A036
	- Weighted sound absorption coefficient α_w - Class sound absorption B	Thickness [mm] / α_w [-] 100 / 0,85 (H)	
18	**Tensile strength parallel**** (EN 1608) - Thickness 50 mm - Thickness 200 mm -	10,1 kPa 10,2 kPa	Test Report Č. 16/105/C005 A

* Hemp Fibre Insulation materials have no soluble ingredients that are hazardous to water. Hemp fibre insulation materials are not permanently resistant to standing water. Depending on the damage symptoms, damaged areas must be replaced, either partially or extensively.

** The product is mechanically resistant (pressure, tensile load) depending on the insulation material used. Hemp Fibre Insulation materials have no soluble ingredients that are hazardous to water.

Condition of use

The contents of the products apply for the average product under review. The proportions of the ingredients vary depending on the product range. During growth, approx. 6,3 kg CO_2 per declared unit is bound in the product as biogenic carbon content.

Environment and health during use

When Ekolution® Hemp Fibre Insulation materials are used, there is no hazard potential for water, air or soil. When Ekolution® Hemp Fibre Insulation materials are installed correctly, no health risks or impairments are to be expected. It is possible that small quantities of product substances as hemp dust may be released in the air.

Reference to service life

Due to the many different possible applications for Ekolution® Hemp Fibre Insulation, service life of the product can be expected to be 60 years, based on the estimations from the product's form stability.

Reuse & Recycled phase

When disassembled without damage, Ekolution® Hemp Fibre Insulation materials may be re-used for the same application at the end of life or may be reused in the same application spectrum in an alternative location. Insofar as the Ekolution® Hemp Fibre Insulation materials are not contaminated, the raw material can easily be materially recycled and recovered (e.g. re-admission to the production process).

Disposal

Ekolution® Hemp Fibre Insulation materials can be used as renewable energy sources for e.g. in district heating plants. Process energy as well as electricity can be generated.

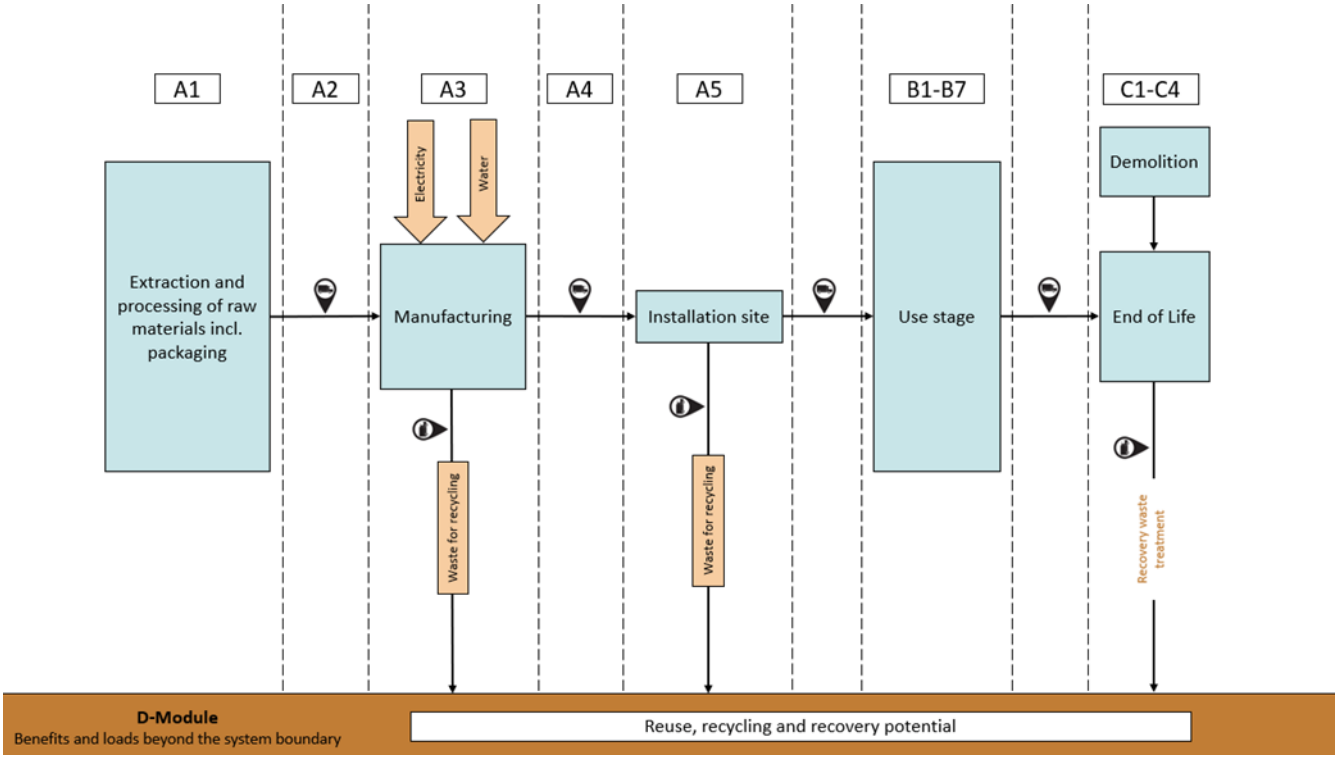
LCA information

Declared unit:
1 m^2 of Hemp Fibre Insulation with a thickness of 100 mm and a weight of 3,5 kg/m^2.

Time representativeness:
The data used to model product manufacturing correspond to 2019. The data from generic databases are from 2021 – 2022. No data used is older than 10 years.

Database(s) and LCA software used:
Calculation completed in LCA for Experts v.10.7 with an integrated Ecoinvent database 3.8.

System diagram:



Description of system boundaries:
Cradle-to-grave with module D.

Allocation:
No by-products are produced besides Ekolution® Hemp Fibre Insulation and no allocation procedure is necessary. All products are made at one factory in Hodonice, Czech Republic.

Scenarios:
The analysis is carried out using factory-specific data for use of energy and utilities and waste generation as well as product-specific data for use of raw materials. Therefore, the results represent the product system and no other scenarios are applied.

Data used:
Site-specific production data have been retrieved from the production site for 2019. The upstream and downstream processes have been modelled based on data from generic databases, mostly Sphera's database.

Cut-off:
The study applies a cut-off criterion of maximum 1% of the material and energy inputs of the system.

Transportation:
The transport of the raw materials to the production site is carried out by average European truck trailer with a 27t payload, average 61% capacity utilisation.

Energy utilities:
Only electricity is used at the final product manufacturing site in Central Europe. The electricity is obtained partly from the grid and from solar panels installed on the site. The electricity from the grid has been modelled using the Czech residual electricity grid mix from IEA 2021.

Direct emissions from production site:
No direct emissions are produced at the production site.

***Figure 2**: Ekolution hemp fibre insulation is appreciated by the carpenters because of the natural qualities of the material. Creating a less hazardous work environment.*

Content declaration

Material content:
Apart from hemp fibres, hemp fibre insulation materials consist of binding agents and other additives. The proportions averaged from the various products for the Environmental Product Declaration are:

- Hemp fibres 87 %
- Bi-component fibres 10 %
- Ammonium phosphate 3 %

The bi-component fibres consist of recycled polyethylene and polypropylene. Ammonium sulphate is used as a flame retardant, which is a food grade mineral salt. The apparent density of the declared average hemp fibre insulation material is 35 kg/m^3.

The ingredients listed apply to the average product declared, and the proportions of the ingredients may vary depending on the product dimensions. During growth, approx. 7.08 kg CO_2 is bound in the product.

No substances that appear in the REACH candidate list of SVHC (Candidate List of Substances of Very High Concern) are present or used in the product concerning this EPD.

Packaging:
For the packaging of Ekolution® Hemp Fibre Insulation, foils made of polyethylene is used. The packing materials is recyclable if unmixed, and/or can be recovered as energy. The final product is then transported on wooden pallets out to the installation site.

Recycled material:
The bi-component fibres used as raw material are 50% obtained from recycled post-consumer textile waste.

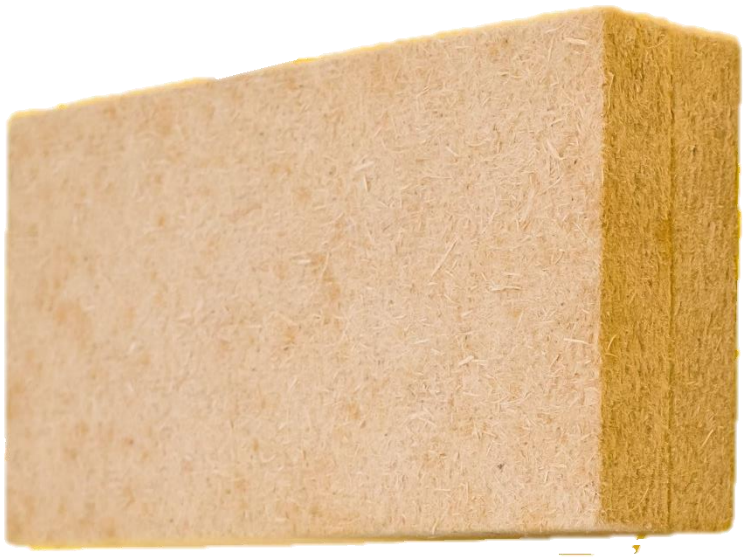


***Figure 3**: Ekolution Hemp Fibre Insulation thicknesses are according to Swedish standards: 45,70,95,120,145,170,195 and 220 mm. Width depends on the studs and distance between studs, 450 of 600 mm.*

Product components	Weight per FU (kg)	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Hemp fibres	3,05	0	87
Bi-component fibres	0,35	5	0
Ammonium phosphate	0,105	0	0
TOTAL	**3,5**	**5**	**87**
Packaging materials	**Weight per FU (kg)**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Pallet	0,625	17,8	0,259
PE	0,0085	0,243	0
TOTAL	**0,6335**	**18,043**	**0,259**

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

	Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beoyond system boundary
	Raw materials	Transport	Manufacturing	Transport	Assembly	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
Geogprahy	EU	EU	CZ	EU	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Specific data used	Specific data used in module A3																
Variation products	0%																
Variation sites	0%																

*Note that it is discouraged to use the results of modules A1-A3 without considering the results of module C when module C is declared.

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.

Environmental performance

Core environmental impact indicators per m^2 of Hemp Fibre Insulation with 100 mm thickness

Indicator	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
GWP-total	kg CO2 eq.	-6,81E+00	1,91E-01	5,78E-01	0,00E+00	1,25E-02	7,08E+00**	1,70E-01	2,57E+00
GWP-fossil	kg CO2 eq.	1,01E+00	1,92E-01	-1,60E-02	0,00E+00	1,26E-02	0,00E+00	2,24E-02	-1,75E-01
GWP-biogenic	kg CO2 eq.	-7,88E+00	-2,68E-03	5,94E-01**	0,00E+00	-1,85E-04	7,08E+00**	1,48E-01	2,82E+00
GWP-LULUC	kg CO2 eq.	6,91E-02	1,69E-03	-1,25E-06	0,00E+00	1,16E-04	0,00E+00	8,77E-06	-7,34E-02
ODP	kg CFC11 eq.	4,16E-08	1,74E-14	-5,20E-14	0,00E+00	1,86E-15	0,00E+00	1,54E-14	-1,69E-08
AP	mol H^+ eq.	5,39E-03	6,98E-04	-3,26E-05	0,00E+00	2,38E-05	0,00E+00	4,66E-05	-3,52E-03
EP-freshwater	kg P eq.	8,77E-04	6,67E-07	-2,31E-08	0,00E+00	4,66E-08	0,00E+00	4,09E-06	-8,93E-04
EP-marine	kg N eq.	5,30E-03	2,25E-04	-8,95E-06	0,00E+00	9,85E-06	0,00E+00	4,24E-05	-5,07E-03
EP-terrestial	mol N eq.	1,97E-02	2,53E-03	-9,55E-05	0,00E+00	1,12E-04	0,00E+00	1,69E-04	-1,39E-02
POCP	kg NMVOC eq.	3,98E-03	5,43E-04	-3,52E-05	0,00E+00	2,12E-05	0,00E+00	1,02E-04	-1,33E-03
ADP-M&M	kg Sb eq.	4,15E-06	1,19E-08	-8,32E-10	0,00E+00	8,38E-10	0,00E+00	2,51E-10	-2,76E-06
ADP-fossil	MJ	2,14E+01	2,60E+00	-6,38E-01	0,00E+00	1,75E-01	0,00E+00	1,39E-01	-1,86E+00
WDP	m^3	5,64E+00	2,15E-03	-3,32E-03	0,00E+00	1,79E-04	0,00E+00	5,77E-04	-5,89E+00

***GWP-total**: Global Warming Potential; **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; See "additional Norwegian requirements" for indicator given as PO4 eq. **EP-marine**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestial**: Eutrophication potential, Accumulated Exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil**: Abiotic depletion potential for fossil resources; **WDP**: Water deprivation potential, deprivation weighted water counsumption*

**The biogenic GWP value is from literature as Ecoinvent did not seem to provide with sufficient and accurate up to date information regarding the uptake of carbon from the hemp cultivation. The value for the biogenic is 2,023 kg CO_2-eq. per kg of hemp.*

***The biogenic content in packaging and product contributing to the GWP-biogenic is balanced out in A5 and C3 as positive as the packaging and product leaves the system boundary.*

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
PM	Disease incidence	2,06E-07	8,23E-09	-2,31E-10	0,00E+00	1,45E-10	0,00E+00	4,66E-10	-2,00E-07
IRP	kBq U235 eq.	8,36E-02	6,59E-04	-1,54E-03	0,00E+00	2,08E-04	0,00E+00	2,40E-04	-8,55E-03
ETP-fw	CTUe	2,01E+02	1,83E+00	-3,24E-01	0,00E+00	1,20E-01	0,00E+00	1,80E-01	-2,10E+02
HTP-c	CTUh	3,33E-09	3,68E-11	-7,48E-12	0,00E+00	2,51E-12	0,00E+00	8,06E-12	-1,54E-09
HTP-nc	CTUh	3,21E-08	1,60E-09	-2,40E-10	0,00E+00	1,07E-10	0,00E+00	6,92E-10	5,71E-08
SQP	Dimensionless	1,81E+02	1,04E+00	-2,38E-02	0,00E+00	7,38E-02	0,00E+00	1,31E-02	-1,13E+02

***PM**: Particulate matter emissions; **IRP**: Ionising radiation, human health; **ETP-fw**: Ecotoxicity (freshwater); **ETP-c**: Human toxicity, cancer effects; **HTP-nc**: Human toxicity, non-cancer effects; **SQP**: Land use related impacts / soil quality*

Resource use

Parameter	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
RPEE	MJ	-1,21E+02	1,80E-01	-3,57E-02	0,00E+00	1,61E-02	0,00E+00	1,25E-02	-3,77E+01
RPEM	MJ	1,75E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	5,29E+01	1,80E-01	-3,57E-02	0,00E+00	1,61E-02	0,00E+00	1,25E-02	-3,77E+01
NRPE	MJ	2,06E+01	2,61E+00	-6,39E-01	0,00E+00	1,75E-01	0,00E+00	1,39E-01	-1,86E+00
NRPM	MJ	7,41E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	2,14E+01	2,61E+00	-6,39E-01	0,00E+00	1,75E-01	0,00E+00	1,39E-01	-1,86E+00
SM	kg	0,00E+00	1,99E-04	-9,18E-05	0,00E+00	1,91E-05	0,00E+00	1,79E-05	-1,37E-01
RSF	MJ	0,00E+00	1,80E-01	-3,57E-02	0,00E+00	1,61E-02	0,00E+00	1,25E-02	-3,77E+01
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m^3	1,32E-01	1,80E-01	-3,57E-02	0,00E+00	1,61E-02	0,00E+00	1,25E-02	-3,77E+01

***RPEE**: Renewable primary energy resources used as energy carrier; **RPEM**: Renewable primary energy resources used as raw materials; **TPE**: Total use of renewable primary energy resources; **NRPE:** Non-renewable primary energy resources used as energy carrier; **NRPM:** Non-renewable primary energy resources used as materials; **TRPE:** Total use of non-renewable primary energy resources; **SM:** Use of secondary materials; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **W**: Use of net fresh water*

End of life - Waste

Parameter	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
HW	kg	2,65E-09	8,72E-12	-2,35E-11	0,00E+00	-2,15E-13	0,00E+00	1,15E-11	0,00E+00
NHW	kg	1,41E-02	3,74E-04	-1,74E-04	0,00E+00	2,98E-05	0,00E+00	1,40E-01	0,00E+00
RW	kg	3,94E-04	4,87E-06	-9,38E-06	0,00E+00	1,74E-06	0,00E+00	1,62E-06	0,00E+00

HW: *Hazardous waste disposed;* ***NHW:*** *Non hazardous waste disposed;* ***RW:*** *Radioactive waste disposed*

End of life – output flow

Parameter	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	7,88E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	0,00E+00	0,00E+00	4,31E+00	0,00E+00	0,00E+00	3,33E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CR: *Components for reuse;* ***MR:*** *Materials for recycling;* ***MER:*** *Materials for energy recovery;* ***EEE:*** *Exported electric energy;* ***ETE****: Exported thermal energy*

Additional voluntary indicators

Parameter	Unit	A1-A3	A4	A5	B1-B7	C2	C3	C4	D
GWP-GHG[1]	kg CO2 eq.	1,17E+00	1,95E-01	-1,60E-02	0,00E+00	1,27E-02	0,00E+00	1,42E-01	-3,41E-01

1 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 CO_2 is set to zero.

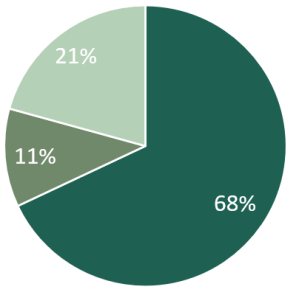
Information describing the biogenic carbon content at the factory gate

Biogenic carbon content*	Unit	Value
Biogenic carbon content in product	kg C	1,22E+00
Biogenic carbon content in the accompanying packaging	kg C	3,27E-01

*44/12 is the ratio between the molecular mass of CO_2 and C molecule

LCA: Interpretation

The different life cycle stages have different impact on the total environmental impact from the production of hemp fibre insulation. The result of the GWP fossil during the product stage (A1-A3) is from the production of raw material (A1) that contributes to 68% of the total impact. Meanwhile, the A2 stage accounts for 11% and the A3 stage for 21%.



The raw material stage is declared including the CO_2 sequestered in the product. The results of the LCA study show that the biogenic carbon dioxide sequestered during plant growth exceeds the emissions from the manufacturing of the product (A1-A3). A closer look on the data reveals that the bi-component fibre used as a binding agent stands for 46% of the total climate impact (GWP fossil) while the hemp fibre production only stands for 27%.

Additional information

Recyclability and reusability:

All Ekolution® Hemp Fibre Insulation materials can be returned to the factory where they will be torn down and blended into new products. 100% of all insulation can be recycled to form new products. The insulation that is not reused can go directly to combustion in heating plants.

Biogenic carbon uptake:

Hemp is a crop that binds up to 24 tonnes of carbon dioxide per hectare (depends on the yield of harvest usually between 10-12 tons per hectare). Studies have obtained results concerning the amount of carbon dioxide that is sequestered per kilogram of products, but an average 2.023 kg CO_2 per kilogram of hemp fibre has been estimated.

Hemp can be grown anywhere in the world, and it is possible to obtain a full harvest in about 100 days. This means a much more time efficient growth rate if compared with other crops and biomass sources, e.g. boreal forests can take around 70 years for one full harvest. This property can make a significant difference in climate change mitigation, as climate impact depends heavily on the timing of the emissions and uptakes.

Other properties:

Almost all varieties of hemp are naturally resistant to insect pests and predators. Not only does this mean that harmful chemical pesticides – which can leach into the soil and waterways – need not be used. Hemp is an important plant for crop rotation for several reasons. Firstly, despite it being an annual crop, hemp's roots reach deep down into the soil. This both helps to hold the soil together, reducing erosion, and to loosen the soil, allowing more delicate plants to grow afterwards. Secondly, hemp produces high quantities of biomass (a matter which returns to the soil and decomposes, feeding nutrients back into the ground). For this reason, hemp is often grown in rotation with winter cereals, which require high-quality soil.

Moreover, no processing is necessary to extract natural bonding agents from naturally produced hemp fibres, making hemp a superior crop with potential applications in a broad range of products. The significant strength of the hemp fibres and its vapour permeability makes it a remarkable material to develop a wide range of construction products.

Climate effects of biogenic carbon storage:

The GWP indicator presented in this EPD does not capture the difference made by the timing of the carbon dioxide uptake during growth. However, other methods exist to do this, one of them being Dynamic LCA where simplified estimations can be used to illustrate the benefits of hemp (Levasseur et al. 2010).

Dynamic LCA is a method where the climate impact of greenhouse gas emissions and uptakes are assessed based on the time when they occur, with reference to a specific time horizon. Assuming that hemp sequesters 2.023 kg CO_2 in year 1. One stand of boreal forest sequesters 1.65 kg CO_2 per kilogram of wood harvested. And that this is equally distributed throughout the 70 years of harvesting period, the following dynamic LCA results are obtained with a time horizon of 100 years for the climate impact of the biogenic carbon uptake per kg of product harvested:

Biomass source	**Cumulative radiative forcing ($W.m^2$)**	**Relative impact (kg CO_2 eq)**
Industrial Hemp Plant	-1,47E-13	-1,5
Wood from boreal forests	-1,03E-13	-1,2

The results in the table above show the cumulative radiative forcing, the phenomenon that causes climate change, avoided by the uptake of biogenic carbon by hemp fibres and wood during the first one hundred years after the harvesting. The hemp may absorb a lower amount of carbon dioxide per kilogram of fibres produced, but since the hemp does this in only one year, the cumulative effect in terms of radiative forcing avoided is higher (-1,43 W.m2) if compared with that of the wood from boreal forests (-1,03 W.m2).

The wood from boreal forests absorbs the carbon dioxide much slower (through 70 years of harvesting periods), and therefore the cumulative radiative forcing is lower. These effects of the timing of emissions are not captured by the GWP indicators used in EPDs, since these indicators are calculated assuming that all the uptakes and emissions of carbon dioxide occur in the first year, which does not represent reality.

Differences Versus Previous Versions

2023-08-31 Version 1

2023-10-03 Version 1.1
***Editorial change**: Corrected GWP-GHG value.*

2024-01-03 Version 1.2
***Editorial change**: Corrected factory name.*

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