



ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804:2012+A2:2019/AC:2021 & ISO 14025:2006
& EN 16485:2014

WOODFIBRE SOFTBOARDS
NORDIC FIBREBOARD LTD OÜ



Rakennustieto EPD
EPD number RTS_414_25

Published date 18.9.2025
Valid until 18.9.2030



GENERAL INFORMATION

MANUFACTURER

Manufacturer	Nordic Fibreboard Ltd OÜ
Address	Rääma 31, Pärnu, Estonia
Contact details	info@nordicfibreboard.com
Website	https://www.nordicfibreboard.com/

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	Rakennustieto EPD Rakennustietosäätiö RTS sr, Malminkatu 16 A, 00100 Helsinki, Finland ymparisto.rakennustieto.fi/en/rakennustieto-epds
Product category rules	EN 15804 serves as the core PCR. In addition, RTS PCR 2024 was used.
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options (A4-A5), modules C1-C4 and D
EPD author	Kirke Maria Lepik, LCA Support
EPD verification	Independent verification of this EPD and data, according to ISO 14025: o Internal verification <input checked="" type="checkbox"/> External verification
EPD verifier	Sigita Židonienė, Vesta Consulting UAB

The EPD owner has the sole ownership, liability, and responsibility for the EPD. Construction products EPDs may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context. EPDs within the same product category but from different programs may not be comparable.

PRODUCT

Product name	Woodfibre softboards manufactured with the wet process: Impregnated softboard SB.H Insulating board WF
Place of production	Rääma 31, Pärnu, Estonia
Period for data	Jan 2024 - Dec 2024

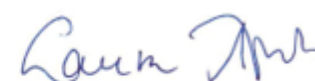
ABOUT THE MANUFACTURER

Nordic Fibreboard is a woodfibre board producer with a global reach since 1945. Our products are made from virgin wood fiber using a wet production technology that allows us to manufacture natural woodfibre products without adding synthetic glues or binding agents.

Nordic Fibreboard is an Estonian company with a global presence. We own and operate two production sites with a total softboard production output capacity of 120,000 m³. This makes us one of the biggest woodfibre board producers in northern Europe.



Jukka Seppänen
RTS EPD Committee Secretary



Laura Apilo
Managing Director

PRODUCT

PRODUCT DESCRIPTION

Woodfibre softboard is used for insulation, sound absorption, and moisture regulation in construction and building applications. These products can easily be incorporated by other manufacturers into their own products, offering versatile and eco-friendly solutions.

Nordic Fibreboard products are woodfibre softboards. The products are made from certified raw material – spruce wood chips. These natural products contain no added chemicals or glues. To improve moisture resistance, selected products are treated with paraffin. Product thicknesses range from 8 to 50 mm. Properties may vary between products.

For more information visit: nordicfibreboard.com

PHYSICAL PROPERTIES

Physical properties may vary between products, but the main data is as follows:

Density $\geq 240 \text{ kg/m}^3$

Thermal conductivity $\leq 0,049 \text{ W/(m} \cdot \text{K)}$

Release of formaldehyde Class E1

Reaction of fire Class E.

Nordic Fibreboard products are produced in accordance to ISO 9001 and ISO 14001 and certified with FSC, PEFC.

Thermal insulation products for buildings are produced according to EN 13171:2012. Wood-based panels for use in construction are produced according to EN 13986:2004.

For further information visit website: nordicfibreboard.com

DECLARED UNIT

This EPD contains the results of two products that are both manufactured with the wet process:

- Impregnated softboard SB.H
- Insulating board WF

The products are sold under different brand names (e.g., see Product Images on pg 5 of this EPD).

The EPD represents average products since the softboards can be manufactured in different dimensions. The declared unit is the same for both impregnated softboards and insulating boards.

Declared unit	1 m ³ of softboard
Mass per declared unit	240 kg
Density	$\geq 240 \text{ kg/m}^3$
Moisture	10%

UN CPC code: 3144 Fibreboard of wood or other ligneous materials

PRODUCT RAW MATERIAL MAIN COMPOSITION:

IMPREGNATED SOFTBOARD

Raw material category	Amount, mass %	Material origin
Bio-based materials	97%	EE
Fossil materials	3%	EU 27
Metals	-	
Minerals	-	

PRODUCT RAW MATERIAL MAIN COMPOSITION:

INSULATING BOARD

Raw material category	Amount, mass %	Material origin
Bio-based materials	100%	EE
Fossil materials	-	EU 27
Metals	-	
Minerals	-	

The products do not contain recycled materials.

PACKAGING MATERIAL COMPOSITION

Material category	Amount, mass %	Material origin
Wooden pallet	95%	EE
Plastic film	5%	EU 27

The products are shipped to the client on wooden pallets that are wrapped in plastic. The total mass of packaging per DU is 6,6 kg for impregnated softboards and 4,7 kg for insulating boards.

BIOGENIC CARBON CONTENT - IMPREGNATED SOFTBOARD

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	106
Biogenic carbon content in packaging, kg C	3

Note. 1 kg biogenic carbon is equivalent to 44/12 kg of biogenic CO₂.

BIOGENIC CARBON CONTENT - INSULATING SOFTBOARD

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	109
Biogenic carbon content in packaging, kg C	2

Note. 1 kg biogenic carbon is equivalent to 44/12 kg of biogenic CO₂.

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT IMAGES



Tuulileijona, Runkoleijona Wind Barrier Boards
(impregnated softboard SB.H)



Huokoleijona - Insulation Board
(insulating board WF)



ISOplaat - Wind Barrier Board
(impregnated softboard SB.H)



ISOplaat - Insulation Board
(insulating board WF)

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
x	x	x	x	x	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = ND.

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission. A market-based approach is used in modelling the electricity mix utilized in the factory.

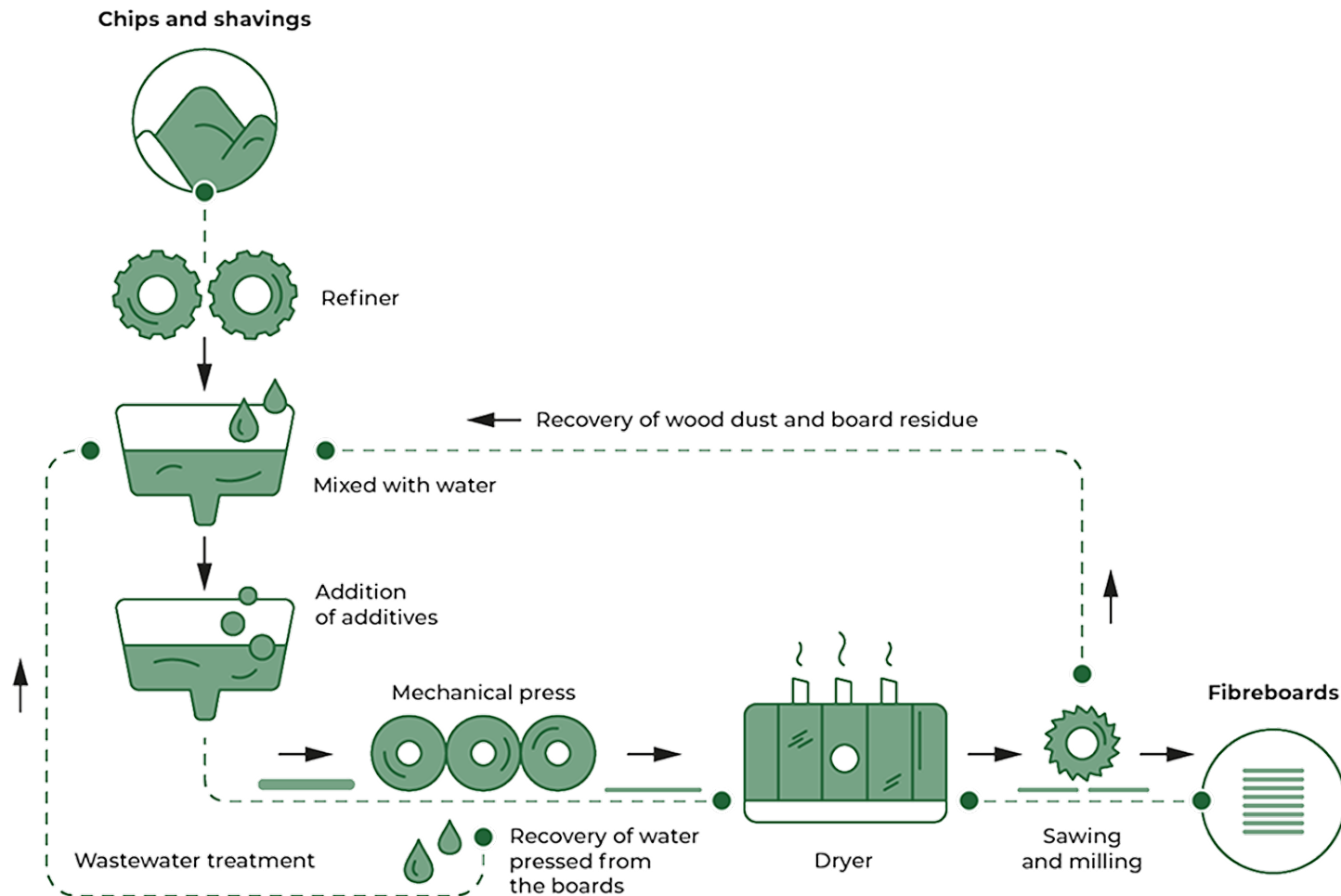
Manufacturing consists of the following steps:

- **Raw Material Preparation:** Wood chips or fibers are initially processed to break them down into smaller components. This is done through mechanical and chemical methods, ensuring the fibers are of consistent size and quality.
- **Fiber Extraction:** The wood fibers are separated from the lignin and other non-fibrous components. This can involve mechanical or chemical pulping methods, depending on the desired properties of the final product.
- **Wet Process Forming:** The extracted fibers are mixed with water to create a slurry. This wet process allows the fibers to be evenly distributed and helps in forming the board.
- **Natural Binding:** During the drying and pressing stages, the natural lignin present in the wood acts as a binding agent. This means no additional chemicals or adhesives are used, resulting in a more natural and environmentally friendly product.
- **Pressing and Finishing:** The wet fiber slurry is formed into mats or boards and then compressed under high pressure and temperature. This step consolidates the fibers into a solid, uniform sheet, which is then cut, sanded, and finished as needed.

Manufacturing energy scenario:

Scenario parameter	Value
Electricity data source and quality	Electricity, Estonia, residual mix, 2023 (One Click LCA)
Electricity CO _{2e} / kWh	0,68
Heating data source and quality	Heat production, wood chips from industry, at furnace 1000kW, state-of-the-art 2014
Heating CO _{2e} / MJ	0,0057

MANUFACTURING PROCESS



TRANSPORT AND INSTALLATION (A4-A5)

The product was assumed to be transported to Helsinki, as per RTS PCR and Finland being the main market area. No losses are assumed to occur during transport since the products are packaged properly.

Scenario parameter	Value
Transported distance	140 by lorry, 118 km by ferry
Emission factor, kg CO ₂ e / tkm	0,105 lorry 0,119 ferry
Capacity utilisation	100%
Bulk density	240 kg/m ³
Volume capacity utilization factor	1

A5 has been declared to account for packaging materials leaving the system. It is assumed that the pallet is shredded, and plastic packaging is incinerated with energy recovery.

Installation scenario documentation A5

Scenario information	Impregnated board	Insulating board
Ancillary materials for installation / kg	0	0
Energy, water, other resource use / m ³	0	0
Materials for recycling: wooden pallet, kg	6,2	4,8
Materials for energy recovery: plastic packaging, kg	0,329	0,23

PRODUCT USE AND MAINTENANCE (B1-B7)

Not declared.

Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

It is estimated that there is no mass loss during the use of the product, therefore the end-of-life product is assumed to have the same weight as the declared product. All the end-of-life products are assumed to be sent to the closest recycling facilities. Transportation distance to the closest disposal area is estimated as 50 km and the transport method is assumed as lorry which is the most common option. It is assumed that the products are removed from the building without additional energy use. 100% of the waste is assumed to be collected. Woodfibre softboard is assumed to be first shredded and then incinerated at a municipal waste treatment facility with energy recovery. The scenario is representative of Finland.

End of life scenario documentation

Scenario information	Value
Collection process - kg collected separately	240
Collection process - kg collected with mixed waste	0
Recovery process - kg for re-use	0
Recovery process - kg for recycling	0
Recovery process - kg for energy recovery	240
Disposal (total) - kg for final deposition	0
Scenario assumptions e.g. transportation	Transported 50 km with lorry

LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation was avoided whenever possible.

Manufacturing energy and water use, manufacturing waste, packaging materials and ancillary materials were allocated according to production volume.

DATA QUALITY

Data collection for production, transport, and packaging was collected from the manufacturer via a questionnaire. Upstream process calculations rely on generic data. The inventory and environmental data can be considered to be of good or very good quality.

PRIMARY DATA

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that do not capture all relevant aspects of data quality. The indicator is not comparable across product categories.

Share of primary data of GWP-GHG results for A1-A3:

- Impregnated softboard: 89%
- Insulating board: 93%

Process	Electricity, Estonia, residual mix, 2023 (One Click LCA)	Heat production, wood chips from industry, at furnace 1000kW, state-of-the-art 2014
Source type	Database	Database
Reference year	2023	2024
Impregnated board: share of primary data of GWP-GHG results for A1-A3	72%	17%
Insulating board: share of primary data of GWP-GHG results for A1-A3	76%	17%

DATABASES AND SOFTWARE

The calculations were conducted using One Click LCA's cloud-based LCA software. The source of LCA data is Ecoinvent 3.10.1 and One Click LCA's database.

ENVIRONMENTAL IMPACT DATA

IMPREGNATED SOFTBOARD SB.H

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS - EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	-4,03E+02	2,94E+00	1,47E+02	-2,53E+02	7,12E+00	1,18E+01	0,00E+00	1,29E+00	4,25E+02	0,00E+00	-4,02E+02
GWP – fossil	kg CO ₂ e	8,15E+00	2,94E+00	1,58E+02	1,69E+02	7,12E+00	9,20E-01	0,00E+00	1,29E+00	1,36E+01	0,00E+00	-4,01E+02
GWP – biogenic	kg CO ₂ e	-4,11E+02	3,76E-04	-1,04E+01	-4,22E+02	1,29E-03	1,09E+01	0,00E+00	0,00E+00	4,11E+02	0,00E+00	-8,88E-02
GWP – LULUC	kg CO ₂ e	1,14E-01	1,14E-03	1,37E-01	2,52E-01	3,11E-03	1,69E-04	0,00E+00	5,78E-04	3,06E-02	0,00E+00	-1,00E-01
Ozone depletion pot.	kg CFC-11e	1,42E-07	6,07E-08	5,77E-06	5,97E-06	1,26E-07	2,88E-09	0,00E+00	1,91E-08	1,85E-07	0,00E+00	-1,05E-05
Acidification potential	mol H ⁺ e	4,75E-02	6,87E-03	1,99E+00	2,05E+00	1,12E-01	7,84E-04	0,00E+00	4,40E-03	9,12E-02	0,00E+00	-7,86E-01
EP-freshwater ²⁾	kg Pe	4,37E-03	2,05E-04	2,84E-02	3,29E-02	3,54E-04	4,65E-05	0,00E+00	1,01E-04	3,25E-03	0,00E+00	-8,40E-02
EP-marine	kg Ne	1,22E-02	1,79E-03	7,06E-01	7,20E-01	2,82E-02	2,87E-04	0,00E+00	1,45E-03	3,84E-02	0,00E+00	-1,89E-01
EP-terrestrial	mol Ne	1,15E-01	1,94E-02	7,67E+00	7,80E+00	3,13E-01	2,81E-03	0,00E+00	1,57E-02	3,87E-01	0,00E+00	-1,96E+00
POCP (“smog”) ³⁾	kg NMVOCe	7,20E-02	1,18E-02	1,96E+00	2,04E+00	9,27E-02	9,27E-04	0,00E+00	6,49E-03	1,11E-01	0,00E+00	-7,68E-01
ADP-minerals & metals ⁴⁾	kg Sbe	5,68E-05	8,61E-06	3,04E-04	3,70E-04	1,36E-05	4,74E-07	0,00E+00	3,60E-06	3,41E-05	0,00E+00	-2,78E-04
ADP-fossil resources	MJ	2,96E+02	4,38E+01	2,17E+03	2,51E+03	9,71E+01	2,48E+00	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Water use ⁵⁾	m ³ e depr.	3,45E+00	2,23E-01	1,14E+03	1,14E+03	3,89E-01	8,57E-02	0,00E+00	9,26E-02	9,29E+00	0,00E+00	-2,97E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO₄e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS - EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	4,84E-07	2,77E-07	2,60E-05	2,68E-05	4,52E-07	1,05E-08	0,00E+00	1,29E-07	1,33E-06	0,00E+00	-3,30E-06
Ionizing radiation ⁶⁾	kBq 11235e	1,69E+00	5,30E-02	2,97E+01	3,15E+01	8,33E-02	2,95E-02	0,00E+00	1,63E-02	6,91E-01	0,00E+00	-5,92E+01
Ecotoxicity (freshwater)	CTUe	3,45E+01	5,26E+00	4,17E+02	4,57E+02	9,48E+00	1,95E+00	0,00E+00	2,65E+00	7,05E+01	0,00E+00	-4,47E+02
Human toxicity, cancer	CTUh	6,54E-09	4,90E-10	1,47E-07	1,54E-07	1,32E-09	9,29E-11	0,00E+00	2,13E-10	8,85E-09	0,00E+00	-4,84E-08
Human tox. non-cancer	CTUh	7,55E-08	2,82E-08	2,81E-06	2,91E-06	4,53E-08	3,17E-09	0,00E+00	1,21E-08	4,79E-07	0,00E+00	-1,97E-06
SQP ⁷⁾	-	2,28E+03	4,17E+01	1,20E+04	1,43E+04	5,72E+01	1,20E+00	0,00E+00	1,89E+01	1,02E+02	0,00E+00	-9,19E+02

6) EN 15804+A2 disclaimer for ionizing radiation, human health. 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	-1,39E+03	7,18E-01	2,23E+03	8,37E+02	1,19E+00	-6,25E+01	0,00E+00	2,57E-01	0,00E+00	0,00E+00	-2,42E+02
Renew. PER as material	MJ	2,46E+03	0,00E+00	9,51E+01	2,56E+03	0,00E+00	-9,51E+01	0,00E+00	0,00E+00	-2,46E+03	0,00E+00	0,00E+00
Total use of renew. PER	MJ	1,07E+03	7,18E-01	2,32E+03	3,39E+03	1,19E+00	-1,58E+02	0,00E+00	2,57E-01	-2,46E+03	0,00E+00	-2,42E+02
Non-re. PER as energy	MJ	1,37E+02	4,38E+01	2,29E+03	2,47E+03	9,71E+01	-9,48E+00	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Non-re. PER as material	MJ	0,00E+00	0,00E+00	2,02E+01	2,02E+01	0,00E+00	-2,02E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	1,37E+02	4,38E+01	2,31E+03	2,49E+03	9,71E+01	-2,97E+01	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Secondary materials	kg	6,07E-02	1,91E-02	9,26E-01	1,01E+00	4,22E-02	1,38E-03	0,00E+00	7,98E-03	1,64E-01	0,00E+00	0,00E+00
Renew. secondary fuels	MJ	9,08E-04	2,41E-04	9,05E+00	9,05E+00	3,40E-04	2,22E-05	0,00E+00	1,01E-04	1,23E-03	0,00E+00	-1,77E-03
Non-ren. secondary fuels	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	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	9,83E-02	6,39E-03	2,01E+00	2,11E+00	1,07E-02	1,92E-03	0,00E+00	2,77E-03	8,88E-02	0,00E+00	-4,29E+00

8) PER = Primary energy resources.

END OF LIFE - WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	4,07E-01	6,35E-02	2,90E+00	3,37E+00	1,31E-01	1,52E-02	0,00E+00	3,18E-02	1,66E+00	0,00E+00	-2,37E+01
Non-hazardous waste	kg	1,67E+01	1,28E+00	8,17E+02	8,35E+02	2,28E+00	8,78E-01	0,00E+00	5,88E-01	2,65E+02	0,00E+00	-4,27E+02
Radioactive waste	kg	4,26E-04	1,31E-05	4,36E-03	4,80E-03	2,05E-05	7,57E-06	0,00E+00	4,00E-06	1,73E-04	0,00E+00	-1,37E-02

END OF LIFE - OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
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	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	5,00E-03	5,00E-03	0,00E+00	6,28E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	4,34E-03	4,34E-03	0,00E+00	3,29E-01	0,00E+00	0,00E+00	2,40E+02	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,15E+01	0,00E+00	0,00E+00	3,67E+03	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,82E+00	0,00E+00	0,00E+00	1,22E+03	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,64E+00	0,00E+00	0,00E+00	2,45E+03	0,00E+00	0,00E+00

ADDITIONAL INDICATOR - GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG ⁹⁾	kg CO ₂ e	8,27E+00	2,95E+00	1,58E+02	1,69E+02	7,12E+00	9,20E-01	0,00E+00	1,29E+00	1,36E+01	0,00E+00	-4,01E+02

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH₄ fossil, CH₄ biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO₂ is set to zero.

ENVIRONMENTAL IMPACT DATA

INSULATING BOARD WF

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS - EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	-3,87E+02	1,22E+00	1,48E+02	-2,38E+02	7,05E+00	8,41E+00	0,00E+00	1,29E+00	4,05E+02	0,00E+00	-4,01E+02
GWP – fossil	kg CO ₂ e	4,48E+00	1,22E+00	1,55E+02	1,61E+02	7,04E+00	6,59E-01	0,00E+00	1,29E+00	1,36E+01	0,00E+00	-4,01E+02
GWP – biogenic	kg CO ₂ e	-3,91E+02	1,86E-05	-7,28E+00	-3,99E+02	1,28E-03	7,75E+00	0,00E+00	0,00E+00	3,91E+02	0,00E+00	-8,87E-02
GWP – LULUC	kg CO ₂ e	1,07E-01	4,73E-04	1,33E-01	2,40E-01	3,08E-03	1,21E-04	0,00E+00	5,78E-04	3,06E-02	0,00E+00	-1,00E-01
Ozone depletion pot.	kg CFC- ₁₁ e	8,22E-08	2,53E-08	5,69E-06	5,80E-06	1,25E-07	2,05E-09	0,00E+00	1,91E-08	1,85E-07	0,00E+00	-1,05E-05
Acidification potential	mol H ⁺ e	2,15E-02	2,86E-03	1,98E+00	2,00E+00	1,11E-01	5,60E-04	0,00E+00	4,40E-03	9,12E-02	0,00E+00	-7,85E-01
EP-freshwater ²⁾	kg Pe	3,45E-03	8,50E-05	2,76E-02	3,11E-02	3,50E-04	3,32E-05	0,00E+00	1,01E-04	3,25E-03	0,00E+00	-8,39E-02
EP-marine	kg Ne	6,82E-03	7,49E-04	7,03E-01	7,10E-01	2,80E-02	2,05E-04	0,00E+00	1,45E-03	3,84E-02	0,00E+00	-1,89E-01
EP-terrestrial	mol Ne	6,46E-02	8,10E-03	7,64E+00	7,71E+00	3,10E-01	2,01E-03	0,00E+00	1,57E-02	3,87E-01	0,00E+00	-1,95E+00
POCP (“smog”) ³⁾	kg NMVOC	5,22E-02	4,96E-03	1,95E+00	2,00E+00	9,20E-02	6,63E-04	0,00E+00	6,49E-03	1,11E-01	0,00E+00	-7,68E-01
ADP-minerals & metals ⁴⁾	kg Sbe	1,21E-05	3,53E-06	2,86E-04	3,02E-04	1,34E-05	3,38E-07	0,00E+00	3,60E-06	3,41E-05	0,00E+00	-2,78E-04
ADP-fossil resources	MJ	8,34E+01	1,82E+01	2,14E+03	2,24E+03	9,61E+01	1,77E+00	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Water use ⁵⁾	m ³ e depr.	2,30E+00	9,31E-02	1,14E+03	1,14E+03	3,85E-01	6,13E-02	0,00E+00	9,26E-02	9,29E+00	0,00E+00	-2,96E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO₄e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS - EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	2,45E-07	1,17E-07	2,58E-05	2,62E-05	4,48E-07	7,50E-09	0,00E+00	1,29E-07	1,33E-06	0,00E+00	-3,30E-06
Ionizing radiation ⁶⁾	kBq 11235a	1,46E+00	2,20E-02	2,96E+01	3,11E+01	8,22E-02	2,11E-02	0,00E+00	1,63E-02	6,91E-01	0,00E+00	-5,92E+01
Ecotoxicity (freshwater)	CTUe	2,17E+01	2,17E+00	4,06E+02	4,30E+02	9,37E+00	1,40E+00	0,00E+00	2,65E+00	7,05E+01	0,00E+00	-4,46E+02
Human toxicity, cancer	CTUh	4,06E-09	2,03E-10	1,42E-07	1,46E-07	1,31E-09	6,65E-11	0,00E+00	2,13E-10	8,85E-09	0,00E+00	-4,84E-08
Human tox. non-cancer	CTUh	3,81E-08	1,18E-08	2,78E-06	2,83E-06	4,48E-08	2,27E-09	0,00E+00	1,21E-08	4,79E-07	0,00E+00	-1,97E-06
SQP ⁷⁾	-	2,16E+03	1,79E+01	1,18E+04	1,39E+04	5,67E+01	8,60E-01	0,00E+00	1,89E+01	1,02E+02	0,00E+00	-9,19E+02

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	-1,33E+03	2,98E-01	2,21E+03	8,81E+02	1,17E+00	-4,46E+01	0,00E+00	2,57E-01	0,00E+00	0,00E+00	-2,42E+02
Renew. PER as material	MJ	2,34E+03	0,00E+00	6,80E+01	2,41E+03	0,00E+00	-6,79E+01	0,00E+00	0,00E+00	-2,34E+03	0,00E+00	0,00E+00
Total use of renew. PER	MJ	1,02E+03	2,98E-01	2,27E+03	3,29E+03	1,17E+00	-1,12E+02	0,00E+00	2,57E-01	-2,34E+03	0,00E+00	-2,42E+02
Non-re. PER as energy	MJ	8,35E+01	1,82E+01	2,26E+03	2,36E+03	9,61E+01	-6,81E+00	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Non-re. PER as material	MJ	0,00E+00	0,00E+00	1,46E+01	1,46E+01	0,00E+00	-1,45E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	8,35E+01	1,82E+01	2,27E+03	2,38E+03	9,61E+01	-2,13E+01	0,00E+00	1,87E+01	1,71E+02	0,00E+00	-6,26E+03
Secondary materials	kg	4,37E-02	7,92E-03	8,17E-01	8,69E-01	4,18E-02	9,87E-04	0,00E+00	7,98E-03	1,64E-01	0,00E+00	0,00E+00
Renew. secondary fuels	MJ	7,05E-04	9,99E-05	8,13E+00	8,13E+00	3,35E-04	1,58E-05	0,00E+00	1,01E-04	1,23E-03	0,00E+00	-1,77E-03
Non-ren. secondary fuels	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	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	6,34E-02	2,68E-03	1,98E+00	2,05E+00	1,06E-02	1,37E-03	0,00E+00	2,77E-03	8,88E-02	0,00E+00	-4,28E+00

8) PER = Primary energy resources.

END OF LIFE - WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	2,17E-01	2,64E-02	2,31E+00	2,55E+00	1,29E-01	1,09E-02	0,00E+00	3,18E-02	1,66E+00	0,00E+00	-2,37E+01
Non-hazardous waste	kg	1,17E+01	5,30E-01	8,11E+02	8,23E+02	2,25E+00	6,28E-01	0,00E+00	5,88E-01	2,65E+02	0,00E+00	-4,27E+02
Radioactive waste	kg	3,68E-04	5,45E-06	4,32E-03	4,69E-03	2,03E-05	5,40E-06	0,00E+00	4,00E-06	1,73E-04	0,00E+00	-1,37E-02

END OF LIFE - OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
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	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	5,00E-03	5,00E-03	0,00E+00	4,48E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,36E-01	0,00E+00	0,00E+00	2,40E+02	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,22E+00	0,00E+00	0,00E+00	3,67E+03	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,74E+00	0,00E+00	0,00E+00	1,22E+03	0,00E+00	0,00E+00
Exported energy –	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,48E+00	0,00E+00	0,00E+00	2,45E+03	0,00E+00	0,00E+00

ADDITIONAL INDICATOR - GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG ⁹⁾	kg CO ₂ e	4,59E+00	1,22E+00	1,55E+02	1,61E+02	7,05E+00	6,59E-01	0,00E+00	1,29E+00	1,36E+01	0,00E+00	-4,01E+02

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH₄ fossil, CH₄ biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO₂ is set to zero.

REFERENCES

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ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

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Ecoinvent 3.10.1 database (2024) and One Click LCA database (2023)