ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

TULPPA - WET ROOM BOARDS

FINNFOAM OY

GENERAL INFORMATION

MANUFACTURER INFORMATION

Manufacturer	Finnfoam Oy
Address	Finnfoam Oy, Satamakatu 5, 24100 Salo, Finland
Contact details	Sari Judin, sari.judin@finnfoam.fi
Website	www.finnfoam.fi www.tulppa.com

PRODUCT IDENTIFICATION

Product name	Tulppa – Wet Room Boards
Place of production	Salo, Finland

Jessica Karhu
RTS EPD Committee secretary

Laura Apilo
Managing Director

EPD INFORMATION

EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

EPD program operator	The Building Information Foundation RTS sr Malminkatu 16 A, 00100 Helsinki, Finland http://cer.rts.fi
EPD standards	This EPD is in accordance with EN 15804 +A2, ISO 14025 and ISO 21930 standards.
Product category rules (PCR)	The CEN standard EN 15804+A2 serves as the core PCR. In addition, the RTS PCR (English version, 26.8.2020) is used.
EPD author	Ipek Goktas, at Bionova Ltd Suvilahdenkatu 10 B 00500 Helsinki, Finland www.bionova.fi
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
EPD verifier	Silvia Vilčeková, Silcert, s.r.o.
Verification date	17.6.2021
EPD number	RTS_135_21
ECO Platform nr.	
Publishing date	9.7.2021
EPD valid until	8.7.2026

PRODUCT INFORMATION

PRODUCT DESCRIPTION

Finnfoam Oy's Tulppa is a Finnish-made wet room panel, which functions as both a construction board and waterproofing material. The core of the panel is made from a closed-cell, waterproof and mold-proof Finnfoam (XPS) insulation material and the surface layer consists of strong, special-purpose cement mortar. The Tulppa panel can be used as a base for tiling.

PRODUCT RAW MATERIAL COMPOSITION

Material	Weight, kg
Finnfoam XPS board	0.4 – 2.8
Cement plaster	2.8
Glass fibre mesh	0.3

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Minerals	53 - 88	Europe
Fossil materials	12 - 47	Europe
Metals	-	-
Bio-based materials	-	-

SUBSTANCES, REACH - VERY HIGH CONCERN

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

PRODUCT APPLICATION

Tulppa is a horizontally installed wet room panel, which functions as both a construction board and waterproofing material.

TECHNICAL SPECIFICATIONS

Tulppa and INFRA are available as 600x2600 mm panels and the following conductivity/thickness combinations; Tulppa: 0.033 W/mK (20 and 30 mm), 0.035 W/mK (50 mm), 0.037 W/mK (80 mm) and INFRA: 0.035 W/mK (50mm) and 0.037 W/mK (80 and 100 mm). Tulppa wet room boards are used simultaneously as building boards and waterproofing materials. INFRA insulation panels are used in infrastructure applications such as dividing layers in low-speed roads and low-load-bearing grounds prone to freezing. Tulppa and INFRA products have been modeled as an average product with a thickness of 50 mm, of which 48 mm XPS-board and 2 mm cement plaster. The results of this EPD represent this average product thickness. The nominal density of the average product is 87 kg/m3 and thermal conductivity 0.035 W/mK.

PRODUCT STANDARDS

ETAG 022-3 Watertight covering kits for wet room floors and/or wall Part 3 – Kits based on inherently watertight boards. EN 13164:2012+A1:2015 Thermal insulation products for buildings. Factory made extruded polystyrene foam (XPS) products.

PHYSICAL PROPERTIES OF THE PRODUCT

Detailed physical information can be found from the manufacturer's webpage (https://www.tulppa.com/Tulppa-panel).

ADDITIONAL TECHNICAL INFORMATION

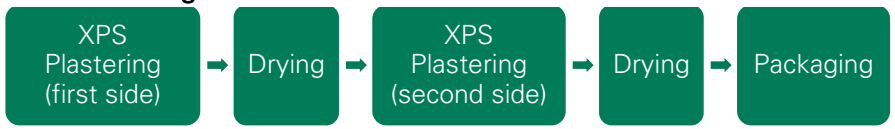
Further information can be found at www.tulppa.com.

PRODUCT LIFE CYCLE

MANUFACTURING AND PACKAGING (A1-A3)

Tulppa and INFRA insulation panels are manufactured from Finnfoam thermal insulation (XPS) panels, which are covered on both sides with a fibre-glass mesh and a special cement plaster. The mesh and plaster are first applied on one side of the panel, after which it is dried in a drying tunnel. The panels are then collected and moved to the beginning of the production line, where the mesh reinforced plaster is applied to the other side of the panel. After the plaster has dried in the tunnel the product is trimmed, wrapped in plastic and piled on wooden pallets.

Manufacturing flow chart



TRANSPORT AND INSTALLATION (A4-A5)

Annual delivery rates are taken into consideration for transportation scenario. There is no significant weight loss due to the emission of ethanol in the XPS board during transportation. Transportation impacts occurred from delivering of the product cover direct exhaust emissions of fuel, environmental impacts of fuel production, as well as related infrastructure emissions. (A4)

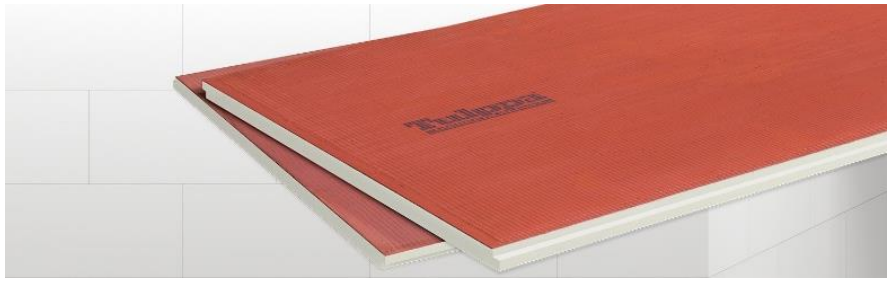
Environmental impacts from installation into the building include waste wood pallet and plastic film which are used for delivering the product. The impacts of weight loss from the product, energy consumption and used ancillary materials during installation are negligible. (A5)

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover use phase. Air, soil and water impacts during the use phase have not been studied. During the service life of the product, ethanol in the XPS board is emitted, however it does not have any harmful impact; therefore, it is not taken into consideration.

PRODUCT END OF LIFE (C1-C4, D)

The blowing agent ethanol in the XPS board is assumed to be emitted during the service life of the product; therefore, the mass loss due to the blowing agent is taken into consideration in end-of-life stage. Consumption of energy and natural resources in demolition process assumed to be negligible. (C1) The distance for transportation to disposal is assumed as 50 km and the transportation method is assumed to be lorry. (C2) Considering the manufacturer's information, 100% of end-of-life EPS product is assumed to be recovered to energy in incineration plant as it is easy to collect and qualified for energy recovery. (C3) The environmental impacts of disposal are zero since 100% of the end-of-life product is considered to be recovered to energy. (C4) Thanks to the energy recovery process end-of-life product replaces heat and electricity. (D)



LIFE CYCLE ASSESSMENT

LIFE CYCLE ASSESSMENT INFORMATION

Period for data	year 2019

DECLARED AND FUNCTIONAL UNIT

Declared unit	1 m^2
Mass per declared unit	3.54 kg (with 12.5 mm XPS) 3.80 kg (with 20 mm XPS) 4.15 kg (with 30 mm XPS) 4.85 kg (with 50 mm XPS) 5.90 kg (with 80 mm XPS)

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	0.15 - 0.24

SYSTEM BOUNDARY

The scope of the EPD is "cradle to gate with modules A4, A5, C1-C4 and D". The modules A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing), A4 (Transport), A5 (Assembly) as well as C1 (Deconstruction/ demolition), C2 (Transport at end-of-life), C3 (Waste processing), C4 (Disposal) and D (benefits and loads beyond the system boundary) are included in the study.

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	D	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x	x	x
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND.

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the *EN 15804A1:2012+A2:2019* and *RTS 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 which data are available for are included in the calculation. There is no neglected unit process more than 1% of total mass and energy flows. The total neglected input and output flows do also not exceed 5% of energy usage or mass. The life cycle analysis includes all industrial processes from raw material acquisition to production, distribution, and end-of-life stages.

The modules A5, B1-B7 have not been calculated nor included in the LCA calculations.

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 is based on annual production rate and made with high accuracy and precision. The values for 1 m^2 of the produced product which is used within this study are calculated by considering the total product weight per annual production. The product output is fixed to 1 m^2 and the corresponding amount of product is used in the calculations.

In the production plant, several kinds of products are produced; since the production processes of these products are similar, the annual production percentages are taken into consideration for allocation. According to the ratio of the annual production of the declared product to the total annual production at the factory, the annual total energy consumption, packaging materials and the generated waste per the declared product are allocated. Subsequently, the produced product output fixed to 1 m^2 and the corresponding amount of product is used in the calculations.

This LCA study is conducted in accordance with all methodological considerations, such as performance, system boundaries, data quality, allocation procedures, and decision rules to evaluate inputs and outputs. All estimations and assumptions are given below.

- Module A2, A4 & C2: Vehicle capacity utilization volume factor is assumed to be 1 which means full load. In reality it may vary but as the role of transportation emission in total results is small and so the variety in load assumed to be negligible. Empty returns are not taken into account as it is assumed that return trip is used by transportation companies to serve the needs of other clients.
- Module A4: Transportation doesn't cause losses as products are packaged properly. Also, volume capacity utilisation factor is assumed to be 1 for the nested packaged products. Additionally, transportation distances and vehicle types are assumed according to the delivery in the last year.
- Module C1: The impacts of the disassembly stage are assumed zero, since the consumption of energy and natural resources for disassembling the end-of-life product is negligible.
- Module C2: Transportation distance to the closest disposal area is estimated as 50 km and the transportation method is assumed as lorry which is the most common.
- Module C3, C4, D: 100% of the end-of-life product is assumed to be recovered to energy. According to the manufacturer's information, Module C3 includes the incineration of the product, including the landfilling of the formed slag and ash. Module C4 impacts are zero as the products are considered to be 100 % collected for incineration. Module D considers the benefits of energy recovery which replaces district heat and electricity.

AVERAGES AND VARIABILITY

Any average and variation are not concerned since this EPD refers one specific product produced in one production plant. There are different thickness options for the product; however, the products with different thicknesses have been assessed independently. The results are given separately for each thickness.

ENVIRONMENTAL IMPACT DATA

The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Note: "ENVIRONMENTAL IMPACTS - EN 15804+A1, CML / ISO 21930" and "ENVIRONMENTAL IMPACTS - TRACI 2.1" are presented in ANNEX-1 and ANNEX-2 respectively.

TULPPA WITH 12.5 MM XPS

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	2.29E+00	5.07E-01	-1.18E-01	2.68E+00	6.98E-02	5.68E-01	MND	0.00E+00	2.25E-02	2.46E+00	0.00E+00	-9.05E-01
Climate change – fossil	kg CO_2e	2.27E+00	5.07E-01	4.06E-01	3.19E+00	7.04E-02	3.02E-02	MND	0.00E+00	2.25E-02	8.26E-01	0.00E+00	-9.05E-01
Climate change – biogenic	kg CO_2e	1.80E-02	2.70E-04	-5.31E-01	-5.13E-01	5.11E-05	5.38E-01	MND	0.00E+00	1.38E-05	1.63E+00	0.00E+00	-4.33E-04
Climate change – LULUC	kg CO_2e	1.28E-03	1.80E-04	8.00E-03	9.46E-03	2.12E-05	2.73E-06	MND	0.00E+00	7.93E-06	1.46E-05	0.00E+00	-3.75E-05
Ozone depletion	kg CFC11e	1.02E-07	1.15E-07	8.87E-08	3.05E-07	1.65E-08	1.51E-09	MND	0.00E+00	5.15E-09	7.46E-09	0.00E+00	-1.87E-07
Acidification	mol H^+e	9.80E-03	2.07E-03	2.11E-03	1.40E-02	2.96E-04	8.31E-05	MND	0.00E+00	9.26E-05	3.56E-04	0.00E+00	-8.12E-03
Eutrophication, aquatic freshwater [1]	kg Pe	4.37E-05	4.24E-06	2.02E-05	6.82E-05	5.73E-07	1.29E-07	MND	0.00E+00	1.94E-07	7.60E-07	0.00E+00	-1.77E-06
Eutrophication, aquatic marine	kg Ne	2.08E-03	6.15E-04	4.75E-04	3.17E-03	8.91E-05	3.66E-05	MND	0.00E+00	2.74E-05	1.46E-04	0.00E+00	-7.66E-04
Eutrophication, terrestrial	mol Ne	2.31E-02	6.79E-03	4.78E-03	3.46E-02	9.84E-04	3.87E-04	MND	0.00E+00	3.03E-04	1.50E-03	0.00E+00	-7.49E-03
Photochemical ozone formation	kg NMVOCe	6.72E-03	2.08E-03	1.46E-03	1.03E-02	3.16E-04	1.00E-04	MND	0.00E+00	9.51E-05	4.43E-04	0.00E+00	-2.47E-03
Abiotic depletion, minerals & metals [2]	kg Sbe	1.73E-04	1.37E-05	2.77E-06	1.89E-04	1.20E-06	1.86E-07	MND	0.00E+00	5.61E-07	8.32E-07	0.00E+00	-5.31E-07
Abiotic depletion of fossil resources [2]	MJ	5.02E+01	7.64E+00	1.85E+01	7.63E+01	1.09E+00	1.17E-01	MND	0.00E+00	3.43E-01	6.21E-01	0.00E+00	-1.15E+01
Water use [2]	m^3e deprived	4.80E-01	2.46E-02	2.84E-01	7.88E-01	4.07E-03	-2.00E-03	MND	0.00E+00	1.22E-03	-3.56E-02	0.00E+00	-1.69E-01

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 12.5 MM XPS

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	6.80E-08	3.53E-08	2.34E-08	1.27E-07	6.37E-09	1.01E-09	MND	0.00E+00	1.73E-09	9.45E-09	0.00E+00	-7.47E-08
Ionizing radiation, human health [3]	kBq U235e	2.98E-01	3.34E-02	5.05E-01	8.36E-01	4.78E-03	3.95E-04	MND	0.00E+00	1.50E-03	2.04E-03	0.00E+00	-5.06E-02
Eco-toxicity (freshwater) [2]	CTUe	2.24E+01	5.90E+00	1.06E+01	3.89E+01	8.37E-01	1.73E-01	MND	0.00E+00	2.68E-01	1.87E+00	0.00E+00	-5.89E+00
Human toxicity, cancer effects [2]	CTUh	1.02E-09	1.71E-10	4.13E-10	1.60E-09	2.14E-11	1.88E-11	MND	0.00E+00	7.58E-12	2.35E-10	0.00E+00	-3.72E-10
Human toxicity, non-cancer effects [2]	CTUh	5.55E-08	6.67E-09	5.49E-09	6.76E-08	9.92E-10	8.36E-10	MND	0.00E+00	3.07E-10	5.74E-09	0.00E+00	-3.33E-09
Land use related impacts/soil quality [2]	-	5.54E+00	6.36E+00	6.75E-01	1.26E+01	1.65E+00	1.03E-01	MND	0.00E+00	3.82E-01	9.62E-01	0.00E+00	-1.98E-01

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "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."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	2.30E+00	1.08E-01	1.38E+01	1.62E+01	1.38E-02	4.96E+00	MND	0.00E+00	4.87E-03	1.29E-02	0.00E+00	-3.25E-02
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	5.17E+00	5.17E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	2.30E+00	1.08E-01	1.90E+01	2.14E+01	1.38E-02	4.96E+00	MND	0.00E+00	4.87E-03	1.29E-02	0.00E+00	-3.25E-02
Non-renewable PER used as energy	MJ	3.04E+01	7.64E+00	1.81E+01	5.61E+01	1.09E+00	1.17E-01	MND	0.00E+00	3.43E-01	6.21E-01	0.00E+00	-1.15E+01
Non-renewable PER used as materials	MJ	1.98E+01	0.00E+00	4.45E-01	2.02E+01	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable PER	MJ	5.02E+01	7.64E+00	1.85E+01	7.63E+01	1.09E+00	1.17E-01	MND	0.00E+00	3.43E-01	6.21E-01	0.00E+00	-1.15E+01
Use of secondary materials	kg	2.82E-03	0.00E+00	1.45E-04	2.96E-03	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	2.12E-02	1.31E-03	1.04E-02	3.29E-02	2.28E-04	1.32E-04	MND	0.00E+00	6.50E-05	8.18E-04	0.00E+00	-1.38E-03

PER abbreviation stands for primary energy resources.

TULPPA WITH 12.5 MM XPS

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	4.16E-02	7.76E-03	2.73E-02	7.66E-02	1.06E-03	2.01E-03	MND	0.00E+00	3.57E-04	0.00E+00	0.00E+00	-3.78E-03
Non-hazardous waste	kg	1.73E+00	5.33E-01	5.35E-01	2.79E+00	1.18E-01	3.33E-01	MND	0.00E+00	2.97E-02	0.00E+00	0.00E+00	-5.54E-02
Radioactive waste	kg	6.67E-05	5.24E-05	2.16E-04	3.35E-04	7.52E-06	6.00E-07	MND	0.00E+00	2.34E-06	0.00E+00	0.00E+00	-8.35E-05

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	3.13E-01	MND	0.00E+00	0.00E+00	3.53E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	6.48E-01	1.43E-01	-3.34E-02	7.58E-01	1.97E-02	1.61E-01	MND	0.00E+00	6.36E-03	6.95E-01	0.00E+00	-2.56E-01
Abiotic depletion. minerals & metals [2]	kg Sbe	4.88E-05	3.87E-06	7.83E-07	5.34E-05	3.39E-07	5.26E-08	MND	0.00E+00	1.59E-07	2.35E-07	0.00E+00	-1.50E-07
Abiotic depletion of fossil resources [2]	MJ	1.42E+01	2.16E+00	5.23E+00	2.16E+01	3.08E-01	3.31E-02	MND	0.00E+00	9.70E-02	1.76E-01	0.00E+00	-3.25E+00
Water use [2]	m^3e deprived	1.36E-01	6.95E-03	8.03E-02	2.23E-01	1.15E-03	-5.65E-04	MND	0.00E+00	3.45E-04	-1.01E-02	0.00E+00	-4.78E-02
Use of secondary materials	kg	7.96E-04	0.00E+00	4.10E-05	8.37E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	4.14E-02	4.14E-02	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 20 MM XPS

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	2.97E+00	5.07E-01	-1.26E-01	3.35E+00	7.49E-02	6.10E-01	MND	0.00E+00	2.41E-02	2.93E+00	0.00E+00	-1.44E+00
Climate change – fossil	kg CO_2e	2.95E+00	5.07E-01	4.36E-01	3.89E+00	7.56E-02	3.24E-02	MND	0.00E+00	2.41E-02	1.30E+00	0.00E+00	-1.44E+00
Climate change – biogenic	kg CO_2e	1.84E-02	2.70E-04	-5.70E-01	-5.51E-01	5.49E-05	5.78E-01	MND	0.00E+00	1.48E-05	1.63E+00	0.00E+00	-6.87E-04
Climate change – LULUC	kg CO_2e	1.56E-03	1.80E-04	8.59E-03	1.03E-02	2.28E-05	2.93E-06	MND	0.00E+00	8.51E-06	1.67E-05	0.00E+00	-5.96E-05
Ozone depletion	kg CFC11e	1.13E-07	1.15E-07	9.53E-08	3.24E-07	1.78E-08	1.63E-09	MND	0.00E+00	5.53E-09	8.67E-09	0.00E+00	-2.96E-07
Acidification	mol H^+e	1.17E-02	2.07E-03	2.27E-03	1.61E-02	3.18E-04	8.92E-05	MND	0.00E+00	9.93E-05	4.43E-04	0.00E+00	-1.29E-02
Eutrophication, aquatic freshwater [1]	kg Pe	4.87E-05	4.24E-06	2.17E-05	7.46E-05	6.15E-07	1.39E-07	MND	0.00E+00	2.08E-07	8.36E-07	0.00E+00	-2.81E-06
Eutrophication, aquatic marine	kg Ne	2.47E-03	6.15E-04	5.10E-04	3.59E-03	9.57E-05	3.94E-05	MND	0.00E+00	2.94E-05	1.88E-04	0.00E+00	-1.22E-03
Eutrophication, terrestrial	mol Ne	2.74E-02	6.79E-03	5.13E-03	3.93E-02	1.06E-03	4.15E-04	MND	0.00E+00	3.25E-04	1.91E-03	0.00E+00	-1.19E-02
Photochemical ozone formation	kg NMVOCe	8.20E-03	2.08E-03	1.57E-03	1.18E-02	3.40E-04	1.08E-04	MND	0.00E+00	1.02E-04	5.66E-04	0.00E+00	-3.92E-03
Abiotic depletion, minerals & metals [2]	kg Sbe	1.74E-04	1.37E-05	2.98E-06	1.90E-04	1.29E-06	1.99E-07	MND	0.00E+00	6.02E-07	9.62E-07	0.00E+00	-8.43E-07
Abiotic depletion of fossil resources [2]	MJ	7.26E+01	7.64E+00	1.99E+01	1.00E+02	1.18E+00	1.26E-01	MND	0.00E+00	3.68E-01	7.16E-01	0.00E+00	-1.83E+01
Water use [2]	m^3e deprived	6.05E-01	2.46E-02	3.05E-01	9.34E-01	4.38E-03	-2.15E-03	MND	0.00E+00	1.31E-03	-3.39E-02	0.00E+00	-2.68E-01

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 20 MM XPS

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	8.13E-08	3.53E-08	2.52E-08	1.42E-07	6.84E-09	1.08E-09	MND	0.00E+00	1.86E-09	1.08E-08	0.00E+00	-1.19E-07
Ionizing radiation, human health [3]	kBq U235e	4.46E-01	3.34E-02	5.42E-01	1.02E+00	5.14E-03	4.24E-04	MND	0.00E+00	1.61E-03	2.34E-03	0.00E+00	-8.03E-02
Eco-toxicity (freshwater) [2]	CTUe	2.55E+01	5.90E+00	1.14E+01	4.28E+01	8.99E-01	1.86E-01	MND	0.00E+00	2.87E-01	2.53E+00	0.00E+00	-9.35E+00
Human toxicity, cancer effects [2]	CTUh	1.14E-09	1.71E-10	4.43E-10	1.75E-09	2.30E-11	2.02E-11	MND	0.00E+00	8.14E-12	3.24E-10	0.00E+00	-5.90E-10
Human toxicity, non-cancer effects [2]	CTUh	6.28E-08	6.67E-09	5.90E-09	7.53E-08	1.07E-09	8.98E-10	MND	0.00E+00	3.29E-10	7.25E-09	0.00E+00	-5.28E-09
Land use related impacts/soil quality [2]	-	5.89E+00	6.36E+00	7.25E-01	1.30E+01	1.78E+00	1.10E-01	MND	0.00E+00	4.10E-01	1.10E+00	0.00E+00	-3.14E-01

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "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."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	2.90E+00	1.08E-01	1.48E+01	1.78E+01	1.48E-02	5.33E+00	MND	0.00E+00	5.22E-03	1.45E-02	0.00E+00	-5.16E-02
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	5.55E+00	5.55E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	2.90E+00	1.08E-01	2.04E+01	2.34E+01	1.48E-02	5.33E+00	MND	0.00E+00	5.22E-03	1.45E-02	0.00E+00	-5.16E-02
Non-renewable PER used as energy	MJ	4.10E+01	7.64E+00	1.94E+01	6.80E+01	1.18E+00	1.26E-01	MND	0.00E+00	3.68E-01	7.16E-01	0.00E+00	-1.83E+01
Non-renewable PER used as materials	MJ	3.16E+01	0.00E+00	4.78E-01	3.21E+01	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable PER	MJ	7.26E+01	7.64E+00	1.99E+01	1.00E+02	1.18E+00	1.26E-01	MND	0.00E+00	3.68E-01	7.16E-01	0.00E+00	-1.83E+01
Use of secondary materials	kg	2.92E-03	0.00E+00	1.56E-04	3.08E-03	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	2.44E-02	1.31E-03	1.12E-02	3.70E-02	2.45E-04	1.41E-04	MND	0.00E+00	6.97E-05	9.43E-04	0.00E+00	-2.19E-03

PER abbreviation stands for primary energy resources.

TULPPA WITH 20 MM XPS

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	4.34E-02	7.76E-03	2.94E-02	8.06E-02	1.14E-03	2.16E-03	MND	0.00E+00	3.83E-04	0.00E+00	0.00E+00	-5.99E-03
Non-hazardous waste	kg	1.80E+00	5.33E-01	5.75E-01	2.90E+00	1.26E-01	3.58E-01	MND	0.00E+00	3.18E-02	0.00E+00	0.00E+00	-8.79E-02
Radioactive waste	kg	8.03E-05	5.24E-05	2.32E-04	3.65E-04	8.07E-06	6.44E-07	MND	0.00E+00	2.52E-06	0.00E+00	0.00E+00	-1.33E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	3.36E-01	MND	0.00E+00	0.00E+00	3.78E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	7.81E-01	1.33E-01	-3.32E-02	8.82E-01	1.97E-02	1.61E-01	MND	0.00E+00	6.34E-03	7.71E-01	0.00E+00	-3.79E-01
Abiotic depletion. minerals & metals [2]	kg Sbe	4.57E-05	3.61E-06	7.84E-07	5.01E-05	3.39E-07	5.24E-08	MND	0.00E+00	1.58E-07	2.53E-07	0.00E+00	-2.22E-07
Abiotic depletion of fossil resources [2]	MJ	1.91E+01	2.01E+00	5.24E+00	2.64E+01	3.11E-01	3.32E-02	MND	0.00E+00	9.68E-02	1.88E-01	0.00E+00	-4.82E+00
Water use [2]	m^3e deprived	1.59E-01	6.47E-03	8.03E-02	2.46E-01	1.15E-03	-5.66E-04	MND	0.00E+00	3.45E-04	-8.92E-03	0.00E+00	-7.05E-02
Use of secondary materials	kg	7.69E-04	0.00E+00	4.11E-05	8.10E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	4.14E-02	4.14E-02	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 30 MM XPS

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	3.87E+00	5.07E-01	-1.38E-01	4.24E+00	8.19E-02	6.66E-01	MND	0.00E+00	2.63E-02	3.57E+00	0.00E+00	-2.15E+00
Climate change – fossil	kg CO_2e	3.85E+00	5.07E-01	4.76E-01	4.83E+00	8.26E-02	3.54E-02	MND	0.00E+00	2.63E-02	1.94E+00	0.00E+00	-2.14E+00
Climate change – biogenic	kg CO_2e	1.89E-02	2.70E-04	-6.23E-01	-6.04E-01	6.00E-05	6.31E-01	MND	0.00E+00	1.61E-05	1.63E+00	0.00E+00	-1.03E-03
Climate change – LULUC	kg CO_2e	1.95E-03	1.80E-04	9.38E-03	1.15E-02	2.49E-05	3.20E-06	MND	0.00E+00	9.28E-06	1.94E-05	0.00E+00	-8.90E-05
Ozone depletion	kg CFC11e	1.29E-07	1.15E-07	1.04E-07	3.48E-07	1.94E-08	1.78E-09	MND	0.00E+00	6.03E-09	1.03E-08	0.00E+00	-4.43E-07
Acidification	mol H^+e	1.43E-02	2.07E-03	2.47E-03	1.89E-02	3.47E-04	9.74E-05	MND	0.00E+00	1.08E-04	5.58E-04	0.00E+00	-1.92E-02
Eutrophication, aquatic freshwater [1]	kg Pe	5.52E-05	4.24E-06	2.38E-05	8.33E-05	6.72E-07	1.51E-07	MND	0.00E+00	2.27E-07	9.37E-07	0.00E+00	-4.19E-06
Eutrophication, aquatic marine	kg Ne	2.98E-03	6.15E-04	5.58E-04	4.16E-03	1.05E-04	4.30E-05	MND	0.00E+00	3.21E-05	2.43E-04	0.00E+00	-1.82E-03
Eutrophication, terrestrial	mol Ne	3.31E-02	6.80E-03	5.61E-03	4.55E-02	1.15E-03	4.53E-04	MND	0.00E+00	3.54E-04	2.46E-03	0.00E+00	-1.77E-02
Photochemical ozone formation	kg NMVOCe	1.02E-02	2.08E-03	1.71E-03	1.40E-02	3.71E-04	1.18E-04	MND	0.00E+00	1.11E-04	7.31E-04	0.00E+00	-5.85E-03
Abiotic depletion, minerals & metals [2]	kg Sbe	1.75E-04	1.37E-05	3.25E-06	1.92E-04	1.41E-06	2.18E-07	MND	0.00E+00	6.56E-07	1.14E-06	0.00E+00	-1.26E-06
Abiotic depletion of fossil resources [2]	MJ	1.03E+02	7.64E+00	2.17E+01	1.32E+02	1.28E+00	1.38E-01	MND	0.00E+00	4.01E-01	8.43E-01	0.00E+00	-2.73E+01
Water use [2]	m^3e deprived	7.71E-01	2.46E-02	3.32E-01	1.13E+00	4.78E-03	-2.35E-03	MND	0.00E+00	1.42E-03	-3.17E-02	0.00E+00	-4.00E-01

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	9.91E-08	3.53E-08	2.75E-08	1.62E-07	7.47E-09	1.18E-09	MND	0.00E+00	2.03E-09	1.27E-08	0.00E+00	-1.77E-07
Ionizing radiation, human health [3]	kBq U235e	6.44E-01	3.34E-02	5.92E-01	1.27E+00	5.61E-03	4.63E-04	MND	0.00E+00	1.75E-03	2.74E-03	0.00E+00	-1.20E-01
Eco-toxicity (freshwater) [2]	CTUe	2.97E+01	5.90E+00	1.25E+01	4.81E+01	9.82E-01	2.03E-01	MND	0.00E+00	3.13E-01	3.42E+00	0.00E+00	-1.40E+01
Human toxicity, cancer effects [2]	CTUh	1.30E-09	1.71E-10	4.84E-10	1.96E-09	2.51E-11	2.21E-11	MND	0.00E+00	8.87E-12	4.42E-10	0.00E+00	-8.82E-10
Human toxicity, non-cancer effects [2]	CTUh	7.25E-08	6.67E-09	6.45E-09	8.56E-08	1.16E-09	9.81E-10	MND	0.00E+00	3.59E-10	9.26E-09	0.00E+00	-7.89E-09
Land use related impacts/soil quality [2]	-	6.35E+00	6.36E+00	7.92E-01	1.35E+01	1.94E+00	1.20E-01	MND	0.00E+00	4.47E-01	1.27E+00	0.00E+00	-4.69E-01

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "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."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	3.69E+00	1.08E-01	1.62E+01	2.00E+01	1.62E-02	5.82E+00	MND	0.00E+00	5.70E-03	1.66E-02	0.00E+00	-7.70E-02
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	6.06E+00	6.06E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	3.69E+00	1.08E-01	2.23E+01	2.61E+01	1.62E-02	5.82E+00	MND	0.00E+00	5.70E-03	1.66E-02	0.00E+00	-7.70E-02
Non-renewable PER used as energy	MJ	5.51E+01	7.64E+00	2.12E+01	8.40E+01	1.28E+00	1.38E-01	MND	0.00E+00	4.01E-01	8.43E-01	0.00E+00	-2.73E+01
Non-renewable PER used as materials	MJ	4.75E+01	0.00E+00	5.21E-01	4.80E+01	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable PER	MJ	1.03E+02	7.64E+00	2.17E+01	1.32E+02	1.28E+00	1.38E-01	MND	0.00E+00	4.01E-01	8.43E-01	0.00E+00	-2.73E+01
Use of secondary materials	kg	3.07E-03	0.00E+00	1.70E-04	3.24E-03	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	2.87E-02	1.31E-03	1.22E-02	4.22E-02	2.67E-04	1.54E-04	MND	0.00E+00	7.60E-05	1.11E-03	0.00E+00	-3.27E-03

PER abbreviation stands for primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	4.59E-02	7.76E-03	3.21E-02	8.57E-02	1.25E-03	2.36E-03	MND	0.00E+00	4.17E-04	0.00E+00	0.00E+00	-8.95E-03
Non-hazardous waste	kg	1.89E+00	5.33E-01	6.28E-01	3.05E+00	1.38E-01	3.91E-01	MND	0.00E+00	3.47E-02	0.00E+00	0.00E+00	-1.31E-01
Radioactive waste	kg	9.83E-05	5.24E-05	2.53E-04	4.04E-04	8.82E-06	7.03E-07	MND	0.00E+00	2.74E-06	0.00E+00	0.00E+00	-1.98E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	3.67E-01	MND	0.00E+00	0.00E+00	4.13E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	9.32E-01	1.22E-01	-3.33E-02	1.02E+00	1.97E-02	1.60E-01	MND	0.00E+00	6.34E-03	8.60E-01	0.00E+00	-5.18E-01
Abiotic depletion. minerals & metals [2]	kg Sbe	4.21E-05	3.30E-06	7.83E-07	4.62E-05	3.40E-07	5.25E-08	MND	0.00E+00	1.58E-07	2.75E-07	0.00E+00	-3.04E-07
Abiotic depletion of fossil resources [2]	MJ	2.47E+01	1.84E+00	5.23E+00	3.18E+01	3.08E-01	3.33E-02	MND	0.00E+00	9.66E-02	2.03E-01	0.00E+00	-6.58E+00
Water use [2]	m^3e deprived	1.86E-01	5.93E-03	8.00E-02	2.72E-01	1.15E-03	-5.66E-04	MND	0.00E+00	3.42E-04	-7.64E-03	0.00E+00	-9.64E-02
Use of secondary materials	kg	7.39E-04	0.00E+00	4.10E-05	7.80E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	4.14E-02	4.14E-02	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 50 MM XPS

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	5.67E+00	5.07E-01	-1.62E-01	6.02E+00	9.57E-02	7.79E-01	MND	0.00E+00	3.07E-02	4.84E+00	0.00E+00	-3.56E+00
Climate change – fossil	kg CO_2e	5.65E+00	5.07E-01	5.56E-01	6.71E+00	9.65E-02	4.15E-02	MND	0.00E+00	3.06E-02	3.20E+00	0.00E+00	-3.56E+00
Climate change – biogenic	kg CO_2e	1.99E-02	2.71E-04	-7.29E-01	-7.09E-01	7.01E-05	7.37E-01	MND	0.00E+00	1.88E-05	1.63E+00	0.00E+00	-1.70E-03
Climate change – LULUC	kg CO_2e	2.72E-03	1.80E-04	1.10E-02	1.39E-02	2.90E-05	3.74E-06	MND	0.00E+00	1.08E-05	2.50E-05	0.00E+00	-1.48E-04
Ozone depletion	kg CFC11e	1.60E-07	1.15E-07	1.22E-07	3.97E-07	2.27E-08	2.08E-09	MND	0.00E+00	7.02E-09	1.35E-08	0.00E+00	-7.35E-07
Acidification	mol H^+e	1.95E-02	2.07E-03	2.89E-03	2.44E-02	4.05E-04	1.14E-04	MND	0.00E+00	1.26E-04	7.90E-04	0.00E+00	-3.20E-02
Eutrophication, aquatic freshwater [1]	kg Pe	6.84E-05	4.24E-06	2.78E-05	1.00E-04	7.85E-07	1.77E-07	MND	0.00E+00	2.65E-07	1.14E-06	0.00E+00	-6.96E-06
Eutrophication, aquatic marine	kg Ne	4.02E-03	6.16E-04	6.52E-04	5.29E-03	1.22E-04	5.03E-05	MND	0.00E+00	3.74E-05	3.54E-04	0.00E+00	-3.02E-03
Eutrophication, terrestrial	mol Ne	4.46E-02	6.80E-03	6.55E-03	5.80E-02	1.35E-03	5.30E-04	MND	0.00E+00	4.13E-04	3.57E-03	0.00E+00	-2.95E-02
Photochemical ozone formation	kg NMVOCe	1.41E-02	2.08E-03	2.00E-03	1.82E-02	4.34E-04	1.37E-04	MND	0.00E+00	1.30E-04	1.06E-03	0.00E+00	-9.72E-03
Abiotic depletion, minerals & metals [2]	kg Sbe	1.77E-04	1.37E-05	3.81E-06	1.95E-04	1.65E-06	2.55E-07	MND	0.00E+00	7.65E-07	1.48E-06	0.00E+00	-2.09E-06
Abiotic depletion of fossil resources [2]	MJ	1.63E+02	7.65E+00	2.54E+01	1.96E+02	1.50E+00	1.61E-01	MND	0.00E+00	4.68E-01	1.10E+00	0.00E+00	-4.54E+01
Water use [2]	m^3e deprived	1.10E+00	2.46E-02	3.89E-01	1.52E+00	5.58E-03	-2.74E-03	MND	0.00E+00	1.66E-03	-2.72E-02	0.00E+00	-6.64E-01

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 50 MM XPS

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	1.35E-07	3.53E-08	3.22E-08	2.02E-07	8.73E-09	1.38E-09	MND	0.00E+00	2.36E-09	1.64E-08	0.00E+00	-2.94E-07
Ionizing radiation, human health [3]	kBq U235e	1.04E+00	3.34E-02	6.92E-01	1.76E+00	6.56E-03	5.41E-04	MND	0.00E+00	2.04E-03	3.54E-03	0.00E+00	-1.99E-01
Eco-toxicity (freshwater) [2]	CTUe	3.80E+01	5.90E+00	1.46E+01	5.85E+01	1.15E+00	2.37E-01	MND	0.00E+00	3.65E-01	5.19E+00	0.00E+00	-2.32E+01
Human toxicity, cancer effects [2]	CTUh	1.63E-09	1.71E-10	5.67E-10	2.36E-09	2.93E-11	2.59E-11	MND	0.00E+00	1.03E-11	6.79E-10	0.00E+00	-1.46E-09
Human toxicity, non-cancer effects [2]	CTUh	9.20E-08	6.67E-09	7.54E-09	1.06E-07	1.36E-09	1.15E-09	MND	0.00E+00	4.19E-10	1.33E-08	0.00E+00	-1.31E-08
Land use related impacts/soil quality [2]	-	7.26E+00	6.37E+00	9.27E-01	1.46E+01	2.27E+00	1.41E-01	MND	0.00E+00	5.21E-01	1.63E+00	0.00E+00	-7.79E-01

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "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."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	5.29E+00	1.08E-01	1.90E+01	2.44E+01	1.89E-02	6.80E+00	MND	0.00E+00	6.64E-03	2.10E-02	0.00E+00	-1.28E-01
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	7.10E+00	7.10E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	5.29E+00	1.08E-01	2.61E+01	3.15E+01	1.89E-02	6.80E+00	MND	0.00E+00	6.64E-03	2.10E-02	0.00E+00	-1.28E-01
Non-renewable PER used as energy	MJ	8.34E+01	7.65E+00	2.48E+01	1.16E+02	1.50E+00	1.61E-01	MND	0.00E+00	4.68E-01	1.10E+00	0.00E+00	-4.54E+01
Non-renewable PER used as materials	MJ	7.91E+01	0.00E+00	6.12E-01	7.97E+01	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable PER	MJ	1.63E+02	7.65E+00	2.54E+01	1.96E+02	1.50E+00	1.61E-01	MND	0.00E+00	4.68E-01	1.10E+00	0.00E+00	-4.54E+01
Use of secondary materials	kg	3.35E-03	0.00E+00	2.00E-04	3.55E-03	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	3.73E-02	1.31E-03	1.43E-02	5.29E-02	3.13E-04	1.81E-04	MND	0.00E+00	8.86E-05	1.44E-03	0.00E+00	-5.43E-03

PER abbreviation stands for primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	5.08E-02	7.76E-03	3.75E-02	9.60E-02	1.46E-03	2.76E-03	MND	0.00E+00	4.86E-04	0.00E+00	0.00E+00	-1.49E-02
Non-hazardous waste	kg	2.07E+00	5.33E-01	7.35E-01	3.34E+00	1.61E-01	4.57E-01	MND	0.00E+00	4.04E-02	0.00E+00	0.00E+00	-2.18E-01
Radioactive waste	kg	1.34E-04	5.24E-05	2.96E-04	4.83E-04	1.03E-05	8.22E-07	MND	0.00E+00	3.20E-06	0.00E+00	0.00E+00	-3.29E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	4.29E-01	MND	0.00E+00	0.00E+00	4.81E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	1.17E+00	1.05E-01	-3.34E-02	1.24E+00	1.97E-02	1.61E-01	MND	0.00E+00	6.33E-03	9.98E-01	0.00E+00	-7.34E-01
Abiotic depletion. minerals & metals [2]	kg Sbe	3.66E-05	2.82E-06	7.86E-07	4.02E-05	3.40E-07	5.26E-08	MND	0.00E+00	1.58E-07	3.05E-07	0.00E+00	-4.31E-07
Abiotic depletion of fossil resources [2]	MJ	3.35E+01	1.58E+00	5.24E+00	4.03E+01	3.09E-01	3.32E-02	MND	0.00E+00	9.65E-02	2.27E-01	0.00E+00	-9.36E+00
Water use [2]	m^3e deprived	2.27E-01	5.07E-03	8.02E-02	3.13E-01	1.15E-03	-5.65E-04	MND	0.00E+00	3.42E-04	-5.61E-03	0.00E+00	-1.37E-01
Use of secondary materials	kg	6.90E-04	0.00E+00	4.12E-05	7.32E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	4.14E-02	4.14E-02	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

TULPPA WITH 80 MM XPS

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	8.37E+00	5.08E-01	-1.95E-01	8.68E+00	1.16E-01	9.47E-01	MND	0.00E+00	3.72E-02	6.74E+00	0.00E+00	-5.69E+00
Climate change – fossil	kg CO_2e	8.35E+00	5.07E-01	6.76E-01	9.53E+00	1.17E-01	5.03E-02	MND	0.00E+00	3.72E-02	5.10E+00	0.00E+00	-5.68E+00
Climate change – biogenic	kg CO_2e	2.14E-02	2.71E-04	-8.84E-01	-8.62E-01	8.53E-05	8.97E-01	MND	0.00E+00	2.28E-05	1.63E+00	0.00E+00	-2.72E-03
Climate change – LULUC	kg CO_2e	3.87E-03	1.80E-04	1.33E-02	1.74E-02	3.53E-05	4.55E-06	MND	0.00E+00	1.31E-05	3.33E-05	0.00E+00	-2.36E-04
Ozone depletion	kg CFC11e	2.06E-07	1.15E-07	1.48E-07	4.69E-07	2.76E-08	2.53E-09	MND	0.00E+00	8.52E-09	1.83E-08	0.00E+00	-1.17E-06
Acidification	mol H^+e	2.72E-02	2.07E-03	3.52E-03	3.28E-02	4.93E-04	1.39E-04	MND	0.00E+00	1.53E-04	1.14E-03	0.00E+00	-5.10E-02
Eutrophication, aquatic freshwater [1]	kg Pe	8.81E-05	4.24E-06	3.37E-05	1.26E-04	9.55E-07	2.15E-07	MND	0.00E+00	3.21E-07	1.44E-06	0.00E+00	-1.11E-05
Eutrophication, aquatic marine	kg Ne	5.57E-03	6.16E-04	7.93E-04	6.98E-03	1.49E-04	6.11E-05	MND	0.00E+00	4.53E-05	5.21E-04	0.00E+00	-4.82E-03
Eutrophication, terrestrial	mol Ne	6.18E-02	6.80E-03	7.96E-03	7.66E-02	1.64E-03	6.45E-04	MND	0.00E+00	5.01E-04	5.22E-03	0.00E+00	-4.71E-02
Photochemical ozone formation	kg NMVOCe	2.00E-02	2.08E-03	2.43E-03	2.45E-02	5.28E-04	1.67E-04	MND	0.00E+00	1.57E-04	1.55E-03	0.00E+00	-1.55E-02
Abiotic depletion, minerals & metals [2]	kg Sbe	1.81E-04	1.37E-05	4.62E-06	1.99E-04	2.00E-06	3.10E-07	MND	0.00E+00	9.28E-07	2.00E-06	0.00E+00	-3.34E-06
Abiotic depletion of fossil resources [2]	MJ	2.52E+02	7.65E+00	3.09E+01	2.91E+02	1.83E+00	1.96E-01	MND	0.00E+00	5.67E-01	1.48E+00	0.00E+00	-7.25E+01
Water use [2]	m^3e deprived	1.60E+00	2.46E-02	4.72E-01	2.10E+00	6.79E-03	-3.35E-03	MND	0.00E+00	2.01E-03	-2.04E-02	0.00E+00	-1.06E+00

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	1.88E-07	3.54E-08	3.90E-08	2.63E-07	1.06E-08	1.68E-09	MND	0.00E+00	2.87E-09	2.20E-08	0.00E+00	-4.69E-07
Ionizing radiation, human health [3]	kBq U235e	1.63E+00	3.34E-02	8.42E-01	2.51E+00	7.98E-03	6.58E-04	MND	0.00E+00	2.48E-03	4.74E-03	0.00E+00	-3.18E-01
Eco-toxicity (freshwater) [2]	CTUe	5.05E+01	5.90E+00	1.77E+01	7.41E+01	1.40E+00	2.88E-01	MND	0.00E+00	4.43E-01	7.85E+00	0.00E+00	-3.70E+01
Human toxicity, cancer effects [2]	CTUh	2.11E-09	1.71E-10	6.88E-10	2.97E-09	3.57E-11	3.14E-11	MND	0.00E+00	1.25E-11	1.03E-09	0.00E+00	-2.34E-09
Human toxicity, non-cancer effects [2]	CTUh	1.21E-07	6.68E-09	9.16E-09	1.37E-07	1.65E-09	1.39E-09	MND	0.00E+00	5.08E-10	1.93E-08	0.00E+00	-2.09E-08
Land use related impacts/soil quality [2]	-	8.64E+00	6.37E+00	1.13E+00	1.61E+01	2.76E+00	1.71E-01	MND	0.00E+00	6.32E-01	2.16E+00	0.00E+00	-1.24E+00

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "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."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	7.68E+00	1.08E-01	2.31E+01	3.09E+01	2.30E-02	8.27E+00	MND	0.00E+00	8.06E-03	2.74E-02	0.00E+00	-2.04E-01
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	8.60E+00	8.60E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	7.68E+00	1.08E-01	3.17E+01	3.95E+01	2.30E-02	8.27E+00	MND	0.00E+00	8.06E-03	2.74E-02	0.00E+00	-2.04E-01
Non-renewable PER used as energy	MJ	1.26E+02	7.65E+00	3.01E+01	1.64E+02	1.83E+00	1.96E-01	MND	0.00E+00	5.67E-01	1.48E+00	0.00E+00	-7.25E+01
Non-renewable PER used as materials	MJ	1.27E+02	0.00E+00	7.41E-01	1.27E+02	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable PER	MJ	2.52E+02	7.65E+00	3.09E+01	2.91E+02	1.83E+00	1.96E-01	MND	0.00E+00	5.67E-01	1.48E+00	0.00E+00	-7.25E+01
Use of secondary materials	kg	3.77E-03	0.00E+00	2.42E-04	4.02E-03	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	5.01E-02	1.31E-03	1.74E-02	6.88E-02	3.80E-04	2.19E-04	MND	0.00E+00	1.07E-04	1.95E-03	0.00E+00	-8.67E-03

PER abbreviation stands for primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	5.82E-02	7.77E-03	4.56E-02	1.12E-01	1.77E-03	3.35E-03	MND	0.00E+00	5.90E-04	0.00E+00	0.00E+00	-2.37E-02
Non-hazardous waste	kg	2.35E+00	5.33E-01	8.92E-01	3.78E+00	1.96E-01	5.56E-01	MND	0.00E+00	4.91E-02	0.00E+00	0.00E+00	-3.48E-01
Radioactive waste	kg	1.88E-04	5.24E-05	3.60E-04	6.01E-04	1.25E-05	1.00E-06	MND	0.00E+00	3.88E-06	0.00E+00	0.00E+00	-5.25E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	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	5.22E-01	MND	0.00E+00	0.00E+00	5.83E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	1.42E+00	8.61E-02	-3.31E-02	1.47E+00	1.97E-02	1.60E-01	MND	0.00E+00	6.31E-03	1.14E+00	0.00E+00	-9.64E-01
Abiotic depletion. minerals & metals [2]	kg Sbe	3.07E-05	2.32E-06	7.83E-07	3.38E-05	3.39E-07	5.25E-08	MND	0.00E+00	1.57E-07	3.39E-07	0.00E+00	-5.66E-07
Abiotic depletion of fossil resources [2]	MJ	4.28E+01	1.30E+00	5.24E+00	4.93E+01	3.10E-01	3.32E-02	MND	0.00E+00	9.61E-02	2.51E-01	0.00E+00	-1.23E+01
Water use [2]	m^3e deprived	2.72E-01	4.17E-03	8.00E-02	3.56E-01	1.15E-03	-5.68E-04	MND	0.00E+00	3.41E-04	-3.46E-03	0.00E+00	-1.80E-01
Use of secondary materials	kg	6.40E-04	0.00E+00	4.10E-05	6.81E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	4.14E-02	4.14E-02	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation

Scenario parameter	Value
Electricity data source and quality	Ecoinvent v3.6 is used as a background data. Electricity emissions have been calculated on the basis of the average distribution
Electricity CO2e / kWh	0.0579 kg CO2e / kWh
District heating data source and quality	Ecoinvent v3.6 is used as a background data. District heating emissions have been calculated on the basis of the average resource use
District heating CO2e / kWh	0.0470 kg CO2e / kWh

Transport scenario documentation

Scenario parameter	Value
A4 specific transport CO2e emissions, kg CO_2e / tkm	0.0901
A4 average transport distance, km	200

End of life scenario documentation*

Scenario parameter	Value
Collection process – kg collected separately	3.5 - 5.8
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	3.5 - 5.8
Disposal (total) – kg for final deposition	0
Scenario assumptions for transportation	End-of-life product is transported 50 km with an average lorry

* The values are based on the manufacturer's information regarding the end-of-life treatment of the product.

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ANNEX-1: ENVIRONMENTAL IMPACTS - EN 15804+A1, CML / ISO 21930

TULPPA WITH 12.5 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	2.22E+00	5.02E-01	4.05E-01	3.12E+00	6.98E-02	3.08E-02	MND	0.00E+00	2.23E-02	8.13E-01	0.00E+00	-9.00E-01
Depletion of stratospheric ozone	kg CFC11e	9.18E-08	9.16E-08	1.21E-07	3.04E-07	1.32E-08	1.24E-09	MND	0.00E+00	4.10E-09	6.09E-09	0.00E+00	-1.48E-07
Acidification	kg SO_2e	7.78E-03	1.02E-03	1.67E-03	1.05E-02	1.43E-04	4.92E-05	MND	0.00E+00	4.58E-05	2.44E-04	0.00E+00	-7.11E-03
Eutrophication	kg $(PO_4)^{3-}e$	1.85E-03	2.09E-04	5.46E-04	2.61E-03	2.89E-05	9.29E-05	MND	0.00E+00	9.53E-06	2.42E-03	0.00E+00	-3.55E-04
Photochemical ozone formation	kg C_2H_4e	5.74E-04	6.69E-05	1.01E-04	7.42E-04	9.08E-06	2.00E-06	MND	0.00E+00	2.96E-06	2.97E-05	0.00E+00	-2.74E-04
Abiotic depletion of non-fossil resources	kg Sbe	1.73E-04	1.37E-05	2.77E-06	1.89E-04	1.20E-06	1.86E-07	MND	0.00E+00	5.61E-07	8.32E-07	0.00E+00	-5.31E-07
Abiotic depletion of fossil resources	MJ	5.02E+01	7.64E+00	1.85E+01	7.63E+01	1.09E+00	1.17E-01	MND	0.00E+00	3.43E-01	6.21E-01	0.00E+00	-1.15E+01

TULPPA WITH 20 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	2.86E+00	5.02E-01	4.35E-01	3.80E+00	7.49E-02	3.32E-02	MND	0.00E+00	2.39E-02	1.28E+00	0.00E+00	-1.43E+00
Depletion of stratospheric ozone	kg CFC11e	1.04E-07	9.16E-08	1.30E-07	3.25E-07	1.41E-08	1.33E-09	MND	0.00E+00	4.40E-09	7.08E-09	0.00E+00	-2.34E-07
Acidification	kg SO_2e	9.37E-03	1.02E-03	1.80E-03	1.22E-02	1.54E-04	5.29E-05	MND	0.00E+00	4.91E-05	3.11E-04	0.00E+00	-1.13E-02
Eutrophication	kg $(PO_4)^{3-}e$	2.03E-03	2.09E-04	5.87E-04	2.82E-03	3.11E-05	9.98E-05	MND	0.00E+00	1.02E-05	3.78E-03	0.00E+00	-5.64E-04
Photochemical ozone formation	kg C_2H_4e	8.02E-04	6.69E-05	1.08E-04	9.77E-04	9.75E-06	2.15E-06	MND	0.00E+00	3.18E-06	4.27E-05	0.00E+00	-4.34E-04
Abiotic depletion of non-fossil resources	kg Sbe	1.74E-04	1.37E-05	2.98E-06	1.90E-04	1.29E-06	1.99E-07	MND	0.00E+00	6.02E-07	9.62E-07	0.00E+00	-8.43E-07
Abiotic depletion of fossil resources	MJ	7.26E+01	7.64E+00	1.99E+01	1.00E+02	1.18E+00	1.26E-01	MND	0.00E+00	3.68E-01	7.16E-01	0.00E+00	-1.83E+01

TULPPA WITH 30 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	3.72E+00	5.03E-01	4.75E-01	4.70E+00	8.19E-02	3.62E-02	MND	0.00E+00	2.61E-02	1.91E+00	0.00E+00	-2.13E+00
Depletion of stratospheric ozone	kg CFC11e	1.20E-07	9.16E-08	1.42E-07	3.53E-07	1.54E-08	1.45E-09	MND	0.00E+00	4.79E-09	8.40E-09	0.00E+00	-3.50E-07
Acidification	kg SO_2e	1.15E-02	1.02E-03	1.96E-03	1.45E-02	1.68E-04	5.78E-05	MND	0.00E+00	5.36E-05	3.99E-04	0.00E+00	-1.69E-02
Eutrophication	kg $(PO_4)^{3-}e$	2.26E-03	2.09E-04	6.41E-04	3.11E-03	3.39E-05	1.09E-04	MND	0.00E+00	1.11E-05	5.59E-03	0.00E+00	-8.42E-04
Photochemical ozone formation	kg C_2H_4e	1.11E-03	6.69E-05	1.18E-04	1.29E-03	1.06E-05	2.35E-06	MND	0.00E+00	3.46E-06	6.01E-05	0.00E+00	-6.48E-04
Abiotic depletion of non-fossil resources	kg Sbe	1.75E-04	1.37E-05	3.25E-06	1.92E-04	1.41E-06	2.18E-07	MND	0.00E+00	6.56E-07	1.14E-06	0.00E+00	-1.26E-06
Abiotic depletion of fossil resources	MJ	1.03E+02	7.64E+00	2.17E+01	1.32E+02	1.28E+00	1.38E-01	MND	0.00E+00	4.01E-01	8.43E-01	0.00E+00	-2.73E+01

TULPPA WITH 50 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	5.45E+00	5.03E-01	5.56E-01	6.50E+00	9.57E-02	4.24E-02	MND	0.00E+00	3.04E-02	3.15E+00	0.00E+00	-3.54E+00
Depletion of stratospheric ozone	kg CFC11e	1.52E-07	9.17E-08	1.66E-07	4.09E-07	1.80E-08	1.69E-09	MND	0.00E+00	5.59E-09	1.10E-08	0.00E+00	-5.81E-07
Acidification	kg SO_2e	1.57E-02	1.02E-03	2.30E-03	1.90E-02	1.96E-04	6.75E-05	MND	0.00E+00	6.25E-05	5.77E-04	0.00E+00	-2.80E-02
Eutrophication	kg $(PO_4)^{3-}$e	2.72E-03	2.09E-04	7.49E-04	3.68E-03	3.97E-05	1.27E-04	MND	0.00E+00	1.30E-05	9.20E-03	0.00E+00	-1.40E-03
Photochemical ozone formation	kg C_2H_4e	1.71E-03	6.69E-05	1.38E-04	1.92E-03	1.24E-05	2.74E-06	MND	0.00E+00	4.04E-06	9.48E-05	0.00E+00	-1.08E-03
Abiotic depletion of non-fossil resources	kg Sbe	1.77E-04	1.37E-05	3.81E-06	1.95E-04	1.65E-06	2.55E-07	MND	0.00E+00	7.65E-07	1.48E-06	0.00E+00	-2.09E-06
Abiotic depletion of fossil resources	MJ	1.63E+02	7.65E+00	2.54E+01	1.96E+02	1.50E+00	1.61E-01	MND	0.00E+00	4.68E-01	1.10E+00	0.00E+00	-4.54E+01

TULPPA WITH 80 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	8.03E+00	5.03E-01	6.75E-01	9.21E+00	1.16E-01	5.14E-02	MND	0.00E+00	3.68E-02	5.03E+00	0.00E+00	-5.65E+00
Depletion of stratospheric ozone	kg CFC11e	2.00E-07	9.17E-08	2.02E-07	4.93E-07	2.19E-08	2.06E-09	MND	0.00E+00	6.78E-09	1.50E-08	0.00E+00	-9.28E-07
Acidification	kg SO_2e	2.21E-02	1.02E-03	2.79E-03	2.59E-02	2.39E-04	8.21E-05	MND	0.00E+00	7.58E-05	8.43E-04	0.00E+00	-4.47E-02
Eutrophication	kg $(PO_4)^{3-}$e	3.42E-03	2.09E-04	9.11E-04	4.54E-03	4.83E-05	1.55E-04	MND	0.00E+00	1.58E-05	1.46E-02	0.00E+00	-2.23E-03
Photochemical ozone formation	kg C_2H_4e	2.62E-03	6.70E-05	1.68E-04	2.86E-03	1.51E-05	3.34E-06	MND	0.00E+00	4.90E-06	1.47E-04	0.00E+00	-1.72E-03
Abiotic depletion of non-fossil resources	kg Sbe	1.81E-04	1.37E-05	4.62E-06	1.99E-04	2.00E-06	3.10E-07	MND	0.00E+00	9.28E-07	2.00E-06	0.00E+00	-3.34E-06
Abiotic depletion of fossil resources	MJ	2.52E+02	7.65E+00	3.09E+01	2.91E+02	1.83E+00	1.96E-01	MND	0.00E+00	5.67E-01	1.48E+00	0.00E+00	-7.25E+01

ANNEX-2: ENVIRONMENTAL IMPACTS - TRACI 2.1

TULPPA WITH 12.5 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	2.22E+00	5.02E-01	4.06E-01	3.13E+00	6.97E-02	3.09E-02	MND	0.00E+00	2.22E-02	8.15E-01	0.00E+00	-9.00E-01
Ozone depletion	kg CFC11e	1.18E-07	1.22E-07	1.47E-07	3.87E-07	1.75E-08	1.61E-09	MND	0.00E+00	5.46E-09	7.96E-09	0.00E+00	-1.97E-07
Acidification	kg SO_2e	8.29E-03	1.80E-03	1.75E-03	1.18E-02	2.58E-04	7.60E-05	MND	0.00E+00	8.05E-05	3.26E-04	0.00E+00	-6.44E-03
Eutrophication	kg Ne	6.64E-04	2.54E-04	3.26E-04	1.24E-03	3.62E-05	2.35E-05	MND	0.00E+00	1.14E-05	1.19E-04	0.00E+00	-4.26E-04
Photochemical smog formation	kg O_3e	1.31E-01	3.90E-02	2.43E-02	1.94E-01	5.65E-03	2.23E-03	MND	0.00E+00	1.74E-03	8.68E-03	0.00E+00	-4.35E-02
Depletion of non-renewable energy	MJ	6.88E+00	1.09E+00	5.17E-01	8.49E+00	1.57E-01	1.63E-02	MND	0.00E+00	4.89E-02	8.13E-02	0.00E+00	-1.74E+00

TULPPA WITH 20 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	2.87E+00	5.02E-01	4.36E-01	3.81E+00	7.48E-02	3.33E-02	MND	0.00E+00	2.39E-02	1.28E+00	0.00E+00	-1.43E+00
Ozone depletion	kg CFC11e	1.32E-07	1.22E-07	1.57E-07	4.11E-07	1.88E-08	1.73E-09	MND	0.00E+00	5.86E-09	9.23E-09	0.00E+00	-3.12E-07
Acidification	kg SO_2e	9.91E-03	1.80E-03	1.88E-03	1.36E-02	2.77E-04	8.17E-05	MND	0.00E+00	8.63E-05	4.08E-04	0.00E+00	-1.02E-02
Eutrophication	kg Ne	7.60E-04	2.54E-04	3.52E-04	1.37E-03	3.89E-05	2.52E-05	MND	0.00E+00	1.22E-05	1.45E-04	0.00E+00	-6.77E-04
Photochemical smog formation	kg O_3e	1.56E-01	3.90E-02	2.61E-02	2.21E-01	6.07E-03	2.39E-03	MND	0.00E+00	1.86E-03	1.11E-02	0.00E+00	-6.90E-02
Depletion of non-renewable energy	MJ	1.02E+01	1.09E+00	5.55E-01	1.19E+01	1.68E-01	1.75E-02	MND	0.00E+00	5.25E-02	9.47E-02	0.00E+00	-2.77E+00

TULPPA WITH 30 MM XPS

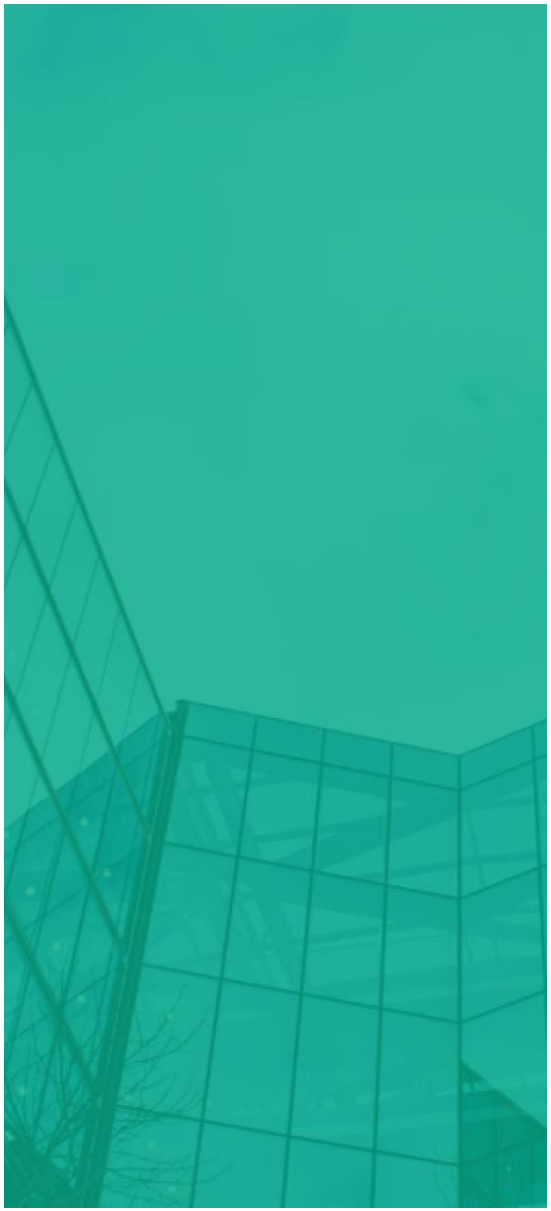
Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	3.73E+00	5.02E-01	4.76E-01	4.71E+00	8.17E-02	3.63E-02	MND	0.00E+00	2.60E-02	1.91E+00	0.00E+00	-2.13E+00
Ozone depletion	kg CFC11e	1.51E-07	1.22E-07	1.72E-07	4.45E-07	2.06E-08	1.89E-09	MND	0.00E+00	6.39E-09	1.09E-08	0.00E+00	-4.66E-07
Acidification	kg SO_2e	1.21E-02	1.80E-03	2.05E-03	1.59E-02	3.02E-04	8.92E-05	MND	0.00E+00	9.41E-05	5.17E-04	0.00E+00	-1.53E-02
Eutrophication	kg Ne	8.87E-04	2.54E-04	3.85E-04	1.53E-03	4.25E-05	2.75E-05	MND	0.00E+00	1.33E-05	1.79E-04	0.00E+00	-1.01E-03
Photochemical smog formation	kg O_3e	1.90E-01	3.90E-02	2.85E-02	2.58E-01	6.63E-03	2.61E-03	MND	0.00E+00	2.03E-03	1.43E-02	0.00E+00	-1.03E-01
Depletion of non-renewable energy	MJ	1.47E+01	1.09E+00	6.06E-01	1.64E+01	1.84E-01	1.91E-02	MND	0.00E+00	5.72E-02	1.13E-01	0.00E+00	-4.13E+00

TULPPA WITH 50 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	5.46E+00	5.02E-01	5.57E-01	6.52E+00	9.55E-02	4.25E-02	MND	0.00E+00	3.03E-02	3.16E+00	0.00E+00	-3.54E+00
Ozone depletion	kg CFC11e	1.88E-07	1.22E-07	2.01E-07	5.11E-07	2.40E-08	2.20E-09	MND	0.00E+00	7.44E-09	1.43E-08	0.00E+00	-7.75E-07
Acidification	kg SO_2e	1.64E-02	1.80E-03	2.40E-03	2.06E-02	3.53E-04	1.04E-04	MND	0.00E+00	1.10E-04	7.36E-04	0.00E+00	-2.53E-02
Eutrophication	kg Ne	1.14E-03	2.54E-04	4.50E-04	1.85E-03	4.97E-05	3.22E-05	MND	0.00E+00	1.55E-05	2.48E-04	0.00E+00	-1.68E-03
Photochemical smog formation	kg O_3e	2.59E-01	3.90E-02	3.33E-02	3.31E-01	7.74E-03	3.05E-03	MND	0.00E+00	2.37E-03	2.08E-02	0.00E+00	-1.71E-01
Depletion of non-renewable energy	MJ	2.37E+01	1.09E+00	7.09E-01	2.55E+01	2.15E-01	2.23E-02	MND	0.00E+00	6.67E-02	1.48E-01	0.00E+00	-6.86E+00

TULPPA WITH 80 MM XPS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	8.06E+00	5.02E-01	6.77E-01	9.24E+00	1.16E-01	5.16E-02	MND	0.00E+00	3.68E-02	5.03E+00	0.00E+00	-5.65E+00
Ozone depletion	kg CFC11e	2.44E-07	1.22E-07	2.44E-07	6.10E-07	2.92E-08	2.68E-09	MND	0.00E+00	9.03E-09	1.94E-08	0.00E+00	-1.24E-06
Acidification	kg SO_2e	2.29E-02	1.80E-03	2.91E-03	2.76E-02	4.30E-04	1.27E-04	MND	0.00E+00	1.33E-04	1.06E-03	0.00E+00	-4.05E-02
Eutrophication	kg Ne	1.52E-03	2.54E-04	5.47E-04	2.33E-03	6.04E-05	3.92E-05	MND	0.00E+00	1.88E-05	3.52E-04	0.00E+00	-2.68E-03
Photochemical smog formation	kg O_3e	3.61E-01	3.90E-02	4.05E-02	4.41E-01	9.42E-03	3.71E-03	MND	0.00E+00	2.87E-03	3.05E-02	0.00E+00	-2.73E-01
Depletion of non-renewable energy	MJ	3.71E+01	1.09E+00	8.61E-01	3.91E+01	2.62E-01	2.71E-02	MND	0.00E+00	8.09E-02	2.02E-01	0.00E+00	-1.09E+01



ABOUT THE MANUFACTURER

Over nearly forty-year-long history, Finnfoam has become one of the leading manufacturers of plastic-based thermal insulation solutions. The roots of Finnfoam's thermal insulation competence are embedded into the frozen Finnish soil. Today, the group is known for quality, product development, and reliability. Finnfoam's product range includes XPS, EPS and PIR thermal insulation and the Tulppa - wet room boards. The entire Finnfoam (XPS) thermal insulation product range is suitable for use as frost insulation and for insulating floors, ceilings, and walls, as well as for various types of supplementary thermal insulation. As frost and floor insulation, Finnfoam is highly resistant to moisture, freezing, and load. FF-EPS is best suited for use as thermal insulation for walls and ceilings, where it provides a safe and highly cost-effective solution. It can also be used in floors that are not subjected to significant loads. The applications of FF-PIR polyurethane insulation products include the thermal insulation of walls and ceilings as well as saunas. FF-PIR insulation products have a very high thermal insulation capacity, which allows for lower structural thickness.

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EPD author	Bionova Ltd, www.bionova.fi
EPD verifier	Silvia Vilčeková, Silcert, s.r.o.
EPD program	RTS EPD
Background data	Ecoinvent 3.6 (cut-off) and Finnfoam XPS EPD 2021-2026
LCA software	One Click LCA Pre-Verified Generator for Plastic Products