epd-norway
Global Program Operator

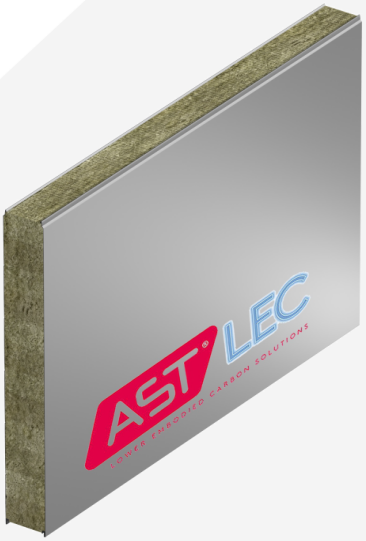
ECO PLATFORM EPD VERIFIED

Paroc Panel System

EPD

Environmental Product Declaration for Paroc Panel System AST® L LEC Wall Panel in accordance with ISO 14025 and EN 15804 + A2

AST® L LEC



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General information

Product:

The following products are covered within this EPD:

AST® L LEC Built-On Wall Panel
AST® L LEC Delign Architectural Wall Panel
AST® L LEC Shadow Architectural Wall Panel
AST® L LEC Wall Panel

Program operator:

The Norwegian EPD Foundation
P.O. Box 5250 Majorstuen, 0303 Oslo Norway
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Declaration number:

NEPD-5455-4769-EN

ECO Platform reference number:

This declaration is based on Product Category Rules:

CEN Standard EN 15804 serves as core PCR
NPCR part A ver 2.0 Construction products and services
NPCR part B 010 ver 4.0 Building Boards

Statement of liability:

The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturerinformation, life cycle assessment data and evidences.

Declared unit:

1 m2 covering surface of installed Paroc stonewool sandwich panel, including waste treatment at end-of-life.

Declared unit with option:

Functional unit:

1 m2 covering surface of installed Paroc stonewool sandwich panel, from cradle-to-grave, with activities needed for a study period of 60 years for the building

Verification:

The CEN Norm EN 15804 serves as the core PCR.
Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:

Martin Erlandsson, IVL Swedish Environmental Research Inst
(Independent verifier approved by EPD Norway)

Owner of the declaration:

Kingspan OY / Paroc panel systems
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Manufacturer:

Kingspan OY / Paroc panel systems
Sysilahden teollisuusalue 2 Parainen, FI-21600
Phone: +358 468768716
e-mail: panelinfo@parocpanels.com

Place of production:

Parainen, Finland

Management system:

ISO 14001, ISO 9001, ISO 450001, ISO 50001, BES 6001

Organisation no:

2383916-7

Issue date:

30.11.2023

Valid to:

30.11.2028

Year of study:

2022

Comparability:

EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

The EPD has been worked out by:

Hannes Westberg
Niclas Silfverstrand

RAMBØLL

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
AST® LEC insulated panels are part of our Lower Embodied Carbon solutions. The AST® (Advanced Structural Technology) ensures high tensile strength, reliable longevity and high fire resistance of sandwich panels. AST® LEC insulated panels can be installed in a variety of wall and ceiling applications, especially where high fire resistance and a low carbon footprint are required.

Product specification:
The life cycle assessment is based on 1 m2 of Paroc AST L LEC 150 mm stonewool sandwich panels. This EPD is valid for all variations of Paroc AST L LEC.

The panels are produced in different thicknessess. The evironmental impac of the panels with different thicknesses can be estimated by multiplying the LCA result of each impact category in the environmental impact table (page 7) with the corresponding factors given in table 3.

Table 1: Composition of 1m^2 of AST L LEC 150 mm panel.

Materials	kg	%
Mineral wool	10,50	52,6
Metal sheet	8,90	44,6
Glue	0,54	2,7
Sealant	0,01	0,1
Total	20,0	100
Packaging		
Forklift- and supportfoot (EPS)	0,17	
Wrapping plastic (LLDPE)	0,07	
Cellular plastic (foamed LD-PE)	0,03	
Top protection (cardboard)	0,16	
Sum Packaging	0,42	

Technical data:
The mass of the declared unit is 20,68 kg and the thickness is 150 mm.

Technical specification can be found on the product page for the panels:

AST L LEC:
https://www.parocpanels.com/gb/en/products/wall-panel-systems/ast-panel-systems/ast-l-lec

Market:

The scenarios beyond cradle-to-gate are based on the Norweigan market. The panels are sold to customers in Finland, Sweden, Norway, Denmark, and Exports to mainly Germany and UK.

Reference service life, product:
The reference service life of Paroc stonewool sandwich panels is 60 years is when applied according to the product description.

Reference service life, building:
The reference service life of 60 years has been assumed for the building in all calculations.

Table 3: Factors for the estimation of the environmental impact from different panel thicknesses. Multiply the LCA-result of each impact category in the environmental impact table (page 7) with the corresponding factors.

Impact category	Thickness [mm]								
	50	80	100	120	150	175	200	240	300
GWP-total	0,83	0,88	0,92	0,95	1,00	1,04	1,08	1,15	1,25
GWP-fossil	0,83	0,88	0,91	0,95	1,00	1,04	1,09	1,16	1,26
GWP-biogenic	0,94	0,96	0,97	0,98	1,00	1,01	1,03	1,05	1,09
GWP-luluc	0,95	0,97	0,98	0,99	1,00	1,01	1,02	1,04	1,07
ODP	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
AP	0,63	0,74	0,81	0,89	1,00	1,09	1,19	1,33	1,56
EP-freshwater	0,94	0,96	0,97	0,98	1,00	1,01	1,03	1,05	1,09
EP-marine	0,84	0,89	0,92	0,95	1,00	1,04	1,08	1,14	1,24
EP-terrestrial	0,62	0,73	0,81	0,89	1,00	1,10	1,19	1,34	1,57
POCP	0,82	0,88	0,91	0,95	1,00	1,04	1,09	1,16	1,27
ADPm1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
ADPf1	0,85	0,89	0,92	0,95	1,00	1,04	1,08	1,14	1,23
WDP1	0,85	0,89	0,92	0,95	1,00	1,04	1,08	1,14	1,23
PERE	0,82	0,87	0,91	0,95	1,00	1,05	1,09	1,16	1,27
PERM	0,38	0,56	0,69	0,81	1,00	1,16	1,31	1,56	1,94
PERT	0,81	0,87	0,90	0,94	1,00	1,05	1,10	1,17	1,29
PENRE	0,89	0,92	0,95	0,97	1,00	1,03	1,05	1,10	1,16
PENRM	0,34	0,54	0,67	0,80	1,00	1,16	1,33	1,59	1,98
PENRT	0,85	0,89	0,92	0,95	1,00	1,04	1,08	1,14	1,23
SM	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
RSF	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
NRSF	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
FW	0,49	0,64	0,75	0,85	1,00	1,13	1,25	1,46	1,76

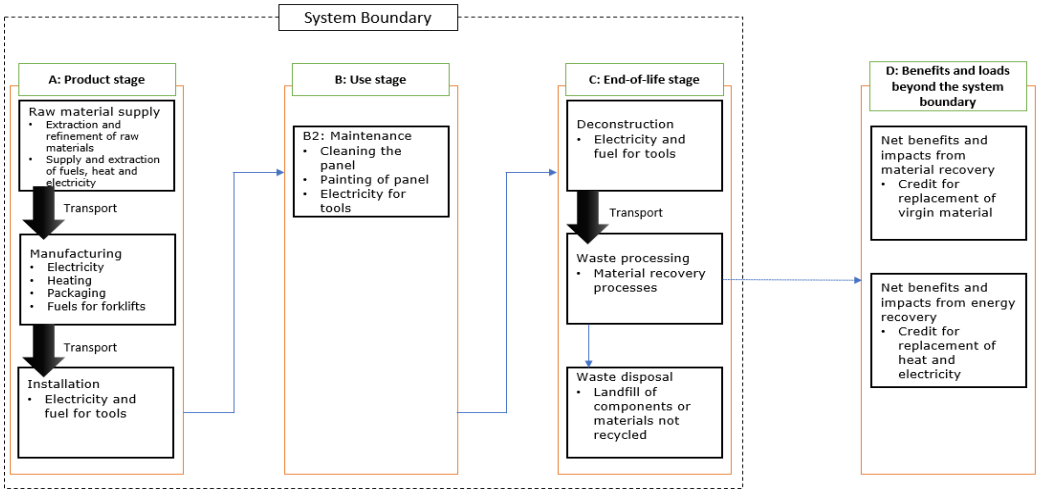
Conversion factor to kg per m^2 panel	Thickness [mm]								
	50	80	100	120	150	175	200	240	300
AST L LEC	13,7	15,8	17,2	18,6	20,7	22,4	24,2	27,0	31,2

LCA: Calculation rules

Functional unit:
1 m2 covering surface of installed Paroc stonewool sandwich panel, including waste treatment at end-of-life.

System boundary:
A diagram of the system boundary is shown in figure 1 below. A tabular overview of the system boundary is shown on page 7.

Figure 1: Illustration of the system and the system boundary



Data quality:
The data quality requirements are according to EN15804 and PCR 010 ver 4.0 for building boards. Specific data from 2022 production at the manufacturing site is applied in A3.The production data for Paroc stonewool sandwich panels is from one production site, Parainen in Finland, and therefore no average data has been used for different locations. Generic datasets were obtained from the Sphera Professional database 2023 and Ecoinvent v3.8. To represent the stone wool in the product the EPD PAROC FI Produced Stone Wool Thermal Insulation has been used (NEPD-4607-3858-EN).

Cut-off criteria:
General cut-off criteria are given in standard EN 15804 clause 6.3.5. In compliance with these criteria, all major raw materials and all the essential energy are included. The infrastructure of the manufacturing site, production of packaging for incoming raw materials, joint insulation, joint sealants and screws used in A5 with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (kg/km)
Truck	50	Euro V (28-32t gw), Truck	29	0,02 kg/tkm	0,42
Boat	53	Freight ship	229	0,0009 kg/tkm	66,1
Truck	50	Euro V (28-32t gw), Truck	900	0,02 kg/tkm	0,42

The transport in A4 is a representative transport distance from production site in Finland to the building site in Norway.

Assembly (A5)

	Unit	Value
Auxiliary	kg	0,47
Electricity consumption	kWh	0,017
Other energy carriers	kWh	0,044
Material loss	kg	0

The installation (A5) includes the energy and materials used for unloading of the panel packages from a truck, lifting up the panels to the building frame and fixing the panels with screws and selants. Material loss is estimated to be 0.

Use (B1)

	Unit	Value
No LCA-related environmental impacts	-	-

There is no environmental related impact (B1) by the panel during the service life.

Maintenance (B2)/Repair (B3)

	Unit	Value
Paint used for maintenance	kg	0,24
Detergent used for cleaning	kg	0,2
Water used for cleaning	l	7,6
Electricity use	kWh	0,556

Replacement (B4)/Refurbishment (B5)

	Unit	Value
Replacement cycle*	Yr	60

* Number or RSL (Reference Service Life)

The maintenance (B2) of the panels is assumed to be performed by applying two layers of paint once during the life time of the panels. Cleaning of the surface of the panels using detergent four times during the life time is also included.

In normal use scenario, it is assumed that there is no repair (B3), replacement (B4) and refubrishment (B5) is needed.

Operational energy (B6) and water consumption (B7)

	Unit	Value
No LCA-related environmental impacts	-	-

B6 and B7 do not have any LCA-related impacts.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	
Collected as mixed construction waste	kg	
Reuse	kg	
Recycling	kg	9,4
Energy recovery	kg	
To landfill	kg	11,8

End-of-life life scenario, C1, C3 and C4, is based on materials being separated on site. The steel is assumed to be 100% recycled and the mineral wool is assumed to be 100% landfilled. Energy for deconstruction is included in C1, and activities related to steel recycling is included in C3.

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	61	Euro V (28-32t gw), Truck	50	0,02 kg/tkm	1,2

The transport in C2 represents transport to recycling and disposal site in Norway.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Net steel recycling	kg	0,77
Heat replaced	MJ	2,64
Electricity replaced	MJ	1,49

The net virgin steel minus 10% losses is in module D substituted with virgin steel produced on the european market. 9% of incoming steel to the system is virgin steel whereby 8% of the steel leaving C3 recieves a credit.
Moreover, the energy recovered is assumed to replace the local energy mixes, Norweigan electrical and district heating mixes. European district heating mix was used as proxy data to represent the Norweigan district heating mix.

LCA: Results

The calculations are based on the Paroc AST L LEC stonewool sandwich panels.

Note that when interpreting the results, the benefits from recylcing of the steel in module D is calculated based on assumption of 100% steel recycling.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

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

Environmental impact

Parameter	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-total	[kg CO2 eq.	1,68E+01	2,11E+00	2,15E+00	9,11E-01	9,16E-03	8,70E-02	5,41E-01	1,61E-01	-1,17E+00
GWP-fossil	[kg CO2 eq.	1,70E+01	2,08E+00	2,12E+00	1,06E+00	9,05E-03	8,59E-02	5,41E-01	1,66E-01	-1,16E+00
GWP-biogeni	[kg CO2 eq.	1,21E-02	6,12E-03	2,24E-02	-3,56E-01	3,60E-05	2,53E-04	2,92E-04	-5,52E-03	-2,58E-03
GWP-luluc	[kg CO2 eq.	2,39E-02	1,91E-02	4,09E-04	2,05E-01	7,05E-05	7,94E-04	1,02E-04	5,16E-04	-3,66E-04
ODP	g CFC 11 e	1,15E-08	1,82E-13	1,32E-13	2,62E-08	9,96E-15	1,12E-14	1,12E-07	4,22E-13	-2,58E-12
AP	[mol H+ eq.	9,14E-02	8,61E-03	3,38E-03	6,05E-03	2,68E-05	3,35E-04	5,52E-03	1,18E-03	-2,62E-03
EP-freshwate	[kg P eq.]	7,97E-05	7,52E-06	1,02E-06	1,81E-04	3,15E-08	3,13E-07	3,14E-05	3,34E-07	-1,98E-06
EP-marine	[kg N eq.]	1,72E-02	4,03E-03	7,65E-04	3,25E-03	1,21E-05	1,56E-04	2,41E-03	3,04E-04	-6,68E-04
EP-terrestria	[mol N eq.]	3,07E-01	4,51E-02	8,26E-03	1,51E-02	1,35E-04	1,75E-03	2,63E-02	3,35E-03	-7,14E-03
POCP	g NMVOC e	4,31E-02	7,85E-03	2,60E-03	4,87E-03	2,41E-05	3,03E-04	7,24E-03	9,19E-04	-2,23E-03
ADPm*	[kg Sb eq.]	1,84E-03	1,33E-07	7,10E-06	7,99E-06	1,29E-09	5,65E-09	8,85E-07	7,66E-09	-6,94E-08
ADPf*	[MJ]	2,48E+02	2,83E+01	1,31E+01	2,09E+01	1,22E-01	1,17E+00	7,46E+00	2,21E+00	-1,07E+01
WDP*	[m3]	2,91E+00	2,38E-02	4,01E-01	2,08E+00	3,53E-04	1,04E-03	2,38E-02	1,82E-02	-3,26E-02

GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-biogenic = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidifcation; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP

* The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited

Additional environmental impacts

Parameter	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
PM	incidence]	1,01E-06	5,35E-08	4,19E-08	6,55E-08	1,60E-10	1,90E-09	1,44E-07	1,45E-08	-3,58E-08
IRP2	eq.]	2,78E-01	5,28E-03	2,45E-02	7,33E-02	3,98E-04	3,27E-04	3,58E-02	2,91E-03	-1,88E-02
ETP-fw1	[CTUe]	1,39E+02	1,97E+01	3,13E+00	3,31E+01	7,91E-02	8,29E-01	4,82E+00	1,21E+00	-2,57E+00
HTP-c1	[CTUh]	3,63E-08	4,01E-10	1,27E-08	4,33E-09	5,55E-12	1,70E-11	1,59E-10	1,86E-10	-1,30E-09
HTP-nc1	[CTUh]	1,03E-07	2,47E-08	2,06E-08	3,25E-07	9,79E-11	1,05E-09	3,97E-09	2,04E-08	-1,68E-08
SQP1	-	5,58E+01	1,17E+01	6,57E-01	2,43E+01	5,36E-02	4,88E-01	1,08E+00	5,37E-01	-4,99E+00
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)									
Disclaimers	1 The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									
	2 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.									

Resource use

Parameter	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
RPEE	MJ	2,96E+02	1,99E+00	2,83E+00	1,15E+01	1,70E-01	8,50E-02	7,82E-02	3,60E-01	-4,63E+00
RPEM	MJ	2,19E+00	0,00E+00	-2,19E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	2,98E+02	1,99E+00	6,43E-01	1,15E+01	1,70E-01	8,50E-02	7,82E-02	3,60E-01	-4,63E+00
NRPE	MJ	2,37E+02	2,83E+01	2,42E+01	2,12E+01	1,23E-01	1,17E+00	7,46E+00	2,21E+00	-1,08E+01
NRPM	MJ	1,11E+01	0,00E+00	-1,11E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	2,49E+02	2,83E+01	1,31E+01	2,12E+01	1,23E-01	1,17E+00	7,46E+00	2,21E+00	-1,08E+01
SM	kg	7,73E+00	0,00E+00	1,22E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m^3	2,66E-01	2,19E-03	9,97E-03	4,95E-02	2,35E-04	9,31E-05	5,55E-04	5,59E-04	-4,77E-03

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

End of life - Waste

Parameter	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HW	kg	1,63E-04	1,05E-10	9,89E-09	2,43E-10	-1,40E-11	3,63E-12	0,00E+00	4,82E-11	3,58E-10
NHW	kg	3,07E+00	4,07E-03	6,16E-02	5,88E-01	8,89E-05	1,79E-04	0,00E+00	1,11E+01	-1,87E-02
RW	kg	6,12E-03	3,66E-05	2,19E-05	2,35E-04	3,36E-06	2,19E-06	0,00E+00	2,52E-05	-1,80E-04

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

End of life - Output flow

Parameter	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
CR	kg	0	0	0,00E+00	0	0	0	0,00E+00	0	0
MR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,97E+00	0,00E+00	0,00E+00
MER	kg	0	0	0,00E+00	0	0	0	0,00E+00	0	0
EEE	MJ	0,00E+00	0,00E+00	1,49E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	2,64E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

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

Instantaneous oxidation of biogenic carbon

Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-IOBC	[kg CO2 eq.]	1,67E+01	2,10E+00	2,13E+00	1,27E+00	9,12E-03	8,67E-02	5,41E-01	1,67E-01	-1,17E+00

Reading example: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

Biogenic content

Parameter	Unit	A1-A3
Biogenic carbon content in product	kg	0,00E+00
Biogenic carbon content in the accompanying packaging	kg	6,90E-02

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase
Finnish wind-power and Solar PV, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess(A3).

Data source	Amount	Unit
Sphera Professional Database 2023 Edition	0,02	CO_2-eqv/kWh

Dangerous substances

- ☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount

Guarantees of origin from the use of electricity in the manufacturing phase
Where guarantees of origin is applied in stead of national production mix – the electricity for the manufacturing prosess (A3) shall be stated clearly in the EPD per functional unit.

Electricity source	Foreground / core [kWh]	GWPtotal [kg CO2 - eq/kWh]	SUM [kgCO2 - eq]Unit
Amount of guarantee of origin electricity used in the foreground (Wind power)	2,45	0,01	0,03
Amount of guarantee of origin electricity used in the foreground (Solar PV)	0,40	0,04	0,02
Amount of residual mix electricity used in the foreground	0	0	0

The guarantee of origin utilized in this EPD is provided by Helen Ltd, with a validity period between 1.1.2022 – 31.12.2023. The origin of elerctricity is Nordic Wind-Electricity. The electricity derived from solar PV is generated by Kingspans' own PV system. Guarantees of origins was not stated in the EPD for the dataset from upstream activities (A1).

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