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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Forestia AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2058-928-EN
Registration number:	NEPD-2058-928-EN
ECO Platform reference number:	-
Issue date:	25.02.2020
Valid to:	25.02.2025

Forestia Elite particleboard

Forestia AS

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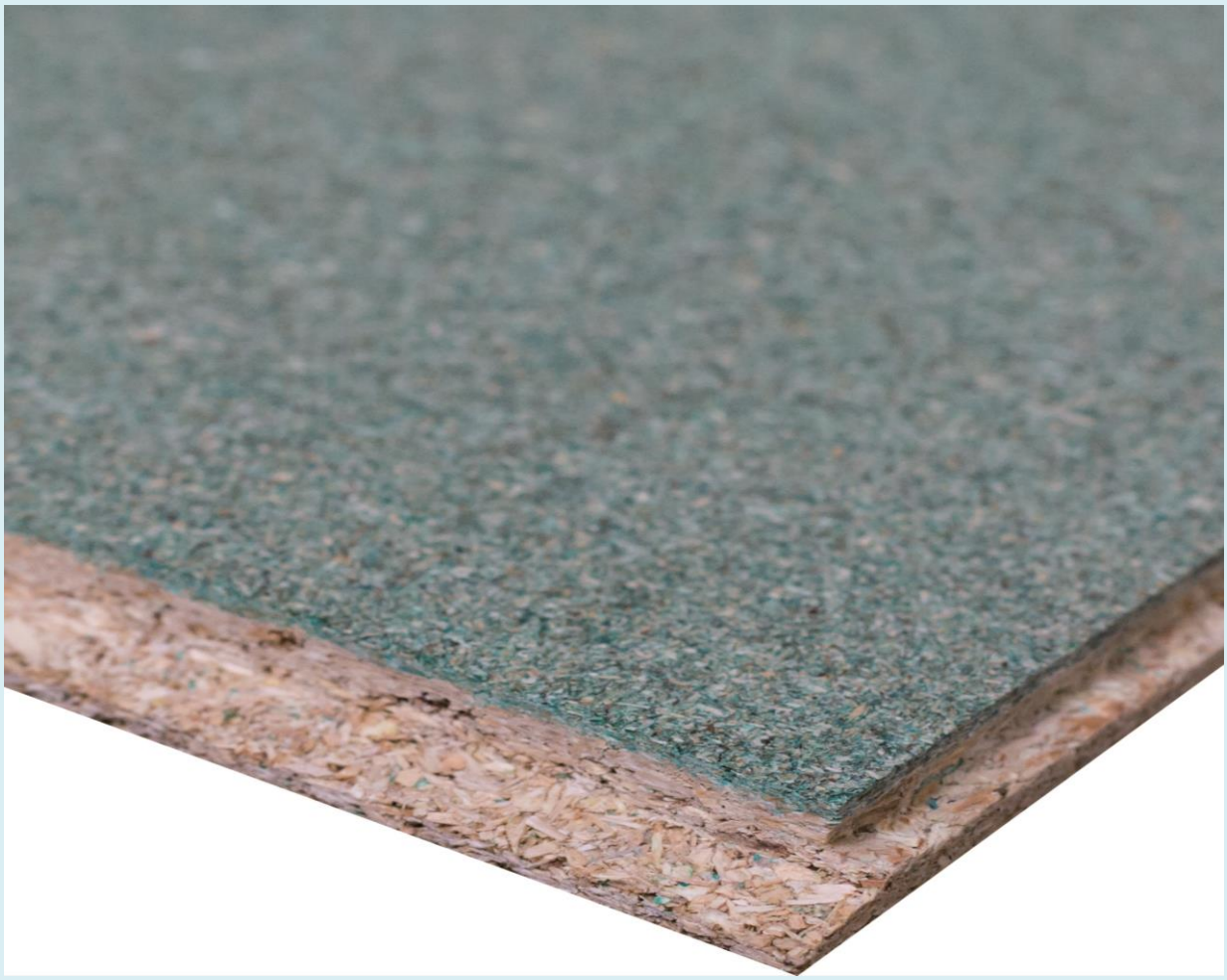

General information

Product:
Forestia Elite particleboard

Owner of the declaration:
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Declaration number:
NEPD-2058-928-EN

Place of production:
Braskereidfoss, Norge

ECO Platform reference number:

Management system:
NS-EN ISO 9001:2015, NS-EN ISO 14001:2015,
PEFC ST 2002:2013

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR010 v3.0 Building boards (04/2019).

Organisation no:
NO 981393 961 MVA

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.

Issue date:
25.02.2020

Valid to:
25.02.2025

Declared unit:

Year of study:
2019

Declared unit with option:
1 m3 installed building board, including waste treatment at end-of-life.

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

Functional unit:

The EPD has been worked out by:
Lars G. F. Tellnes

Østfoldforskning

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:
Michael M. Jenssen, Asplan Viak AS
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Particleboards are made of saw dust and other wood sources that are mixed with adhesive and other additives before it is pressed to boards. Elite particleboards are used for heavy duty load-bearing applications in construciton and furniture. Elite particleboard uses a adhesive that is more water resistant than in standard and a green pigment to separate from standard particleboards.

Technical data:
Density of 750 kg/m3, thickness 6-40 mm.
Classification requirements in NS-EN 312:2010
P7 - heavy duty load-bearing boards for use in humid conditions

Product specification:
Elite particleboard with sanded surface for use in flooring, walls, ceilings and furniture.

Materials	kg	%
Wood	576,88	76,89 %
Water	39,51	5,27 %
Adhesive	118,78	15,83 %
Wax	7,02	0,94 %
Ammonia solution	0,46	0,06 %
Ammonium nitrate	4,89	0,65 %
Urea	2,71	0,36 %
Green pigment	0,06	0,01 %
Total for product	750,31	100 %
Particleboard	8	
Solid wood	3,73	
Steel packaging	0,07	
Plastic packaging	0,15	
Total product + packaging	762,26	

Market:
Norway / Nordic / Europe. The scenarios beyond gate are based on the situation in the Norwegian market.

Reference service life, product:
Same as the building.

Reference service life, building:
Typically, reference service life of 60 years is used for buildings.

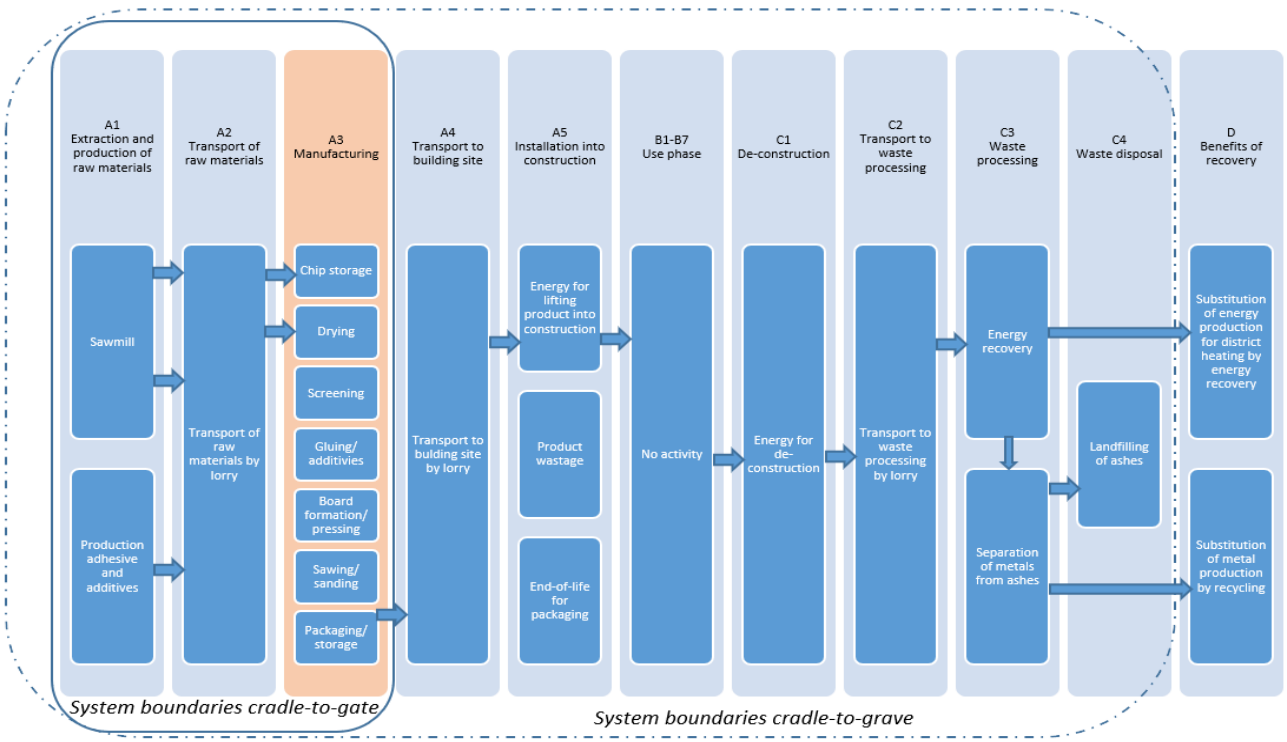
Recalculating to per square meter:
The results can be recalculating from per cubic meters to per square meters of a specific thickness with this formula

Value per m3 x specific thickness i mm / 1000 = value per m2 at a specific thickness

LCA: Calculation rules

Declared unit:
1 m3 installed building board, including waste treatment at end-of-life.

System boundary:
Flow chart for the complete life cycle (A1-C4) with system boandaries are shown in the figure below. Module D is also declared outsitde the life cycle with energy substitution from recovery and is further explained in the scenarios.



Data quality:
Manfaucturing data was collected in 2019 and with 2018 as reference year. Adhesive manufacturing is based on specific data from the manufacturer. For wood raw materials and transport, these are based on ecoinvent, but have major changes to be representative for Norwegian conditions. Other data are from ecoinvent v3.5, released in 2018, but with some changes to improve representativeness.

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included 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 first sub-divided and then 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. Upstream wood industry and forestry are sub-divided and joint co-production procesess have economic allocation.

Calculation of biogenic carbon:
Uptake and emissions of biogenic carbon are calculated according to EN 16485:2014. This is based on the modularity principle in EN 15804:2012, where the emissions shall be accounted in the module where it occurs. The amount of biogenic carbon is calculated according to EN 16449:2014. Net contributrion of biogenic carbon is calculated for each module on page 8. The wood is from sustainable sources and has PEFC Chain-of-Custody certification.

LCA: Scenarios and additional technical information

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

All produce is either first transported to a building mechant or directly to a building site. A scenario is included for building merchant where 250 km are on large lorry and 50 km in a smaller lorry to building site.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Unit
Truck	73	EURO5, >32 tonn	250	0,018	l/tkm
Truck	38	EURO5, 3.5-7.5t tonn	50	0,038	l/tkm

It is assumed 1 MJ of electricity use in assembly and 10 % wastage of the product, in addition to waste management of the packaging.

There are no LCA-related environmental impacts during use.

Assembly (A5)

	Unit	Value
Auxiliary	kg	0
Water consumption	m^3	0
Electricity consumption	MJ	1
Other energy carriers	MJ	0
Material loss	kg	75
Output materials from waste treatment	kg	12
Dust in the air	kg	0

Use (B1)

	Unit	Value
Relevant emissions during use	kg	0

It is assumed that there is no need for maintenance nor repair under a normal scenario.

Maintenance (B2)/Repair (B3)

	Unit	Value
Maintenance cycle*		
Auxiliary	kg	0
Other resources	kg	0
Water consumption	m^3	0
Electricity consumption	kWh	0
Other energy carriers	MJ	0
Material loss	kg	0

It is assumed that there is no need for operational energy nor water under a normal scenario.

Operational energy (B6) and water consumption (B7)

	Unit	Value
Water consumption	m^3	0
Electricity consumption	kWh	0
Other energy carriers	MJ	0
Power output of equipment	kW	0

It is assumed that there is no need for replacement nor refurbishment under a normal scenario.

Replacement (B4)/Refurbishment (B5)

	Unit	Value
Replacement cycle*	yr	60
Electricity consumption	kWh	0
Replacement of worn parts	0	0

* Number or RSL (Reference Service Life)

Particleboards can be disposed as mixed wood or residual waste. The most common treatment is energy recovery and the scenario is for a municipal incinerator.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	750
Reuse	kg	0
Recycling	kg	0
Energy recovery	kg	750
To landfill	kg	0

The transport of wood waste is based on average distance for Norway in 2007 and was 85 km (Raadahl et al, 2009).

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Unit
Truck		Unspecified	85	0,027	l/tkm
Railway					kWh/tkm
Boat					l/tkm
<Other Transportation>					

The benefits from exported energy from municipal incineration was calculated from amounts in 2015 and that substiututes Norwegian electricity mix and district heating mix.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substitution of electric energy	MJ	1224
Substitution of thermal energy	MJ	8413
Substitution of raw materials	kg	0
Substitution of fuels	kg	0
Substiution of products	kg	0

LCA: Results

The results for global warming of the different modules have a large contribution from uptake and emission of biogenic carbon. The net contribution of biogenic carbon to each modules is shown on page 8.

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	B1	B2	B3	B4	B5
GWP	kg CO_2-eqv	-6,92E+02	1,90E+01	7,68E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ODP	kg CFC11-eqv	5,55E-05	3,69E-06	6,27E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
POCP	kg C_2H_4-eqv	1,87E-01	3,18E-03	1,98E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
AP	kg SO_2-eqv	1,99E+00	5,98E-02	2,32E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EP	kg PO_4^{3-}-eqv	3,51E-01	1,21E-02	4,50E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ADPM	kg Sb-eqv	3,06E-03	4,72E-05	3,16E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ADPE	MJ	7,24E+03	3,05E+02	1,03E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Environmental impact

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
GWP	kg CO_2-eqv	0,00E+00	0,00E+00	8,38E-03	8,27E+00	1,22E+03	8,29E-02		-5,98E+01
ODP	kg CFC11-eqv	0,00E+00	0,00E+00	7,92E-10	1,56E-06	1,49E-06	2,46E-08		-6,78E-06
POCP	kg C_2H_4-eqv	0,00E+00	0,00E+00	1,88E-06	1,44E-03	5,24E-03	2,51E-05		-3,03E-02
AP	kg SO_2-eqv	0,00E+00	0,00E+00	3,91E-05	3,59E-02	1,98E-01	5,15E-04		-2,99E-01
EP	kg PO_4^{3-}-eqv	0,00E+00	0,00E+00	9,42E-06	6,70E-03	6,92E-02	8,83E-05		-7,63E-02
ADPM	kg Sb-eqv	0,00E+00	0,00E+00	1,37E-07	2,37E-05	1,64E-05	1,44E-07		-1,16E-04
ADPE	MJ	0,00E+00	0,00E+00	8,50E-02	1,28E+02	2,29E+03	2,21E+00		-7,48E+02

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
RPEE	MJ	8,03E+03	1,43E+01	2,09E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RPEM	MJ	1,11E+04	0,00E+00	-1,77E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	1,92E+04	1,43E+01	1,92E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRPE	MJ	4,30E+03	3,11E+02	4,95E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRPM	MJ	3,19E+03	0,00E+00	3,19E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	7,50E+03	3,11E+02	8,14E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
SM	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
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
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m^3	2,05E+00	1,02E-01	3,11E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Resource use

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
RPEE	MJ	0,00E+00	0,00E+00	1,10E+00	1,39E+00	1,09E+04	4,61E-02		-4,89E+03
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,09E+04	0,00E+00		0,00E+00
TPE	MJ	0,00E+00	0,00E+00	1,10E+00	1,39E+00	3,20E+00	4,61E-02		-4,89E+03
NRPE	MJ	0,00E+00	0,00E+00	1,46E-01	1,30E+02	1,53E+02	2,26E+00		-9,18E+02
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00		0,00E+00
TRPE	MJ	0,00E+00	0,00E+00	1,46E-01	1,30E+02	1,53E+02	2,26E+00		-9,18E+02
SM	kg	0,00E+00	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	1,92E-04	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
W	m^3	0,00E+00	0,00E+00	6,04E-05	2,45E-02	8,24E-01	2,21E-03		-2,09E-01

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

End of life - Waste

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
HW	kg	7,58E-03	2,07E-04	8,25E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NHW	kg	1,83E+02	3,02E+01	2,46E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RW	kg	2,04E-02	2,09E-03	2,39E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

End of life - Waste

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
HW	kg	0,00E+00	0,00E+00	1,88E-07	8,26E-05	3,18E-04	1,25E-06		-1,04E-03
NHW	kg	0,00E+00	0,00E+00	1,11E-02	8,66E+00	1,04E+01	8,95E+00		-3,31E+01
RW	kg	0,00E+00	0,00E+00	9,44E-07	8,78E-04	3,18E-04	1,40E-05		-4,12E-03

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

End of life - Output flow

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
CR	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
MR	kg	3,95E-01	0,00E+00	2,64E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	1,53E-03	0,00E+00	1,53E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	2,57E-01	0,00E+00	1,24E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	2,78E+00	0,00E+00	8,55E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00		0,00E+00
MR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00		0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00		0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,11E+03	0,00E+00		-1,22E+03
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,65E+03	0,00E+00		-8,41E+03

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

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

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase
National consumption mix with import on low voltage (production of transmission lines, in addition to direct emissions and losses in grid) are applied electricity for the manufacturing prosess (A3).

Data source	Amount	Unit
Ecoinvent v3.5 (2018)	31,7	g 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.

Indoor environment
The product meets the requirements for low emissions (M1) according to EN15251: 2007 Appendix E.

Carbon footprint
In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator for GWP has been sub-divided into the following:
GWP-IOBC Climate impacts calculated according to the principle of instantanious oxidation
GWP-BC Climate impacts from the net uptake and emission of biogenic carbon from each module.

Climate impacts

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
GWP-IOBC	kg CO_2 -eqv	3,82E+02	1,90E+01	5,98E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP-BC	kg CO_2 -eqv	-1,07E+03	0,00E+00	1,70E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP	kg CO_2 -eqv	-6,92E+02	1,90E+01	7,68E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Climate impacts

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
GWP-IOBC	kg CO_2 -eqv	0,00E+00	0,00E+00	8,38E-03	8,27E+00	1,67E+02	8,29E-02		-5,98E+01
GWP-BC	kg CO_2 -eqv	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,06E+03	0,00E+00		0,00E+00
GWP	kg CO_2 -eqv	0,00E+00	0,00E+00	8,38E-03	8,27E+00	1,22E+03	8,29E-02		-5,98E+01

Bibliography

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ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
EN 16485:2014	*Round and sawn timber - Environmental Product Declaration - Product category rules for wood and wood-based products for use in construction*
EN 16449:2014	*Wood and wood-based products - Calculation of the biogenic carbon content of wood and conversion to carbon dioxide*
NPCR010 V3.0	*Product category rules for building boards*
Ecoinvent v3.5	*Swiss Centre of Life Cycle Inventories. www.ecoinvent.ch*
EN 312:2010	*Particleboards - Specifications*
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Statistics Norway	*Table 04730: Consumption of fuel used fro gross production of district heating, 2015*
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Tellnes (2019)	*LCA-report for Forestia AS. Report OR.40.19 from Østfoldforskning, Kråkerøy, Norway.*
Rakennustieto	*Emission Classification of Building Materials. Forestia AS classification document valid until 19.6.2022. The Building Information Foundation RTS (Rakennustieto). Helsinki, Finland.*

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