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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

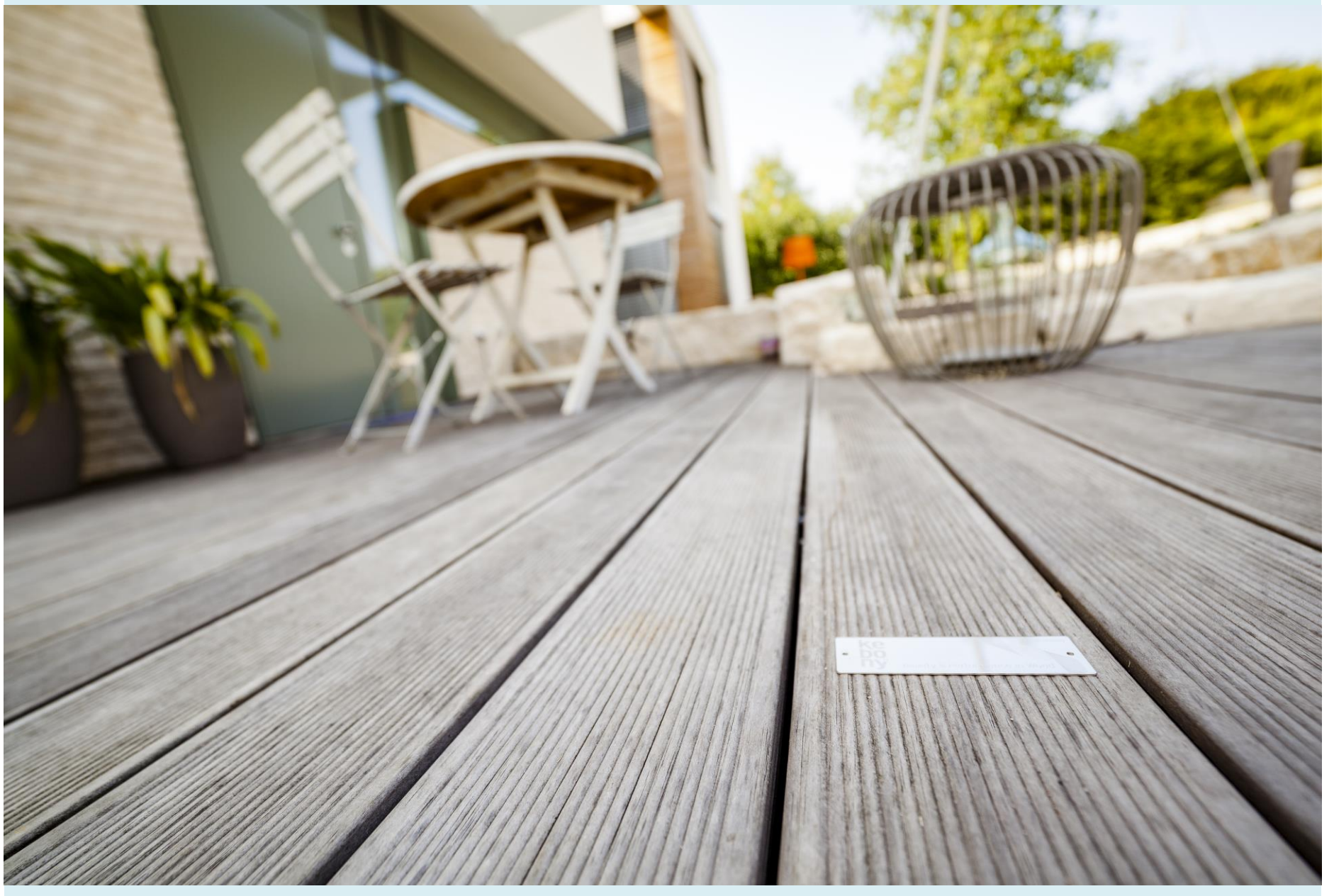
in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Kebony AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-407-287-EN
ECO Platform reference number:	00000303
Issue date:	21.06.2016
Valid to:	21.06.2021

Kebony Clear (Radiata)

Kebony AS

www.epd-norge.no



General information

Product:
Kebony Clear (Radiata)

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Declaration number:
NEPD-407-287-EN

Place of production:
Skien, Norway

ECO Platform reference number:
00000303

Management system:

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 015 rev1 Wood and wood-based products for use in construction, (validity: 2013 - 2018)

Organisation no:
979 446 276

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 manufacturer information, life cycle assessment data and evidences.

Issue date:
21.06.2016

Valid to:
21.06.2021

Declared unit:
1 m^3 of Kebony Radiata

Year of study:
2015

Declared unit with option:

Comparability:
EPD of construction products may not be comparable if they do not comply with, NPCR 015 rev1 and EN 15804 and seen in a building context.

Functional unit:
1 m^3 of Kebony Clear (Radiata), planed, installed and maintained over 30 years

The EPD has been worked out by:
Nicole Lambert and Johannes Daae, Bergfald Miljørådgivere

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:
Marte Reenaas
Marte Reenaas, Rambøll
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Kebony Clear (Radiata) is produced from sustainably managed Radiata from New-Zealand, which is treated with bio-based, renewable chemicals, giving the wood an outstanding durability and an exclusive appearance. Kebony Clear (Radiata) is produced in Kebony's production facilities located in Skien, Norway

Technical data:
Durability class (EN-350) : 1
Hardness: brinell 41 N/mm^2
Maximum movement: 4%
Density: 680 kg/m^3
Technical data sheets for all Kebony Clear (Radiata) Profiles are available on www.kebony.com

Product specification:
Kebony Clear (Radiata) are sold under different profiles.
The material overview below corresponds to the content in the final product and not the input quantities required to produce 1 FU of the product.

Materials	kg/m3	%
Radiata wood	480	70,6 %
Bio-based chemicals	200	29,4 %
Total	680	
Plastic foil packaging	1,65	

Market:
Europe

Reference service life, product:
30 years

Reference service life, building:
30 years

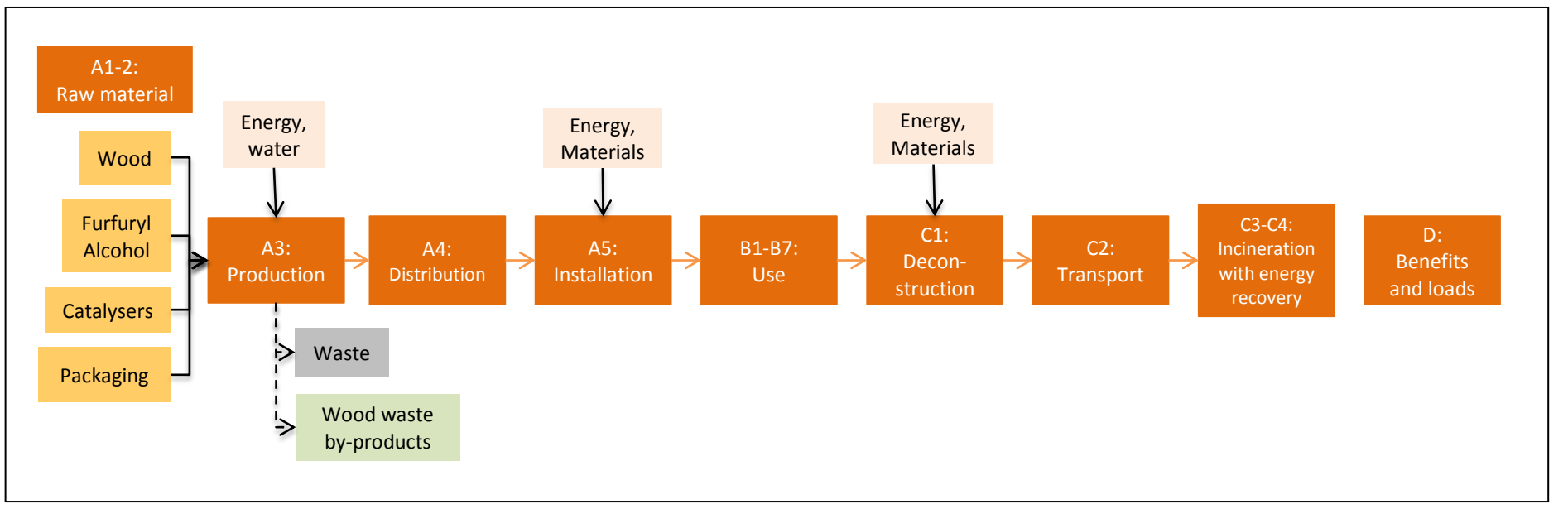
LCA: Calculation rules

Declared unit:
1 m3 of Kebony Clear (Radiata) over 30 years

The production process is divided into 3 stages:
1) impregnation
2) drying
3) final profiling

System boundary:
The scope of the study is ”cradle to grave”, described as A1 to C4 and D. The study takes into consideration the life cycle stages from the extraction of raw materials, production, installation, use and disposal, including all transport stages. The flowchart (Figure 1) illustrates the different stages of the product's life cycle considered.
Module D: energy under the form of heat and electricity is generated from the incineration of Kebony Clear (Radiata) at end-of-life and is associated to the substitution of heat and electricity production for the Europe.

Figure 1: System boundary of Kebony Clear (Radiata)



Data quality:
Upstream:
Specific data was acquired by sending questionnaires to suppliers. The yearly averages for 2014 are referred to in this life cycle analysis. When suppliers did not provide specific data, generic data was used.

Core process:
Specific data was acquired by using measurable consumption and emission data from Kebony’s facilities for 2014. The yearly averages for 2014 are referred to. Only specific data was used to analyse the core process of the LCA.

Downstream:
Scenarios were developed and generic data was used.

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 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.

Conversion to process flows and LCI:
Conversion to primary flows and environmental effects were carried out via OpenLCA (version 1.4.2), which uses datasets from to EcoInvent v3.1. Datasets were selected according to their technological, geographical and time related representativeness for the process assessed.

Impact assessment:
Open LCA software (version 1.4.2) was used to carry out the impact assessment of this LCA, the later refers to the CML baseline method for all impact assessment factors with the exception of the “global warming potential” which is analysed using IPCC 2013.

Biogenic carbon uptake The biogenic carbon uptake of the wood is estimated according to NS-EN 16449:2014. The mass of the green wood is 480 kg/m^3, and the moisture content is assumed to be 12% as recommended by the standard. The biogenic CO_2 uptake from the wood is thus 785,71 kg CO_2.The biogenic carbon uptake in the furfuryl alcohol is calculated based on the stoichiometric formula for furfuryl alcohol, which is C_5 H_6 O_2. This gives a molar mass of 98/mol of which Carbon accounts for 61,2% of this mass. A Kilo furfuryl alcohol thus contains 612 grams of carbon, which in turn results in emissions of 2266 grams of CO_2 when released. 1 m^3 of Kebony Clear (Radiata) contains 286,6 kg of furfuryl alchohol, which represents the biogenic carbon uptake of 590,4 kg. The total Biogenic CO_2 uptake is thus as following:
785,71 CO_2 + 590,4 kg CO_2 =1435,14 kg CO_2.

LCA: Scenarios and additional technical information

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

The transport scenario considered for Kebony Clear (Radiata) is based on the distribution of sales in 2014 and corresponding transport data. Datasets from Ecoinvent were referred to.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	42 %	lorry 16-32 metric ton, EURO5	658	0,034 l/t.km Diesel	22,4
Boat	65 %	transoceanic ship	134	0,0025 kg/t.km heavy fuel oil	0,4

Assembly (A5)
Installation will require the use of an electric saw to adjust the size of the planks to the size of the deck desired and an electric hand drill to fasten the screws/fasteners. The use of a hand drill and electric saw is considered negligible, <1% of the cumulative energy of the system model. Screws/fasteners are also considered negligible, <1% of the cumulative masse.

Use stage : B1- B7
The use of Kebony Clear (Radiata) is passive and does not require resource-demanding maintenance, nor repair/replacement/refurbishment.

End of Life (C1, C3, C4)
De-construction requires minimal tools. Kebony Clear (Radiata) will be sorted as non-hazardous treated wood at the building site and is considered to be incinerated.

	Unit	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	0
Reuse	kg	0
Recycling	kg	0
Incinerator	kg	680
To landfill	kg	0

The transport to waste processing will vary depending on local waste management policy for wood and distance from the waste management facility. An average distance of 50km was considered.

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	42 %	lorry 16-32 metric ton, EURO5	50	0,034 l/t.km Diesel	1,7

Energy recovered from the incineration of Kebony Clear (Radiata) at end-of-life is considered to substitute electricity and heat production in Europe. 60% is assumed to generate energy/heat, based to the waste management systems in the countries where Kebony Clear (Radiata) is sold.

	Unit	Value
electricity, high voltage, production mix Europe	149	kWh
heat production EU without Switzerland	5171	MJ

LCA: Results

The environmental impact categories investigated are in accordance with NPCR 015 rev1.
The results are presented for:
- Product stage, corresponding to modules A1-A3,
- Distribution, module A4
- End of life stage, corresponding to modules C2-C3
- Beyond the system boundaries, module D

The modules for which no results are presented correspond to modules not relevant for the life cycle of the product.

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

Product stage			Assembly 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	MNR	X

Environmental impact

Parameter	Unit	A1- A3	A4	A5	B1-B7	C1	C2	C3	D
GWP	kg CO_2 -eqv	-549,42	75,22	0,00	0,00	0,00	5,31	1459,43	-485,19
ODP	kg CFC11-eqv	0,00016	0,000015	0,00	0,00	0,00	0,0000001	0,000071	-0,000063
POCP	kg C_2H_4 -eqv	0,390	0,015	0,00	0,00	0,00	0,0010	0,052	-0,06
AP	kg SO_2 -eqv	9,32	0,30	0,00	0,00	0,00	0,020	0,87	-1,15
EP	kg PO_4^{3-}-eqv	1,27	0,060	0,00	0,00	0,00	0,0041	0,33	-0,62
ADPM	kg Sb-eqv	0,00300	0,000260	0,00	0,00	0,00	0,000019	0,000084	-0,00005
ADPE	MJ	14692,70	1232,80	0,00	0,00	0,00	86,73	404,50	-7255,97

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; INA: indicator not assessed (due to a lack of specific data) and that the values are considered to be insignificant.

Resource use

Parameter	Unit	A1- A3	A4	A5	B1-B7	C1	C2	C3	D
RPEE	MJ	5575,77	15,05	0,00	0,00	0,00	1,01	6,65	102,18
RPEM	MJ	16475,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TPE	MJ	22051,30	15,05	0,00	0,00	0,00	1,01	6,65	102,18
NRPE	MJ	15353,56	1240,83	0,00	0,00	0,00	87,27	410,85	7127,34
NRPM	MJ	73,59	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TRPE	MJ	15427,15	1240,83	0,00	0,00	0,00	87,27	410,85	7127,34
SM	kg	INA	0,00	0,00	0,00	0,00	0,00	0,00	INA
RSF	MJ	INA	0,00	0,00	0,00	0,00	0,00	0,00	INA
NRSF	MJ	INA	0,00	0,00	0,00	0,00	0,00	0,00	INA
W	m^3	25,00	INA	0,00	0,00	0,00	INA	INA	INA

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; INA: indicator not assessed (due to a lack of specific data) and that the values are considered to be insignificant.

End of life - Waste

Parameter	Unit	A1-A2	A3	A4-A5	B1-B7	C1-C2	C3	D
HW	kg	INA	3,42	INA	0,00	INA	INA	INA
NHW	kg	INA	306,58	INA	0,00	INA	680,00	INA
RW	kg	INA	0,00	INA	0,00	INA	INA	INA

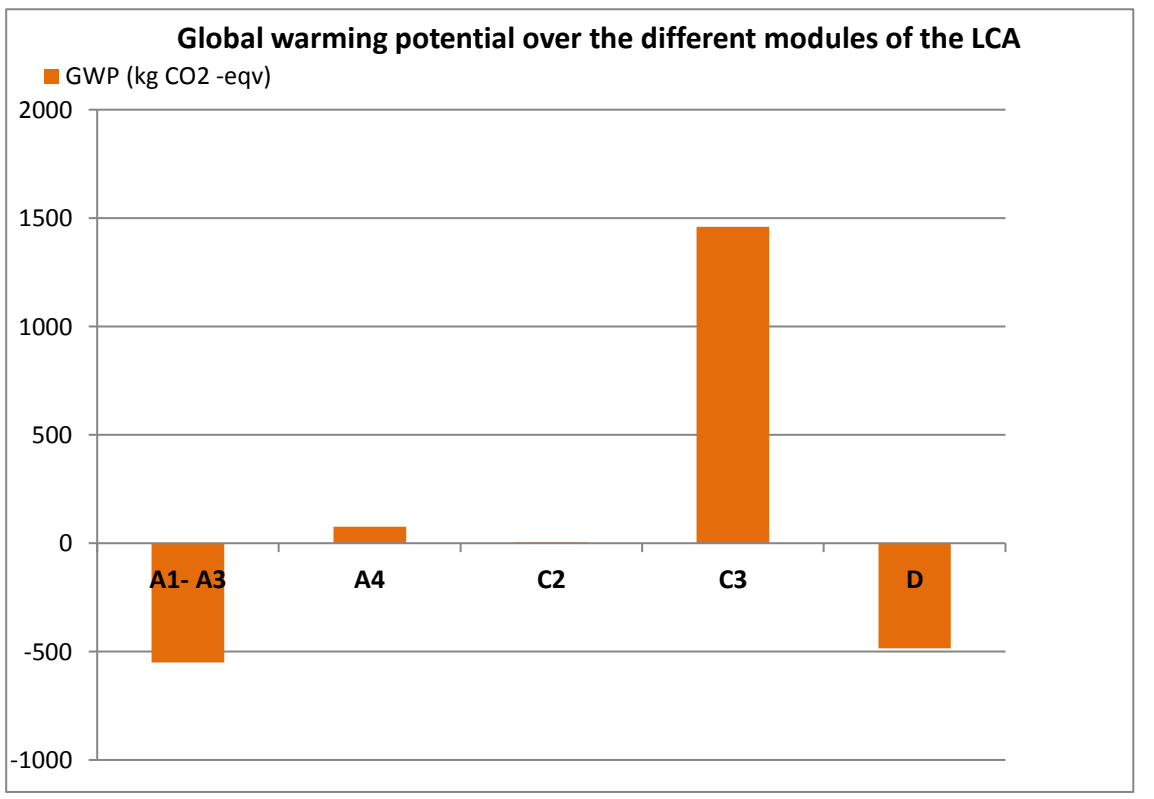
HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed; INA: indicator not assessed (due to a lack of specific data) and that the values are considered to be insignificant.

End of life - Output flow

Parameter	Unit	A1-A2	A3	A4-A5	B1-B7	C1-C2	C3	D
CR	kg	0,00	61,20	0,00	0,00	0,00	0,00	0,00
MR	kg	0,00	0,00	0,00	0,00	0,00	0,00	0,00
MER	kg	0,00	120,00	0,00	0,00	0,00	0,00	0,00
EEE	MJ	0,00	0,00	0,00	0,00	0,00	536,40	0,00
ETE	MJ	0,00	0,00	0,00	0,00	0,00	5171,00	0,00

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

Greenhous gas emission from the use of electricity in the manufacturing phase
Electricity at Kebonys factory is Norwegian hydro power (certificate of origin)

Data source	Amount	Unit
Norwegian Hydro power	0,00675	$kgCO_2$-eqv/kWh

The GWP is calculaed from the coresponding EcoInvent 3.1 datasets, according to the IPCC 2013 method.

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
Not relevant the product is used for outdoor applications

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
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*
EcoInvent 3.1	EcoInvent 3.1 Cutoff, *Swiss Centre of Life-Cycle Database. Www.ecoinvent.ch*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
EN 16449:2014	*Wood and wood based products - Calculation of the biogenic carbon content of wood and conversion to carbon dioxide*
Lambert and Daae, 2016	LCI/LCA report: Kebony SYP and Kebony Radiata
NPCR 015 Rev1	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*

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