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)

**Owner of the declaration:**
Kebony AS
Contact person: Per Brynildsen
Phone: +47 06125
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**Program operator:**
The Norwegian EPD Foundation
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**Declaration number:**
NEPD-407-287-EN

**ECO Platform reference number:**
00000303

**This declaration is based on Product Category Rules:**
CEN Standard EN 15804 serves as core PCR

**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.

**Declared unit:**
1 m$^3$ of Kebony Radiata

**Declared unit with option:**

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

**Verification:**
The CEN Norm EN 15804 serves as the core PCR.
Independent verification of the declaration and data, according to ISO14025:2010
- [ ] internal
- [x] external

**Third party verifier:**
Marte Reenaas
(Ramullan approved by EPD Norway)

**Organisation no:**
979 446 276

**Issue date:**
21.06.2016

**Valid to:**
21.06.2021

**Year of study:**
2015

**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.

**The EPD has been worked out by:**
Nicole Lambert and Johannes Daale, Bergfeld Miljørådgivere

**Approved**

Håkon Haun
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.

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.

<table>
<thead>
<tr>
<th>Materials</th>
<th>kg/m³</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiata wood</td>
<td>480</td>
<td>70.6%</td>
</tr>
<tr>
<td>Bio-based chemicals</td>
<td>200</td>
<td>29.4%</td>
</tr>
<tr>
<td>Total</td>
<td>680</td>
<td></td>
</tr>
<tr>
<td>Plastic foil packaging</td>
<td>1.65</td>
<td></td>
</tr>
</tbody>
</table>

Technical data:
- Durability class (EN-350) : 1
- Hardness: brinell 41 N/mm²
- Maximum movement: 4%
- Density: 680 kg/m³
- Reference service life, product: 30 years
- Reference service life, building: 30 years
- Technical data sheets for all Kebony Clear (Radiata) Profiles are available on www.kebony.com

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.

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.

Figure 1: System boundary of Kebony Clear (Radiata)
Conversion to process flows and LCIs:
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.

LCA: Scenarios and additional technical information

The following information describes 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)

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity utilisation (incl. return) %</th>
<th>Type of vehicle</th>
<th>Distance km</th>
<th>Fuel/Energy consumption</th>
<th>Value (l/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>42%</td>
<td>lorry 16-32 metric ton, EURO5</td>
<td>656</td>
<td>0,034 l/t.km Diesel</td>
<td>22,4</td>
</tr>
<tr>
<td>Boat</td>
<td>65%</td>
<td>transoceanic ship</td>
<td>134</td>
<td>0,0025 kg/l.km heavy fuel oil</td>
<td>0,4</td>
</tr>
</tbody>
</table>

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 mass.

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.

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste disposed</td>
<td>kg</td>
<td>0</td>
</tr>
<tr>
<td>Collected as mixed construction waste</td>
<td>kg</td>
<td>0</td>
</tr>
<tr>
<td>Reuse</td>
<td>kg</td>
<td>0</td>
</tr>
<tr>
<td>Recycling</td>
<td>kg</td>
<td>0</td>
</tr>
<tr>
<td>Incinerator</td>
<td>kg</td>
<td>680</td>
</tr>
<tr>
<td>To landfill</td>
<td>kg</td>
<td>0</td>
</tr>
</tbody>
</table>

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)

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

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.

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>electricity, high voltage, production mix Europe</td>
<td>kWh</td>
<td>149</td>
</tr>
<tr>
<td>heat production EU without Switzerland</td>
<td>MJ</td>
<td>5171</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Raw materials</th>
<th>Transport</th>
<th>Manufacturing</th>
<th>Assembly</th>
<th>Use</th>
<th>Maintenance</th>
<th>Repair</th>
<th>Replacement</th>
<th>Operational energy use</th>
<th>Operational water use</th>
<th>De-construction demolition</th>
<th>Transport</th>
<th>Waste processing</th>
<th>Disposal</th>
<th>Beyond the system boundaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B4</td>
<td>B5</td>
<td>B6</td>
<td>B7</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>C</td>
<td>X</td>
<td>MNR</td>
</tr>
</tbody>
</table>

Environmental impact

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>B1-B7</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP</td>
<td>kg CO₂-eqv</td>
<td>-549,42</td>
<td>75,22</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>5,31</td>
<td>1459,43</td>
<td>-485,19</td>
</tr>
<tr>
<td>ODP</td>
<td>kg CFC11-eqv</td>
<td>0,00016</td>
<td>0,000015</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,0000001</td>
<td>0,000071</td>
<td>-0,000063</td>
</tr>
<tr>
<td>POCP</td>
<td>kg C₃H₆-eqv</td>
<td>0,390</td>
<td>0,015</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00010</td>
<td>0,052</td>
<td>-0,06</td>
</tr>
<tr>
<td>AP</td>
<td>kg SO₂-eqv</td>
<td>9,32</td>
<td>0,30</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,020</td>
<td>0,87</td>
<td>-1,15</td>
</tr>
<tr>
<td>EP</td>
<td>kg PO₄³⁻-eqv</td>
<td>1,27</td>
<td>0,060</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00041</td>
<td>0,33</td>
<td>-0,62</td>
</tr>
<tr>
<td>ADPE</td>
<td>kg Sb-eqv</td>
<td>0,00300</td>
<td>0,000260</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,000019</td>
<td>0,000084</td>
<td>-0,00005</td>
</tr>
<tr>
<td>ADPE</td>
<td>MJ</td>
<td>14692,70</td>
<td>1232,80</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>86,73</td>
<td>404,50</td>
<td>-7255,97</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>B1-B7</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPEE</td>
<td>MJ</td>
<td>5575,77</td>
<td>15,05</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>1,01</td>
<td>6,65</td>
<td>102,18</td>
</tr>
<tr>
<td>RPEM</td>
<td>MJ</td>
<td>16475,53</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
</tr>
<tr>
<td>TPE</td>
<td>MJ</td>
<td>22051,30</td>
<td>15,05</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>1,01</td>
<td>6,65</td>
<td>102,18</td>
</tr>
<tr>
<td>NRPE</td>
<td>MJ</td>
<td>15353,56</td>
<td>1240,83</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>87,27</td>
<td>410,85</td>
<td>7127,34</td>
</tr>
<tr>
<td>NRPM</td>
<td>MJ</td>
<td>73,59</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>87,27</td>
<td>410,85</td>
<td>7127,34</td>
</tr>
<tr>
<td>TRPE</td>
<td>MJ</td>
<td>15427,15</td>
<td>1240,83</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>87,27</td>
<td>410,85</td>
<td>7127,34</td>
</tr>
<tr>
<td>SM</td>
<td>kg</td>
<td>INR</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>INR</td>
</tr>
<tr>
<td>RSF</td>
<td>MJ</td>
<td>INR</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>INR</td>
</tr>
<tr>
<td>NRSF</td>
<td>MJ</td>
<td>INR</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>INR</td>
</tr>
<tr>
<td>W</td>
<td>m³</td>
<td>25,00</td>
<td>INR</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>INR</td>
<td>INR</td>
<td>INR</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A2</th>
<th>A3</th>
<th>A4-A5</th>
<th>B1-B7</th>
<th>C1-C2</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW</td>
<td>kg</td>
<td>INA</td>
<td>3.42</td>
<td>INA</td>
<td>0.00</td>
<td>INA</td>
<td>INA</td>
<td>INA</td>
</tr>
<tr>
<td>NHW</td>
<td>kg</td>
<td>INA</td>
<td>306.58</td>
<td>INA</td>
<td>0.00</td>
<td>INA</td>
<td>680.00</td>
<td>INA</td>
</tr>
<tr>
<td>RW</td>
<td>kg</td>
<td>INA</td>
<td>0.00</td>
<td>INA</td>
<td>0.00</td>
<td>INA</td>
<td>INA</td>
<td>INA</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A2</th>
<th>A3</th>
<th>A4-A5</th>
<th>B1-B7</th>
<th>C1-C2</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>kg</td>
<td>0.00</td>
<td>61.20</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>MR</td>
<td>kg</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>MER</td>
<td>kg</td>
<td>0.00</td>
<td>120.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>EEE</td>
<td>MJ</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>536.40</td>
<td>0.00</td>
</tr>
<tr>
<td>ETE</td>
<td>MJ</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>5171.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

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

Global warming potential over the different modules of the LCA

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

Electricity at Kebony's factory is Norwegian hydro power (certificate of origin).

<table>
<thead>
<tr>
<th>Data source</th>
<th>Amount</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norwegian Hydro power</td>
<td>0.00675</td>
<td>kgCO₂-eqv/kWh</td>
</tr>
</tbody>
</table>

The GWP is calculated from the corresponding 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 contains dangerous substances, more than 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. Wwww.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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