# Environmental Product Declaration

In accordance with EN 15804:2012+A2:2019 for:

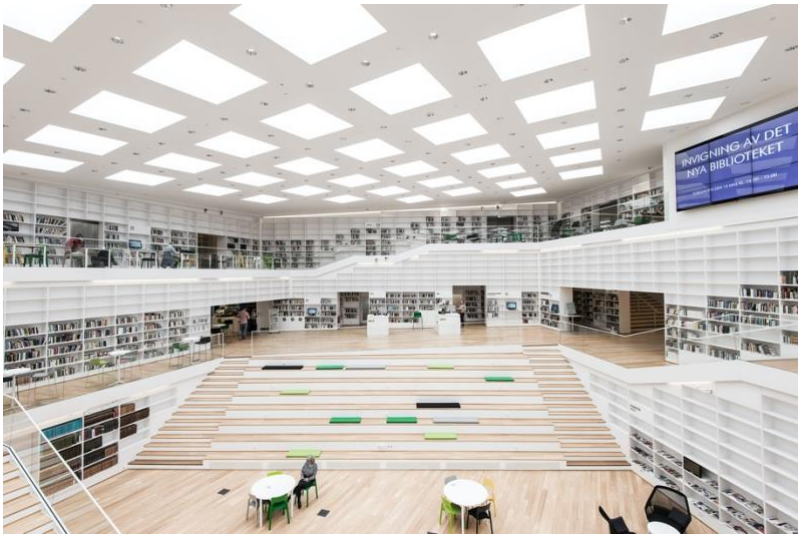
## *Holse & Wibroe Strand Woven Bamboo*

from

## *Holse & Wibroe*

| | |
|---|---|
| Programme: | The International EPD® System, www.environdec.com |
| Programme operator: | EPD International AB |
| EPD registration number: | S-P-08362 |
| Publication date: | 2023-05-22 |
| Valid until: | 2028-05-22 |

*An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com*



# General information

## Programme information

| | |
|---|---|
| **Programme:** | The International EPD® System |
| **Address:** | EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm<br>Sweden |
| **Website:** | www.environdec.com |
| **E-mail:** | info@environdec.com |

| **Accountabilities for PCR, LCA and independent, third-party verification** |
|---|
| **Product Category Rules (PCR)** |
| CEN standard EN 15804 serves as the Core Product Category Rules (PCR) |
| Product Category Rules (PCR):<br>PCR 2019:14 Construction products, version 1.2.5 (2023-01-xx) |
| PCR review was conducted by: *IVL Swedish Environmental Research Institute*<br>Moderator: *Martin Erlandsson, Martin.erlandsson@ivl.se* |
| **Life Cycle Assessment (LCA)** |
| LCA accountability: *Chao WANG, Ecovane Environmental* |
| **Third-party verification** |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:<br><br>☒ EPD verification by individual verifier<br><br>Third-party verifier: Marcus Wendin, Miljögiraff AB (marcus@miljogiraff.se)<br><br>Approved by: The International EPD® System |
| **OR** |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:<br><br>☐ EPD verification by accredited certification body<br><br>Third-party verification: <*name, organisation*> is an approved certification body accountable for the third-party verification<br><br>The certification body is accredited by: <*name of accreditation body & accreditation number, where applicable*> |
| **OR** |

Independent third-party verification of the declaration and data, according to ISO 14025:2006 via:

☐ EPD verification by EPD Process Certification*

Internal auditor: <*name, organisation*>

Third-party verification: <*name, organisation*> is an approved certification body accountable for third-party verification

Third-party verifier is accredited by: <*name of accreditation body & accreditation number, where applicable*>

*For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI v.4, Section 7.5.

Procedure for follow-up of data during EPD validity involves third party verifier:

☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

## Company information

**Owner of the EPD:**

Holse & Wibroe A/S
Address: Agenavej 20, 2670 Greve, Denmark
Website: http://www.holseogwibroe.dk
Tel: +45 8818 2800 Email: oho@holseogwibroe.dk

**Description of the organisation:**

Holse & Wibroe A/S is a Danish company founded in 2004. The entire business is based upon bamboo. Bamboo products were supplied for both outdoor and indoor use. Hereunder bamboo floorings, bamboo panels, bamboo veneer, bamboo decking, bamboo cladding and bamboo beams. The head office is located near Copenhagen, Denmark.

Holse &Wibroe A/S is founded upon the values of honesty, trust, long term partnership and the ability to supply environmental and sustainable bamboo products of high quality, for both residential and commercial use. Together with the long-term partners, Holse &Wibroe A/S strive to develop new bamboo products of high quality, and move the borders for bamboo use in the building industry.

**Name and location of production site(s):**

Anji Qichen Bamboo Industry Co., Ltd.
Address: Baishuiyang, Tianhuangping town, Anji county, Huzhou, P.R.China

## Product information

**Product name:**

Holse & Wibroe Strand Woven Bamboo

**Product identification:**

*Table1 Product technical specifications*

| | |
|---|---|
| Density | 1100 kg/m$^3$ |
| Thickness | 10/14 mm |

**Manufacturing process:**

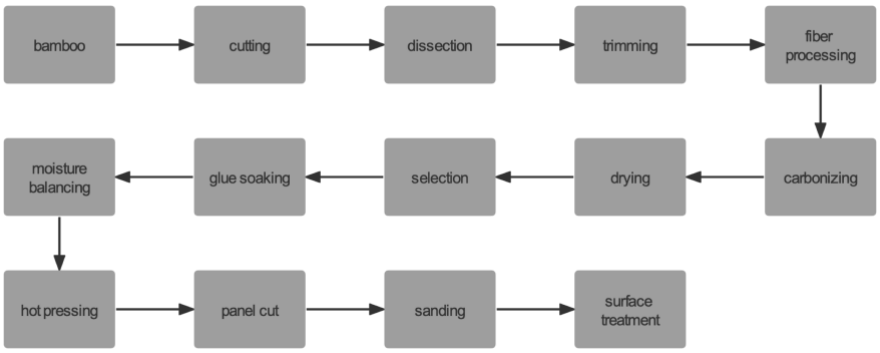



*Figure1 Holse & Wibroe strand woven bamboo manufacturing process*

**Product description:**

Bamboo is one of the fastest-growing plants in the world. It is a renewable and versatile resource with multi- purpose usage. Bamboos are of notable economic and cultural significance in South Asia, Southeast Asia, and East Asia where the climate is best suitable for its cultivation. The material may be cut and laminated into sheets and planks, and may be curved or flattened by the application of heat

and pressure. It is an ideal construction material as it is durable, sustainable, and environmentally friendly. Bamboo used for construction purposes must be harvested when the culms reach their greatest strength and when the sugar level in the sap is at its lowest (usually when the bamboo culm is 3 to 5 years old), and afterwards it should be cured and dried properly for further treatment and manufacturing purpose. Harvesting is best taking place at the end of the dry season, and a few months prior to the start of the rainy season.

*Figure2 Bamboo culms and rough processing site near plantations*

Strand woven bamboo floorings are made from bamboo fibers that are crushed, put in resin and then pressed under extreme high pressure. Creating an extremely dense and solid material, much harder than any hardwood. The look is similar with known hardwoods. Floorings are delivered with tongue & grove or click-assembly. Produced from bamboo specie "Phyllostachus Pubescens", origin China.

**UN CPC code:**
3145 Plywood, veneer panels and similar laminated wood of bamboo

**Geographical scope:**
Global

## LCA information

**Functional unit / declared unit:**
The declared unit is 1kg of bamboo product.

**Time representativeness:**
The study used primary data collected from January 2021 to January 2022.

**Database(s) and LCA software used:**
SimaPro9 was used for the LCA modelling. In the study, the key parameters for producer-specific foreground data were based on one year (January 2021 to January 2022) of averaged data from Holse & Wibroe. Generic data for certain processes were sourced from Ecoinvent 3.8 database in SimaPro9.4.0.1. Modification of the global background database was done by replacing all the energy data, especially electricity production data, by localized Chinese energy data.

The data quality requirements for this study were as follows:

- Existing LCI data were, at most, 10 years old. Newly collected LCI data were current or up to 3 years old;
- The LCI data related to the geographical locations where the processes took place, e.g. electricity and transportation data from China, disposal data from Europe were utilized;

- The scenarios represented the average technologies at the time of data collection.

**System diagram:**

| DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product Stage | | | Construction process stage | | Use Stage | | | | | | | End of life stage | | | | Resource recovery stage |
| Raw Material | Transport | Manufacturing | Transport | Assembly / Install | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction and 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 | MND | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X |

**Description of system boundaries:**

The is a “cradle-to-gate with options” EPD. The LCA study traced all energy and material inputs back to the extraction of resources for each life-cycle stage of the products. In addition, the study quantified emissions from the whole system, and included various waste management scenarios.

The life cycle stages below have been covered:

- A1-A3: Product stage (raw material acquisition, transport to manufacturing site and manufacturing)
- A4: Construction stage (transport to user site)
- C1-C4: End-of-life stage (deconstruction, transport, waste processing and disposal)
- D: Resource recovery stage (reuse, recovery, recycling)

**Excluded lifecycle stages:**

The installation stage on the construction site and the usage stage of the product are excluded from this study.

**Assumption and limitations:**

For certain aspects of bamboo flooring studied, the following key assumptions were made as follows:

- For missing background data, substitution of missing data using similar background data approach was taken to shorten the gap.
- Transport assumptions were made where it was not possible to obtain the specific data, for instance from distribution center to outlet and from outlet to consumer. When this occurred, it was clearly stated in the report;
- Electricity consumption data was not obtained for certain processes so assumptions were made for these. When this occurred, it was clearly stated in the report;
- A modification of the global background database was done by replacing all the energy data, especially electricity production data, by Chinese energy data, and the study used the modified background data to get better indication of the potential environmental impact results by using more localized dataset of energy supply.

**Allocation:**

During the production process of Holse & Wibroe strand woven bamboo products, the use of raw materials and resource were calculated according to the relationship between output and energy

consumption, water consumption, and related resources, avoiding the use of mass, energy, and economic distribution method.

During manufacturing process, there is no generation of by-products that need to be allocated in this situation.

**Cut-off rules:**
Raw materials that account for less than 1% of the mass of the product were allowed not to be considered in the study, including the transportation of the associated materials. The infrastructure for manufacturing was not included in the LCA, including the machine, either.

**Electricity source:**
As required in PCR Section 4.8, "If purchased electricity used in the manufacturing process of module A3 accounts for more than 30% of the GWP-GHG results of modules A1-A3, the EPD shall declare the energy source behind the purchased electricity and its climate impact as kg $CO_2$ eq./kWh (using the GWP-GHG indicator)."

In this LCA, the grid mix data on electricity for the site in Zhejiang Province was based on grid mixes of China. The electricity inventory is based on the year of 2018 for Chinese electricity generation (China Energy Statistics). Eastern China grid electricity mix is used.

In Chinese map of electricity generation, thermal power is the principal part of total national installed capacity and electricity generation. Development of hydropower is slower than that of thermal power, and nuclear power is still in its initial step. Power generation from renewable energy resources, such as wind, solar energy, and tide, are usually not included due to the small share in electricity generation in China. However, the renewable energy was also considered in this study by taking a small ratio of wind, solar, and other renewable energy generation in China into account.

In 2018, the source of power supply is 71.1% thermal power, 17.2% hydropower and 5.1% wind power. The transmission of electricity in all cases is taken from the power station via a high voltage electricity grid to low voltage electricity suitable for domestic use, with a loss factor of 7.52% of the electricity produced at the power station, and a loss of 6.15% by the electricity consumption at the power plants.

The emission of the electricity used for manufacturing stage is 0.85kg $CO_2$ eq./kWh.

**Life cycle assessment scenarios:**
According to Holse & Wibroe, products are consumed in Denmark, and transportation distance for product delivery was estimated with reference to external resources. The table blow demonstrates the data used for stage A4 in the LCA modelling.

*Table2 Transport to the construction site (A4)*

| Additional technical information for stage A4 | | | |
|---|---|---|---|
| **Scenario title** | **Parameter** | **Units (expressed per declared unit)** | **Value** |
| **A4 Transport to Site** | Vehicle type used for transport | Lorry | Lorry |
| | Vehicle load capacity | Metric ton | 32 |
| | Fuel type and consumption | Diesel, L/100km | 31.11 |

| | | | |
|---|---|---|---|
| | Distance to central warehouse or storage, if relevant | Km | 227 |
| | Distance to construction site | Km | - |
| | Capacity utilization (including empty returns) | % | 50 |
| | Bulk density of transportation | Kg/m$^3$ | Unknown |
| | Volume capacity utilization factor | Not applicable | |

Demounting and demolition of the product were assumed to be conducted manually, so there was no energy and material input involved in the LCA modelling. For waste processing, three sets of background data were used.

*Table3 End of life (C1-C4)*

| **Additional technical information for end-of-life C stage** | | | |
|---|---|---|---|
| **Module** | **Parameter** | **Units (expressed per declared unit)** | **Value** |
| **C1 Deconstruction** | Collection process specified by type | Kg collected separately | 1 |
| | | Kg collected with mixed construction waste | - |
| **C2 Transport** | Assumptions for scenario development | Km | 100 |
| **C3 Waste processing** | Recovery system specified by type | Kg for re-use | - |
| | | Kg for recycling | - |
| | | Kg for incineration | 1 |
| | | Kg for landfill | - |
| **C4 Disposal** | Disposal specified by type | Kg product or material for final deposition | - |

**Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):**

| | Product stage | | | Construction process stage | | Use stage | | | | | | | End of life stage | | | | Resource recovery stage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Raw material supply | Transport | Manufacturing | Transport | Construction installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| **Module** | **A1** | **A2** | **A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| Modules declared | X | X | X | X | ND | ND | ND | ND | ND | ND | ND | ND | X | X | X | X | X |
| Geography | CN | CN | CN | CN | - | - | - | - | - | - | - | - | DK | DK | DK | DK | DK |
| Specific data used | >90% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation – products | <10% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation – sites | 0% | | | | | - | - | - | - | - | - | - | - | - | - | - | - |

## Content information

| Product components | Percentage, % | CAS Number | Biogenic carbon kg C/kg |
|---|---|---|---|
| Bamboo pole | 88.00 | - | 0.3867 |
| Phenolic resin | 12.00 | 9003-35-4 | 0 |
| **Packaging materials** | **Weight, kg** | **Weight-% (versus the product)** | **Weight biogenic carbon, kg C/kg** |
| Corrugated board | 28 | 0.0255 | 12.32 |
| Pallet | 8.5 | 0.0077 | 3.74 |
| Packing film | 0.3 | 0.0003 | 0 |

# Environmental Information

## Potential environmental impact for Holse & Wibroe Strand Woven Bamboo

| Results per functional or declared unit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-fossil | kg $CO_2$ eq. | 1.43E+00 | 2.60E-01 | 0.00E+00 | 1.72E-02 | 1.80E-02 | 0.00E+00 | -6.09E-02 |
| GWP-biogenic | kg $CO_2$ eq. | -1.42E+00 | 2.98E-06 | 0.00E+00 | 1.02E-05 | 1.42E+00 | 0.00E+00 | -7.56E-03 |
| GWP-luluc | kg $CO_2$ eq. | 2.85E-03 | 1.77E-04 | 0.00E+00 | 7.15E-06 | 1.19E-05 | 0.00E+00 | -6.40E-04 |
| GWP-total | kg CO2 eq. | 1.02E-02 | 2.60E-01 | 0.00E+00 | 1.72E-02 | 1.44E+00 | 0.00E+00 | -6.91E-02 |
| ODP | kg CFC 11 eq. | 7.10E-08 | 5.23E-08 | 0.00E+00 | 3.74E-09 | 1.10E-09 | 0.00E+00 | -1.79E-08 |
| AP | mol H+ eq | 7.69E-03 | 7.38E-03 | 0.00E+00 | 8.73E-05 | 1.68E-04 | 0.00E+00 | -2.40E-03 |
| EP-freshwater | kg P eq. | 3.31E-04 | 1.02E-05 | 0.00E+00 | 1.29E-06 | 9.02E-06 | 0.00E+00 | -1.70E-05 |
| EP-marine | kg N eq. | 1.50E-03 | 1.83E-03 | 0.00E+00 | 2.96E-05 | 8.47E-05 | 0.00E+00 | -6.95E-04 |
| EP-terrestrial | mol N eq. | 1.61E-02 | 2.04E-02 | 0.00E+00 | 3.23E-04 | 8.18E-04 | 0.00E+00 | -1.16E-02 |
| POCP | kg NMVOC eq. | 5.27E-03 | 5.29E-03 | 0.00E+00 | 9.20E-05 | 2.01E-04 | 0.00E+00 | -1.97E-03 |
| ADP-minerals&metals* | kg Sb eq. | 4.37E-07 | 5.91E-08 | 0.00E+00 | 5.05E-08 | -2.16E-07 | 0.00E+00 | 6.15E-07 |
| ADP-fossil* | MJ | 3.41E+00 | 2.55E-01 | 0.00E+00 | 1.75E-01 | -7.25E-01 | 0.00E+00 | 2.66E+00 |
| WDP* | m3 | 6.87E-03 | 8.83E-04 | 0.00E+00 | -1.00E-02 | -8.53E-03 | 0.00E+00 | 9.18E-03 |
| GWP-GHG | kg CO2 eq | 1.43E+00 | 2.60E-01 | 0.00E+00 | 1.72E-02 | 1.81E-02 | 0.00E+00 | -6.15E-02 |
| Acronyms | 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 = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption | | | | | | | |

## Use of resources for Holse & Wibroe Strand Woven Bamboo

| Results per functional or declared unit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **C1** | **C2** | **C3** | **C4** | **D** |
| PERE | MJ | 1.83E+01 | 2.60E-02 | 0.00E+00 | 2.95E-03 | 4.42E-02 | 0.00E+00 | -1.18E+01 |
| PERM | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PERT | MJ | 1.83E+01 | 2.60E-02 | 0.00E+00 | 2.95E-03 | 4.42E-02 | 0.00E+00 | -1.18E+01 |
| PENRE | MJ | 2.37E+01 | 3.31E+00 | 0.00E+00 | 2.52E-01 | 1.86E-01 | 0.00E+00 | -6.56E-01 |
| PENRM | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PENRT | MJ | 2.37E+01 | 3.31E+00 | 0.00E+00 | 2.52E-01 | 1.86E-01 | 0.00E+00 | -6.56E-01 |
| 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 | 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 |
| FW | $m^3$ | 7.40E-01 | 4.44E-02 | 0.00E+00 | 3.60E-03 | 9.08E-03 | 0.00E+00 | -3.57E-02 |
| Acronyms | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water | | | | | | | |

## Waste production and output flows for Holse & Wibroe Strand Woven Bamboo

### Waste production

| Results per functional or declared unit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **C1** | **C2** | **C3** | **C4** | **D** |
| Hazardous waste disposed | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Non-hazardous waste disposed | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Radioactive waste disposed | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Output flows**

| Results per functional or declared unit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **C1** | **C2** | **C3** | **C4** | **D** |
| Components for re-use | kg | - | - | - | - | - | - | - |
| Material for recycling | kg | - | - | - | - | - | - | - |
| Materials for energy recover | kg | - | - | - | - | 1.00E+00 | - | - |
| Exported energy, electricity | MJ | - | - | - | - | - | - | - |
| Exported energy, thermal | MJ | - | - | - | - | - | - | - |

# Additional environmental information

The formaldehyde emission of Holse & Wibroe strand woven bamboo is no more than 0.1 mg/m$^2$h and the product reaches therefore the emission level E1 according to GB/T 17657-2013 (Test methods of evaluating the properties of wood- based panels and surface decorated wood-based panels).

# References


General Programme Instructions of the International EPD® System. Version 4.0.
PCR 2019:14. Construction products. (EN15804:A2) Version 1.2.5
*EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declaration – Core rules for the product category of construction products*
*ISO 21930:2017 Environmental declaration of building products*
*ISO 14025:2006 Environmental labels and declaration – Type III environmental declarations – Principles and procedures*
*ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework*
*ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines*
*GB/T 27649-2011 Engineered Bamboo Flooring*
*GB/T 30364-2013 Strand Woven Bamboo Flooring*
*GB/T 17657-2013 Test methods of evaluating the properties of wood-based panels and surface decorated wood-based panels*

# Contact information

## EPD Owner

**Holse & Wibroe A/S**

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Website: www.holseogwibroe.dk

## LCA and EPD Practitioner

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Website: www.1mi1.org

EPD®

www.environdec.com