ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Owner of the declaration	**Verband der Deutschen Holzwerkstoffindustrie e.V.**
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-VHI-20190095-IBG1-EN
Issue date	06/10/2020
Valid to	05/10/2025

Particle board, raw

Verband der Deutschen Holzwerkstoffindustrie e.V.

Association of the German
Wood-based Panel Industry

The legally binding version of these terms is the German EPD-document available on:

www.ibu-epd.com/ https://epd-online.com

1. General Information

Verband der Deutschen Holzwerkstoffindustrie e.V.

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastrasse 1
10178 Berlin

Declaration number
EPD-VHI-20190095-IBG1-EN

This declaration is based on the following product category rules
Derived timber products, 12/2018
(PCR tested and approved by the independent advisory board (SVR))

Issue date
06/10/2020

Valid to
05/10/2025

Dipl. Ing. Hans Peters
(President of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder (Executive Director IBU)

Particle board, raw

Owner of the declaration
Verband der Deutschen Holzwerkstoffindustrie e.V.
Schumannstrasse 9
10117 Berlin

Declared product/declared unit
1m^3 particle board, raw

Scope of application:
The contents of this declaration are based on the specifications for manufacturing raw particle boards from the following manufactures who are members of the Verband der Deutschen Holzwerkstoffindustrie e.V.:

- Pfleiderer Deutschland GmbH (Gütersloh, Neumarkt, Leutkirch)
- Sonae Arauco Deutschland GmbH, Beeskow
- elka-Holzwerke GmbH, Morbach
- Rauch Spanplattenwerk GmbH, Markt Bibart
- Nolte Holzwerkstoff GmbH & Co. KG, Germersheim

The lifecycle assessment of this declaration covers 100 % of the production of raw particle boards by the manufacturers or works listed in 2017. This declaration can be used for raw particle boards from the manufacturers listed above.

The owner of the declaration is liable for the basic information and supporting evidence; any liability of the IBU in relation to manufacturer's information, LCA data and supporting evidence is excluded.
This document is a translation from German to English. It is based on the original declaration number EPD-VHI-20190095-IBG1-DE.

Verification

European standard /EN 15804/ serves as the core PCR
Verification of the declaration and statements by an independent body in accordance with /ISO 14025:2010/
☐ internal ☒ external

Therese Daxner,
Independent verifier appointed by SVR

2. Product

2.1 Product description/Product definition

Raw particle boards are panel-shaped wood-based materials. They consist mainly of small-sized wood particles such as chips and sawdust and are pressed together with duroplastic adhesives. They are not coated.

EU regulation no. /305/2011/ of the European Parliament and Council of 9th March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC applies for putting the product on the market in the EU/EFTA (with the exception of Switzerland). The required declarations of performance and CE labelling were produced in accordance with the specifications of the harmonised standard /EN 13986:2004+A1:2015/, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.

2.2 Application

Particle boards can be used in decorative interior design and exhibition stand and shop construction.

2.3 Technical data

Requirements to /EN 312/
(simplified version for board types P1 - P7)

Constructional data

Name	Value	Unit
Bulk density	600 - 730	kg/m3
Tensile strength (longitudinal) to /EN 310/	7 - 22	N/mm2
Tensile strength (longitudinal) to /EN 319/	0.14 - 0.75	N/mm2
Tensile strength (longitudinal) to /EN 310/	1.2 - 3.35	N/mm2
Material humidity on delivery /EN 322/	5 - 13	%
Thermal conductivity /EN13986/	0.12	W/(mK)
Water vapour diffusion resistance level	damp 15 /dry 50	-
Sound absorption coefficient	0.1 - 0.25	%
Formaldehyde emissions in accordance with EN 717-1, see Requisite evidence	Requirement fulfilled	µg/m3

Please note: Specific technical data is to be found in the technical data sheets of the manufacturer products.

Performance values of the product according to the declaration of performance in relation to its main features in accordance with /EN 13986:2015- 06/, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking. Voluntary information for the product: None (not part of CE labelling/).

2.4 Delivery status

Particle boards from Verband der Deutschen Holzwerkstoffindustrie member companies are available in the following sizes:
Width: 200 – 6250 mm
Length: 200 – 2800 mm
Thickness: 8 – 64 mm
Special formats as regards length, width and thickness are available on request. Classification requirements in accordance with /EN 312/ Tables 2 to 10 /EN 312/; Special qualities available on request.

2.5 Base materials/ancillary materials

Product composition

Raw particle boards consist of small wood particles, binding agents and other additives. Mainly urea-formaldehyde binding agents (UF), melamine-urea-formaldehyde binding agents (MUF), phenol-formaldehyde binding agent and polymer diphenylmethane diisocyanate binding agents (PF) are used. Paraffins are used to hydrophobise the wooden particles.
67 % of the wood used originates from fresh softwoods, 13 % from fresh hardwoods and 20 % from used wood. The percentage shares included in the environmental product declaration are listed in the following table (all raw materials are stated as a percentage of mass; the mean value corresponds to the weighted average and the outer values to the manufacturers' maximum and minimum average values).

Name	Value	Unit
Wood (atro share), mainly softwood	82.9 | 84.4 | 86.6	%
Waste wood portion of wood use	0 | 20 | 42.9	%
Water	5.2 | 6.2 | 7	%
UF	0 | 7.6 | 10.6	%
MUF	0 | 1.03 | 2.2	%
PF	0 | 0.075 | 7.04	%
Paraffins	< 1	%
Urea	< 0.3	%
Fire retardant	< 0.05	%

The product has an average gross density of 641.7 kg/m³. The functional chemical groups of flame retardants are phosphate and nitrogen compounds.

Does the product/at least one part product contain substances which are on the candidate list /(27/06/2018) at a mass concentration above 0.1 %: no.

Does the product/at least one part product contain further CMR Category 1A or 1B substances which are not on the candidate list in doses above 0.1 mass % in at least one part product: no

Were biocidal products added to this building product or was it treated with biocidal products (is this therefore a processed product in terms of /EU Biocide Product Directive no. 528/2012/: no.

2.6 Manufacturing

Raw wood materials from forest wood (industrial wood or wood or forest chips), industry waste wood (industry waste wood, forest chips, sawdust) and recycled wood (waste wood, waste from own production) are first prepared and dried to produce raw particle boards. The fractions are sorted (partly already before drying) and mixed with binding agents before they are spread evenly in horizontal layers and then compressed. The compressed boards or continuous stream of boards are cut and formatted. The boards are packaged once the glue has completely hardened.

2.7 Environment and health during use

The conditions of manufacture require no special health protection measures apart from those which are provided for by the authorities for the specific work area, e.g. high-visibility jacket, safety shoes and dust protection mask. MAC tolerances (Germany) are not exceeded in any part of the plant.

Air: The exhaust air produced by manufacturing is cleaned in accordance with statutory regulations. Emissions are below /Technical Instructions on Air Quality Control (TA Luft)/ values.

Water/Soil: No direct contamination for water or soil is produced.

Noise protection: All values measured inside and outside the production facilities are below the valid requirements for Germany.
Noisy plant sections such as chipping are insulated accordingly by means of constructional measures.

2.8 Product processing/installation

VHI particle boards can be sawn, machined, planed, sanded and bored with normal machines. Recommendations for processing are available in the corresponding data sheets. Professional installation in accordance with constructional requirements must be ensured. When selecting additional products it must be ensured that they do not have a negative effect on the environmental compatibility properties of the specified building products. Normal protective measures (dust mask, gloves, protective clothing, dust extraction) must be complied with when processing the products.

2.9 Packaging

VHI particle boards are supplied with solid wood, wood-based materials, cardboard and plastic packaging. The materials should be recycled or exploited thermally where reuse is impractical.

2.10 Condition of use

The composition for the period of use complies with the base material composition in accordance with Section 2.5 Base materials. Approximately 270.9 kg of carbon dioxide are bound up in 1 m³ of the product during use. This is equivalent to approximately 993.3 kg of carbon dioxide when fully oxidised.

2.11 Environment and health during use

Environmental protection: Based on current knowledge, no hazards for water, air and soil can arise with appropriate use of the products described (see evidence).

Health protection: According to the current state of knowledge no hazards or impairments to health are to be expected if particle boards are used normally as intended. Emissions can only be detected at levels which are harmless to health (see verification).

2.12 Reference period of use

Durability during service life depends on the application classes. (/EN 312/)

2.13 Extraordinary influences - Fire

Raw particle boards have the following fire behaviour in accordance with /EN 13501/:

Fire protection

Name	Value
Building material class	D (normally flammable)
Flaming droplets	d0 (no burning dripping/falling material)
Flue gas development	s2 (limited smoke development)

Change in physical condition: Burning dripping is not possible because raw particle boards do not become liquid on being heated.

Toxicity of flue gases. Verification of the toxicity of flue gases. For Class D building materials is not required.

Water

No ingredients which could be hazardous to water are washed out. VHI particle boards are not resistant to permanent exposure to water. Damaged areas can, however, be replaced in situ.

Mechanical destruction

Sharp edges can form at points of fracture on mechanical destruction.

2.14 End-of-life phase

Re-use: In case of reconstruction or termination of the use phase of a building or other products in case of selective dismantling, VHI particle boards can be collected separately and re-used for the same application or a different one to the original application.

Further use: If single-type boards are available, VHI particle boards can be processed and returned to a manufacturing process for wood-based materials. Due to their high heating value, energetic recycling of particle boards is desirable if re-use or recycling are impractical.

2.15 Disposal

Disposal of waste wood in landfill is not permissible in accordance with Section 9 of the /Waste Wood Ordinance/. Waste code according to the /European Waste Catalogue/ (AVV): 17 02 01.

2.16 Further information

Further information can be found on the VHI home page: https://www.vhi.de

3. LCA: Calculation rules

3.1 Declared unit

The declared unit under ecological review relates to 1 m³ of raw particle board with a mass of 641.7 kg/m³, a water content of 6.25 % and an adhesive and additive content of 9.3 %. The composition complies with the weighted average by production volume.

Specification of the declared unit

Name	Value	Unit
Declared unit	1	m^3
Conversion factor to 1 kg	0.001558	-
Mass reference	641.7	kg/m^3

The balanced production volume included in the average is based on figures from two manufacturers of raw particle boards who belong to the Verband der Deutschen Holzwerkstoffindustrie association (VHI). The underlying production process varies only slightly from one manufacturer to another. Overall, both the representativeness and the robustness of the data can be regarded as good.

3.2 System boundary

The declaration type is an EPD *from cradle to gate with options*. It includes the production stage from the provision of raw materials through to the factory gate of the production facility (*cradle-to-gate*, Modules A1 to A3) and Module A5 and parts of the end-of-life stage (Modules C2 and C3). It also contains an analysis of the potential benefits and loads beyond the lifecycle of the product (Module D).

Module A1 analyses the provision of wood raw materials and the provision of adhesive and additives. Materially used waste wood enters the product system without impacts. Transports of materially used raw materials, including waste wood, are included in Module A2. Module A3 covers the provision of fuels, operating materials and product packaging as well as use of electricity and manufacturing processes on-site. Essentially, these involve the preparation, drying (including emissions), sorting and pressing of the raw materials. Module A5 deals exclusively with the disposal of the product packaging which includes the output of the biogenic carbon and also the primary energy (PERM and PENRM) it contains.

Module C2 includes transport to the disposal company and Module C3 the preparation and sorting of the waste wood. Module C3 also records the CO_2 equivalents to the carbon inherent in wood contained in the product and the renewable and non-renewable primary energy (PERM and PENRM) in accordance with /EN 16485/ as outputs.

Module D analyses the thermal recycling of the product at the end of its life and the resulting potential benefits and loads in the form of a system extension.

3.3 Estimations and assumptions

Generally, all material and energy flows for the processes required for production are determined on the basis of questionnaires. The emissions from burning wood which occur on-site are estimated on the basis of a background data record from the /GaBi Professional Database 2019 Edition/. Emissions from drying wood and hardening adhesive are based on references to literature and are documented in detail in /Rüter, Diederichs 2012/. The transport distance to the works for adhesives and additives is assumed to be 500 km by truck and 500 km by rail as a conservative estimate. All other data is based on average values.

3.4 Cut-off rules

Any decision on the flows to be included emanates from existing studies on analysing wood products. As a minimum, at least those material and energy flows which account for 1 % of the use of renewable and non-renewable primary energy or mass, whereby the total of flows not included is not greater than 5 %. Beyond this, it was ensured that no material and energy flows which exhibit special potential for significant influences in relation to environmental indicators were ignored. The loads for providing infrastructure (machines, buildings, etc.) from the entire foreground system were not included. This is based on the assumption that the above overall loads for setting up and maintaining the infrastructure do not exceed the 1% of total loads already described above. On the other hand, the energetic loads required to operate the infrastructure in the form of heat and electricity are included. Detailed information on cut-off rules is documented in /Rüter, Diederichs 2012/.

3.5 Background data

All background data was taken from the /GaBi Professional Database 2019 Edition/ and the final report on “Basic LCA data for wood-based construction products” /Rüter, Diederichs 2012/. The latter publication forms the basis for a regularly updated internal database from which the modelling for the forest pre-chain and the processes for mapping assumptions listed in Chapter 3.3 are taken.

3.6 Data quality

The foreground data was collected from each manufacturer for twelve consecutive months in the period from 2009 to 2011. The continuing currentness and validity of this data is certified by confirmation from the association on the basis of a member questionnaire.
The foreground data queried was validated on the basis of the mass and in accordance with plausibility criteria. The background data taken from the literature for material and energetically used wood raw products with the exception of forest timber originates from 2008 to 2012. The provision of forest timber was taken from a publication from 2008 which is mainly based in information from 1994 to 1997. All other information was taken from the /GaBi Professional Database 2019 Edition/ and is not more than three years old.

The overall data quality can be regarded as being good.

3.7 Period under review

The foreground data was collected from each manufacturer for twelve consecutive months in the period from 2009 to 2011. The continuing currentness and validity of this data is certified by confirmation from the association on the basis of a member questionnaire.

The production volumes for the calendar year 2017 for the manufacturers involved were collected in a further questionnaire in order to calculate an updated quantity-weighted production average.

3.8 Allocation

The allocations performed comply with the requirements of /EN 15804/ and /EN 16485/ and are explained in detail in /Rüter, Diederichs 2012/. The following main system extensions and allocations were performed.

General

Generally, all material-inherent property flows (biogenic carbon and primary energy contained) were allocated according to physical causalities. All further allocations for associated CO emissions were done on an economic basis. One exception is the allocation of the required heat in combined heat and power units which was allocated on the basis of the exergy of electricity and process heat products.

Module A1

- Forestry: All forestry chain loads were allocated via economic allocation factors to the products of standing and industrial timber based on their prices.
- The provision of waste wood as fuel includes no expenses from the previous lifecycle.

Module A3

- Woodworking industry: Expenses for associated CO emissions were allocated economically to the main products and residual materials on the basis of price.
- Thermal and electrical energy produced from the disposal of waste accruing in Module A3 (with the exception of wood-based materials) is returned to the product system in the form of a mathematical loop. The energy generated and calculated as a loop represents less than 1 % of the energy deployed in Module A3.
- All expenses associated with firing were allocated to firing after exergy in the case of combined production of heat and electricity.
- The provision of waste wood as fuel includes no expenses from the previous lifecycle (the same as in Module A1).

Module D

- The system extension carried out in Module D corresponds to an energetic recycling scenario for waste wood.

3.9 Comparability

In principle, a comparison or the evaluation of EPD data is only possible if all data to be compared was compiled in accordance with /EN 15804/ and the building context or product-specific performance characteristics have been included.

The LCA modelling was performed with the aid of /GaBi ts 2019/ with service pack 39. All background data was taken from the /GaBi Professional Database 2019 Edition/ or comes from the relevant references to literature.

4. LCA: Scenarios and further technical information

The scenarios on which the LCA is based are described in more detail below.

Installation into the building (A5)

Module A5 is declared but merely contains information on the disposal of product packaging and no information on the actual installation of the product in buildings. The quantity of packaging material which accrues as waste for thermal recycling per m³ of product in Module A5 and the resulting exported energy are shown the following table as technical scenario information.

Name	Value	Unit
Packaging wood for thermal recycling	2.346	kg
Plastic packaging for thermal recycling	0.141	kg
Paper and cardboard for thermal recycling	0.059	kg
Total efficiency of thermal waste disposal	38– 44	%
Total exported electrical energy	6.1	MJ
Total exported thermal energy	13.8	MJ

A transport distance of 20 km is assumed for the disposal of product packaging. The total efficiency of waste incineration and the proportion of electricity and heat generation by combined heat and power correspond to the allocated waste incineration process in the /GaBi Professional Database 2019 Edition/.

End-of-life (C1-C4)

Name	Value	Unit
Product share for use as secondary fuel	641.7	kg
Redistribution transport distance of waste wood (Module C2)	20	km

A collection rate of 100 % without losses through crushing the material is assumed for the scenario of thermal recycling.

Reuse, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Waste wood (atro, per net flow of the declared unit)	480.92	kg
Adhesives and additives (per net flow of the declared unit)	59.80	kg
Electricity produced (per net flow of the declared unit)	505.06	kWh
Adhesives and additives (per net flow of the declared unit)	3679.75	MJ

The product is recycled in the same composition as the declared unit described at the end of its life. Energetic recycling in a biomass power station with

an overall efficiency of 55 % and an electrical efficiency of 18.19 % is assumed. Incinerating 1 t of wood (air-dried, approx. 6.16 % wood moisture, 18 MJ/kg) produces approximately 909.48 kWh of electricity and 6626.2 MJ of usable heat. The waste wood entered in Module A3 as a secondary fuel is deducted from 541.8 kg atro wood so that a net flow of 480.9 kg atro wood is added to Module D. Taking into account the share of adhesives and additives, 505.06 kWh of electricity and 3679.75 MJ of thermal energy are produced per declared unit in Module D.
The exported energy replaces fuels from fossil sources, whereby it is assumed that thermal energy is produced with natural gas and the electricity replaced corresponds to the German network's electricity mix in 2016.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

Production stage			Construction process stage		Use stage							End of life stage				Credits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	X	MND	MND	MNR	MNR	MNR	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACTS: 1 m³ VHI raw particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
GWP	[kg CO_2 eq.]	-9.01E+2	8.24E+0	7.65E+1	4.81E+0	7.50E-1	9.97E+2	-3.72E+2
ODP	[kg CFC11 eq.]	6.82E-13	1.96E-14	3.46E-12	9.74E-16	1.26E-16	1.80E-13	-1.15E-11
AP	[kg SO_2 eq.]	1.51E-1	3.39E-2	1.49E-1	5.54E-4	3.17E-3	6.64E-3	-4.28E-1
EP	[kg $(PO_4)^{3-}$e.]	7.40E-2	8.33E-3	2.93E-2	1.05E-4	8.06E-4	1.08E-3	-6.88E-2
POCP	[kg Ethene eq.]	8.92E-3	-1.31E-2	2.02E-1	3.44E-5	-1.31E-3	4.39E-4	-3.91E-2
ADPE	[kg Sb eq.]	1.81E-5	8.02E-7	3.84E-5	9.58E-8	5.86E-8	1.80E-6	-1.00E-4
ADPF	[MJ]	2.20E+3	1.11E+2	9.44E+2	1.01E+0	1.03E+1	4.18E+1	-6.40E+3
Key	GWP = Global warming potential; ODP = Depletion potential for the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential for tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources (ADP – materials); ADPF = Abiotic depletion potential for fossil resources (ADP – fossil energy carriers)							

RESULTS OF THE LCA – RESOURCE USE: 1 m³ VHI raw particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
PERE	[MJ]	1.27E+2	1.08E+1	8.38E+2	3.07E+1	6.00E-1	2.96E+1	-1.90E+3
PERM	[MJ]	8.35E+3	0.00E+0	3.05E+1	-3.05E+1	0.00E+0	-8.35E+3	0.00E+0
PERT	[MJ]	8.48E+3	1.08E+1	8.69E+2	2.15E-1	6.00E-1	-8.32E+3	-1.90E+3
PENRE	[MJ]	1.52E+3	1.17E+2	1.13E+3	6.27E+0	1.03E+1	5.49E+1	-7.23E+3
PENRM	[MJ]	7.28E+2	0.00E+0	5.09E+0	-5.09E+0	0.00E+0	-7.28E+2	0.00E+0
PENRT	[MJ]	2.25E+3	1.17E+2	1.13E+3	1.18E+0	1.03E+1	-6.73E+2	-7.23E+3
SM	[kg]	1.08E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	1.17E+3	0.00E+0	0.00E+0	0.00E+0	9.27E+3
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.28E+2
FW	[m³]	4.35E-1	1.59E-2	6.47E-1	1.15E-2	1.01E-3	1.60E-2	1.51E+0
Key	PERE = Renewable primary energy as energy carrier; PERM = Renewable primary energy as material utilisation; PERT = Total use of renewable primary energy resources; PENRE = Non-renewable primary energy as energy carrier; PENRM = Non-renewable primary energy as material utilisation; PENRT = 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; FW = Use of net fresh water							

RESULTS OF THE LCA: OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ VHI raw particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
HWD	[kg]	2.55E-5	5.85E-6	4.32E-6	4.05E-9	5.78E-7	4.26E-8	-3.80E-6
NHWD	[kg]	5.00E-1	1.71E-2	2.04E+0	6.96E-2	8.41E-4	5.68E-2	1.61E+1
RWD	[kg]	2.00E-2	2.05E-3	7.33E-2	6.75E-5	1.40E-5	5.17E-3	-3.30E-1
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.42E+2	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	0.00E+0	6.07E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	0.00E+0	1.38E+1	0.00E+0	0.00E+0	0.00E+0
Key	HWD = Hazardous waste disposal; NHWD = Non-hazardous waste disposal; RWD = Radioactive waste disposal; CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy EET = Exported thermal energy							

The materially used primary energy (PERM and PENRM) is regarded as a materially inherent property in accordance with /EN 16485/. Consequently it always leaves the product system with the material and is logged out of the corresponding indicator as a negative value. Materially or energetically used secondary material contains no primary energy according to /IBU 2019/ PCR Part A, Version 1.8. The energy bound up in secondary material for material use (SM) is therefore not included in PERM or PENRM. This secondary material is exclusively waste wood as a share of the wood-based materials used, whereby the absolute dry mass is stated which has a lower heating value of 19.27 MJ/kg. The secondary material used as energy is included exclusively in the indicators for using secondary fuels (RSF or NRSF). It is not included in the primary energy indicators.

6. LCA: Interpretation

The focus of the result interpretation lies on the production phase (Modules A1 to A3) as this is based on concrete information from the companies. The interpretation is done by means of a dominance analysis of the environmental impacts (GWP, ODP, AP, EP, POCP, ADPE, ADPF) and renewable/non-renewable primary energy use (PERE, PENRE). In addition, the maximum deviations of the works assessed from the average and also changes compared to the previous EPD are also described and interpreted.

The most significant factors for the respective categories are therefore listed below.

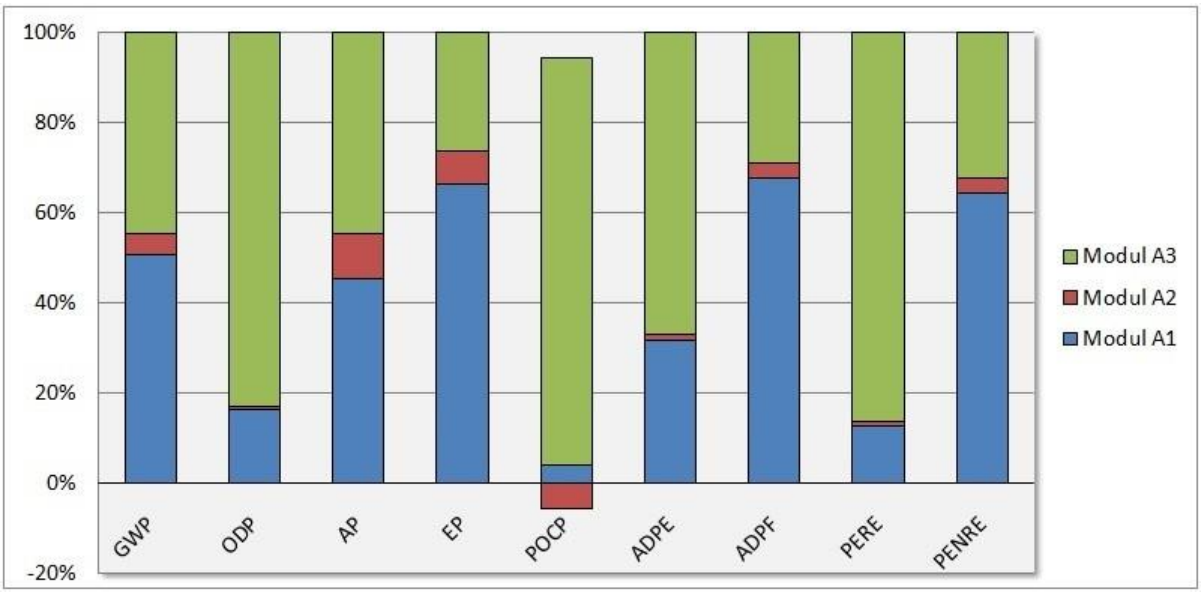

Fig.1: Relative shares of Modules A1-A3 on the influence of environmental impact categories and primary energy use (cradle-to-gate)

6.1 Global warming potential (GWP)

Wood-inherent CO_2 product system inputs and outputs require special examination with regard to global warming potential.

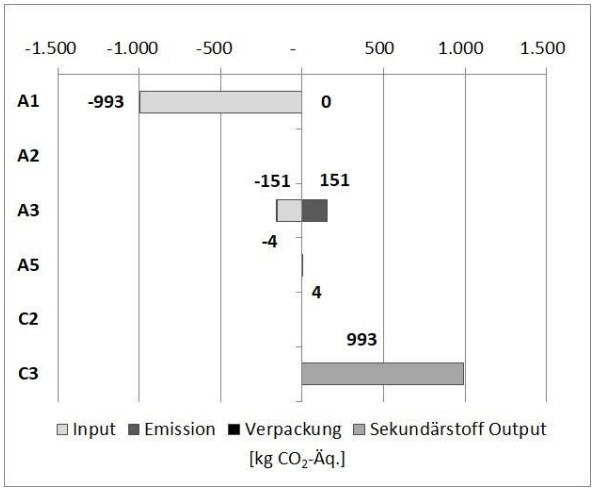

Fig.2: Wood-inherent CO_2 product system inputs and outputs [kg CO_2 eq.]. The inverse signing of the inputs and outputs allows for the LCA CO_2 flow from the point of view of the atmosphere to be examined.

993 kg of CO_2 are bound up in Module A1 through the growth of wood needed for chipboard production. The growth of the wood used for energy in the production process additionally binds up 149 kg of CO_2 which goes into Module A3 and is also emitted again in this module. Some 4 kg of CO_2 which enter the product system in Module A3 and are emitted into the atmosphere again by the thermal recycling of the packaging in Module A5 are bound up by the provision of the wood for product packaging. The remaining 993 kg of CO_2 leaves the product system in Module C3 in the form of recyclable waste wood.

The main causes of fossil-based greenhouse gases are the adhesive and additives at 40 % (Module A1) and the use of electricity in the works at 31 % (module A3). Provision of the raw wood material (Module A1) and heat production in the works (Module A3) each contribute 10 % to fossil GWP.

6.2 Ozone depletion potential (ODP)

56 % of OPD occurs mainly through the provision of plastic components (Module A3). In addition, the provision of the packaging material (Module A3) contributes around 22 % and the provision of adhesives and additives (Module A1) contributes some 12 % to ODP.

6.3 Acidification potential (AP)

Emissions with acidification potential are relatively evenly distributed across Module A1 on the provision of wood as raw material with 26 % and adhesives and additives with 19 %. In Module A3, electricity consumption (26 %) and heat production (12 %) contribute mainly to acidification potential.

6.4 Eutrophication potential (EP)

47 % of the total eutrophication potential is attributable to processes for providing adhesives and additives and a further 19 % to the provision of raw wood material (both Module A1). Electricity consumption

for the production process contributes 13 % and heat production in the works 9 % to eutrophication potential (both Module A3).

6.5 Formation potential for tropospheric ozone photochemical oxidants (POCP)
Positive POCP contributions of 94 % are caused mainly by fibre drying and adhesive hardening in the works (Module A3). The negative values for POCP in Module A2 are attributable to the negative characterisation factor for carbon monoxide emissions of EN 15804+A1- compliant CML-IA Version (2001-Apr. 2013) in combination with the currently used truck transport process in the / for modelling the transport processes of the /GaBi Professional Database 2019 Edition/ for modelling the transport processes. They influence total emissions by -4 %.

6.6 Abiotic depletion potential for non-fossil resources (ADPE)
The main contributions to ADPE are 41 % from electricity consumption in the works (Module A3) and 26 % from the provision of adhesives and additives (Module A1) and 18 % is attributable to provision of operating resources (Module A3).

6.7 Abiotic depletion potential for fossil resources (ADPF)
60 % of the total eutrophication potential is attributable to processes for providing adhesives and additives and a further 7 % to the provision of raw wood material (both Module A1). In Module A3, electricity consumption in the works at 17 % and heat production at 11 % further influence the overall ADPF.

6.8 Renewable primary energy as energy carrier (PERE)
44 % of PERE use is attributable to incinerating wood to produce heat and 38 % to electricity consumption in the works (both Module A3). In addition, the provision of adhesives and additives contributes 9 % and the provision of raw wood materials 4 % to PERE use (both Module A1).

6.9 Non-renewable primary energy as energy carrier (PENRE)
57 % of PENRE use is attributable to the provision of adhesives and additives and 7 % to provision of the raw wood material (both Module A1). As the largest influence in Module A3, electricity consumption in the works causes some 20 % of total PENRE whilst heat production, also in Module A3, is responsible for some 10 %.

6.10 Waste
37 % of special waste is incurred from the provision of the raw wood material (Module A1), whereby diesel consumption in the forest pre-chain is the main cause. A further 34 % of special waste occurs through the provision of product additives and adhesives (also Module A1) and 10 % is attributable to the transport of the wood raw material to the works (module A2).

6.11 Range of results
The individual results of the participating companies differ from the average results in the environmental product declaration. Maximum deviations of +38 %/-25 % (GWP), +42 %/- 22 % (ODP), +88 %/-26 % (AP), +46 %/-21 % (EP), +28 %/- 9 % (POCP), +45 %/-20 % (ADPE) and +58 %/-22 % (ADPF) in relation to the results described in Chapter 5 were calculated for the environmental effects. The reason for these deviations is mainly differences in the fuels used for heat production, in requirements for chip drying, in the ratio of waste wood waste wood used materially and differences in the gluing system used.

6.12 Difference to previous versions of the EPD
The dropping out of one of the companies assessed and the new weighting of the remaining companies by means of current production quantities from 2017 merely leads to a slight displacement of the environmental effect indicators (+/-5 %) in the weighted average and the energy used. ADPE at -16 % is an exception. The influence of the update to the background system for these indicators on the updating of the background database on the other hand is significantly higher, rendering indicators like ODP (- 99.9 %) no longer comparable to the old version of the EPD. Overall, the following changes have ensued (total of Modules A1-A3) which are mainly attributable to the update of the background system: GWP: -6 %; ODP: -99.9 %; AP: -33 %; EP: -27 %; POCP: -20 %; ADPE: -73 %; ADPF: -11 %; PERE: +73 %; PENRE: -30 %.

7. Requisite evidence

7.1 Formaldehyde

Measurement point:
WKI Fraunhofer-Institut für Holzforschung Wilhelm- Klauditz-Institut.
Aim of the test: Determination of formaldehyde emissions in accordance with /EN 717-1/
Test results:

In accordance with the ordinance on the prohibition of and limitations on the putting on the market and supply of certain substances, mixtures and products in accordance with the Chemicals Act, Appendix 1 (to Section 3) Prohibition of putting certain substances on the market, entry 1 Formaldehyde Column 2 (1) Coated and uncoated wood-based materials (particle boards, blockboards, veneered boards and fibreboards) may not be put on the market if the equalisation concentration of formaldehyde caused by the wood material in the air in a test chamber exceeds 0.1 ml/cbm (ppm).

The material tested fulfils the requirements of the /German Chemicals Prohibition Ordinance/ as follows:

Requirement of limit value fulfilled?	Test method *[test result]*	Evaluation acc. limit value	ChemVerbotsV [BGA Blatt 34, 10/91] valid up to 2019-12-31	ChemVerbotsV [BMU Veröffentlichung Prüfverfahren 2018-11-2 valid from 2020-01-01
Chamber method	EN 717-1	0,1 ppm	[X] yes [ ] no	
Chamber method	EN 717-1 *[x factor 2.0]*	0,1 ppm		[X] yes [ ] no

/German Chemicals Prohibition Ordinance/ [BGA page 34, 10/91]
valid to 31/12/2019
Chamber test /EN 717-1/: Requirements fulfilled

/German Chemicals Prohibition Ordinance/ [BMU publication of test process 2018-11-26] valid from 01/01/2020
Chamber test /EN 717-1/ [x factor 2.0]: Requirements fulfilled

7.2 MDI

Measurement point:
EPH Entwicklungs- und Prüflabor Holztechnologie GmbH,
Aim of the test: Determination of methylendiphenylisocyanate (MDI) emissions from a wood-based board in accordance with ISO 16000-9 and OSHA method no. 42
Test results:
MDI (CAS no. 101-68-8) concentration < detection threshold (detection threshold 0.1 µg/ml)

No MDI emissions from the product could be detected.

7.3 Test for pre-treatment of raw materials

Measurement point:
MPA Eberswalde Materialprüfanstalt Brandenburg GmbH.
Aim of the test: Investigation of board material with regard to PCP, tetrachlorphenol and Lindane content.
Analysis method: Quantitative gas chromatography with mass-selective detection (GC-MS) Extraction: Soxhlet extraction over several hours with methanol or with n-hexane; PCP/tetrachlorphenol analysis after derivatisation with acetic anhydride under alkaline conditions in accordance with /CEN/TR 14823: 2003/ or Appendix IV /Waste Wood Ordinance/
Test results:
PCP: 0.2 mg/kg
Tetrachlorphenol: 0.1
mg/kg Lindane: n.d.
(not determinable; detection threshold: 0.1 mg/kg)

7.4 Toxicity of flue gases

The toxicity of flue gases which occur from burning coated particle boards corresponds to the toxicity of flue gases which occur when natural wood burns.

/German Chemicals Prohibition Ordinance/ [BGA page 34, 10/91]
valid to 31/12/2019
Chamber test /EN 717-1/: Requirements fulfilled

/German Chemicals Prohibition Ordinance/ [BMU publication of test process 2018-11-26] valid from 01/01/2020
Chamber test /EN 717-1/ [x factor 2.0]: Requirements fulfilled

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