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-20200163-IBH1-DE
Issue date	**08.10.2020**
Valid to	**17.09.2025**

Particle board, melamine-faced

Verband der Deutschen Holzwerkstoffindustrie e.V. (VHI)

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.

Particle board, melamine-faced

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

Owner of the declaration
Verband der Deutschen Holzwerkstoffindustrie e.V. (VHI)
Schumannstrasse 9
10117 Berlin
Germany

Declaration number
EPD-VHI-20200163-IBH1-DE

Declared product/declared unit 1m³
particle board, melamine-faced

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 18/09/2020

Valid to
17/09/2021

Scope of application:
The contents of this declaration are based on the specifications for manufacturing melamine-faced particle boards from the following manufacturers who are members of the Verband der Deutschen Holzwerkstoffindustrie association (VHI):

- Pfleiderer Deutschland GmbH (Neumarkt, Leutkirch)
- Sonae Arauco Deutschland GmbH, Beeskow
- Nolte Holzwerkstoff GmbH & Co. KG, Germersheim

The lifecycle analysis of this declaration covers 100 % of the production of coated particle boards from the named manufacturer or works in 2017. This declaration can be used for medium-density fibreboards 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-20200163-IBH1DE.

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

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

Dr. Alexander Röder
(Executive Director IBU)

Dr.-Ing. Andreas Ciroth,
Independent verifier appointed by SVR

2. Product

2.1 Product description/Product definition
Melamine-coated 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. The surfaces are coated with melamine-soaked coating papers.

For the marketing of products in the EU/EFTA (except for Switzerland) applies the regulation /(EU) No 305/2011/ of the European Union Parliament and the Council of 9 March 2011 about the establishment of harmonised conditions for

marketing of construction products and cancellation of Council Directive 89/106/EEC.
The required declarations of performance and the CE marking are created according to the specifications of the harmonized standard /EN 13986:2004+A1:2015/: Wood-based materials for use in construction - “characteristics, conformity assessment and Labelling"..

2.2 Application
Melamine-coated particle boards can be used in decorative interior design and exhibition stand and shop construction.

2.3 Technical data
Requirements to /EN 312/

Constructional data

Name	Value	Unit
Bulk density	600 - 660	kg/m³
Bending strength (longitudinal)	7 - 22	N/mm²
Bending strength (transverse)	0.14 - 0.75	N/mm²
Elasticity module (longitudinal)	1.2 - 3.35	N/mm²

Material humidity on delivery	5 - 13	%
Thermal conductivity	0.12	W/(mK)
Water vapour diffusion resistance level	damp 15 /dry 50	-
See verification for formaldehyde emissions	Requirement fulfilled	µg/m³

Specific technical data is to be found in the technical data sheets of the manufacturer products

Technical data to /EU Regulation no. 305/2011/ CPR/. Performance values of the product according to the declaration of performance in relation to its major features in accordance with /EN 13986:2004+A1:2015/, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.

2.4 Delivery status
Particle boards from Verband der Deutschen Holzwerkstoffindustrie member companies are available in the following sizes:
Width: 200 mm – 6250 mm
Length: 200 mm – 2800 mm
Thickness: 8 mm – 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; Special qualities available on request.

2.5 Base materials/ancillary materials
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), softwood	82.9 | 83 | 84.4	%
Waste wood portion of wood use	0 | 22.5 | 27	%
Water content	6 | 6.9 | 7	%
UF	5.7 | 6.7 | 8	%
MUF	0.4 | 1.4 | 2.2	%
PMDI	0| 0.0005| 0.001	%
Coating	0.98 | 1.4 | 2.2	%
Hydrophobising (paraffins)	< 0.5	%
Urea	< 0.3	%
Fire retardant	< 0.1	%

Melamine-coated particle boards consist of small wood particles, binding agents, coatings, and other additives. Mainly urea-formaldehyde binding agents (UF), melamine-urea-formaldehyde binding agents (MUF), phenol-formaldehyde binding agent (PF) and polymer diphenylmethane diisocyanate binding agent (PMDI) are used. Paraffins are used to hydrophobise the wooden particles. Melamine-soaked papers are used for the coating.

Melamine-soaked particle boards have a wood content of approximately 85 % of which up to 25 % is covered by using recycled wood. The shares determined for the environmental product declaration are listed in the following table (specification of all base materials mass % atro)

The product has an average gross density of 638.98 kg/m³. The functional chemical groups of flame retardants are phosphate and nitrogen compounds.

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

Does the product or 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 melamine-coated 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.

To produce coated particle boards, the raw particle boards are coated with melamine-soaked papers after the adhesives have completely hardened. The prepolymerised papers are then pressed together with the particle boards in a hot press. The boards are trimmed and packaged.

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 at any stage of the production process.

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 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.

No additional measures beyond the statutory requirements are prescribed.

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. 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 State of use
The composition for the period of use complies with the base material composition in accordance with Section 2.5 Base materials. Approximately 265 kg of carbon dioxide are bound up in 1m³ of the product during use. This is equivalent to approximately 972 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 does not 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/).

Description of influences on ageing depending on the application in accordance with the rules of technology.

2.13 Extraordinary influences

Fire
Fire class in accordance with / EN 13501-1/.

Fire protection

Name	Value e
Building material class	D
Flaming droplets	d0
Flue gas development	s2

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/. /European Waste Catalogue/ (AVV)

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 coated particle board with a mass of 638.98 kg/m³, a water content of 6.88 %, an adhesive and additive content of 8.73 % and a coating share of 1.43 %. The composition complies with the weighted average by production volume of the manufacturer being assessed.

Specification of the declared unit

Name	Value	Unit
Declared unit	1	m³
Conversion factor to 1 kg	0.001565	-
Mass reference	638.98	kg/m³
Conversion factor (mass/declared unit)	-	-
Layer thickness	-	m
Basis weight	-	kg/m²
Bulk density	-	Kg/m³

The balanced production volume included in the average is based on figures from three manufacturers of coated fibreboards who are member companies of 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 including the coating material. 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. These are mainly 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 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

All material and energy flows for the processes required for production are determined based on questionnaires. The emissions from burning wood which occur on-site are estimated based on 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 assumes that the above overall loads for setting up and maintaining the infrastructure do not exceed the 1 % of total loads already described. 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 based on a member questionnaire.
The foreground data queried was validated based on the mass and in accordance with plausibility criteria. The background data taken from the literature for material and energetically use wood raw products except for forest timber originates from 2008 to 2012. The provision of forest timber was taken from a publication from 2008 which is 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 based on a member questionnaire.

The production volumes for the calendar year of 2017 for the manufacturers involved were collected in a further questionnaire 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 based on the exergy of electricity and process heat.

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 based on price.
- Thermal and electrical energy produced from the disposal of waste accruing in Module A3 (except for 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	2.34	kg
Plastic packaging for thermal recycling	0.14	kg
Paper and cardboard for thermal recycling	0.06	kg
Total efficiency of thermal waste disposal	38– 44	%
Total exported electrical energy	6.17	MJ
Total exported thermal energy	14.43	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	638.98	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)	499.4	kg
Adhesives and additives (per net flow of the declared unit)	64.9	kg
Electricity produced (per net flow of the declared unit)	523.25	kWh
Adhesives and additives (per net flow of the declared unit)	3816.05	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 55 % overall efficiency and electrical efficiency of 18.19 % is assumed. Incinerating 1 t of wood (airdried, 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 530.1 kg atro wood so that a net flow of 499.4 kg atro wood is added to Module D. Considering the share of adhesives and additives, 523.25 kWh of electricity and 3816.05 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 coated particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
GWP	[kg CO_2 eq.]	-8.74E+2	8.56E+0	1.09E+2	4.83E+0	7.47E-1	9.75E+2	-3.73E+2
ODP	[kg CFC11 eq.]	6.48E-11	2.01E-14	4.68E-12	1.60E-15	1.25E-16	1.80E-13	-1.19E-11
AP	[kg SO_2 eq.]	1.59E-1	3.52E-2	2.03E-1	6.55E-4	3.15E-3	6.64E-3	-4.42E-1
EP	[kg $(PO_4)_3$-e.]	7.91E-2	8.66E-3	4.05E-2	1.33E-4	8.02E-4	1.08E-3	-7.13E-2
POCP	[kg Ethene eq.]	9.74E-3	-1.36E-2	2.11E-1	3.53E-5	-1.30E-3	4.39E-4	-4.05E-2
ADPE	[kg Sb eq.]	2.02E-5	8.30E-7	5.11E-5	1.11E-7	5.84E-8	1.80E-6	-1.02E-4
ADPF	[MJ]	2.26E+3	1.16E+2	1.31E+3	1.18E+0	1.03E+1	4.18E+1	-6.65E+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 coated particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
PERE	[MJ]	1.94E+2	1.12E+1	1.36E+3	3.16E+1	5.98E-1	2.96E+1	-1.97E+3
PERM	[MJ]	7.99E+3	0.00E+0	3.14E+1	-3.14E+1	0.00E+0	-7.99E+3	0.00E+0
PERT	[MJ]	8.18E+3	1.12E+1	1.39E+3	2.69E-1	5.98E-1	-7.96E+3	-1.97E+3
PENRE	[MJ]	1.64E+3	1.21E+2	1.58E+3	6.37E+0	1.03E+1	5.49E+1	-7.52E+3
PENRM	[MJ]	6.77E+2	0.00E+0	5.08E+0	-5.08E+0	0.00E+0	-6.77E+2	0.00E+0
PENRT	[MJ]	2.32E+3	1.21E+2	1.59E+3	1.30E+0	1.03E+1	-6.23E+2	-7.52E+3
SM	[kg]	1.19E+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	5.92E+2	0.00E+0	0.00E+0	0.00E+0	9.69E+3
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.77E+2
FW	[m³]	1.04E+0	1.64E-2	7.98E-1	1.18E-2	1.01E-3	1.60E-2	1.60E+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 coated particle board

Parameter	Unit	A1	A2	A3	A5	C2	C3	D
HWD	[kg]	1.27E-4	6.09E-6	6.14E-6	4.42E-9	5.75E-7	4.26E-8	-3.91E-6
NHWD	[kg]	5.83E-1	1.77E-2	2.32E+0	7.09E-2	8.37E-4	5.68E-2	1.83E+1
RWD	[kg]	2.23E-2	2.10E-3	1.07E-1	4.62E-5	1.40E-5	5.17E-3	-3.43E-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	6.39E+2	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	0.00E+0	6.17E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	0.00E+0	1.44E+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 changes compared to the previous EPD are also described and interpreted.

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

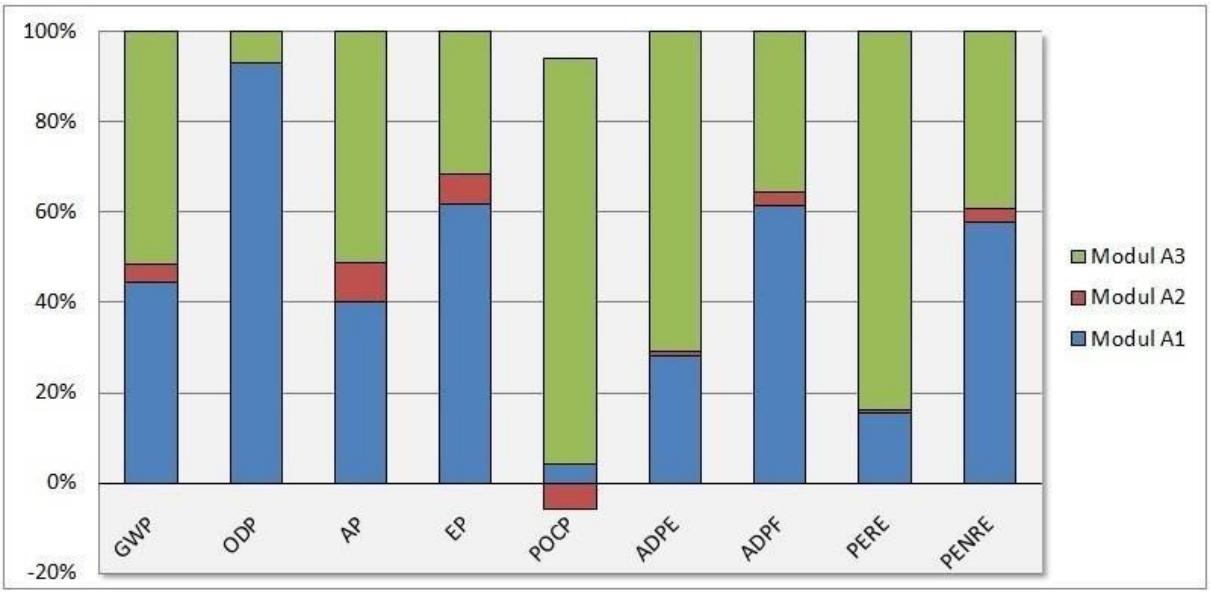

Fig.1: Relative shares of Modules A1-A3 on the influence of environmental impact categories and primary energy use (cradle-to-gate)

6.1 Global warming potential (GWP)

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

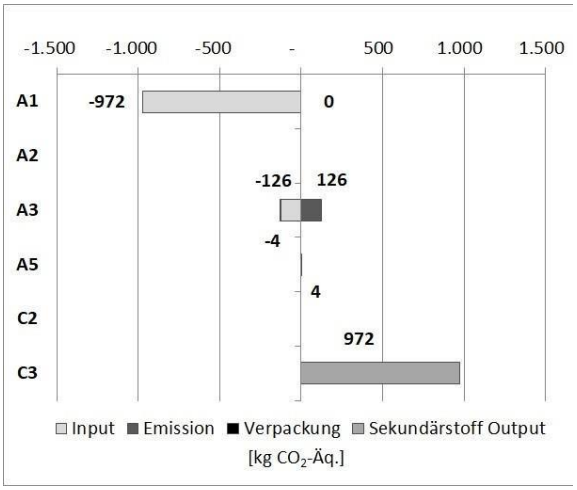

Fig.2: Wood-inherent CO_2 product system inputs and outputs [kg CO_2 eq.]. The inverse signing of the inputs and outputs allows for the LCA CO_2 flow from the point of view of the atmosphere to be examined.

972 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 126 kg of CO_2 which goes into Module A3 and is emitted again in this module by incineration in situ.

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 972 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 36 % (Module A1) and the use of electricity in the works at 33 % (module A3). Provision of the raw wood material (Module A1) contributes 9 % and heat production in the works (Module A3) 13 % to fossil GWP.

6.2 Ozone depletion potential (ODP)

93 % of OPD occurs through the provision of adhesives and additives including coating material (Module A1). Beyond this, electricity consumption in the works (Module A3) also contributes around 4 % to ODP.

6.3 Acidification potential (AP)

Emissions with acidification potential are evenly distributed across Module A1 on the provision of wood as raw material with 22 % and adhesives and additives with 18 %. In Module A3, electricity consumption (28 %) and heat production (13 %) contribute mainly to acidification potential.

6.4 Eutrophication potential (EP)

45 % of the total eutrophication potential is attributable to processes for providing adhesives and additives and a further 16 % to the provision of raw wood material (both Module A1).

Electricity consumption for the production process contributes 14 % and heat production in the works 11 % to eutrophication potential (both Module A3).

6.5 Formation potential for tropospheric ozone photochemical oxidants (POCP)
Positive POCP contributions of 90 % are caused mainly by fibre drying and adhesive hardening (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 24 % from the provision of adhesives and additives (Module A1) and 21 % are attributable to provision of operating resources (Module A3).

6.7 Abiotic depletion potential for fossil resources (ADPF)
55 % of the total eutrophication potential is attributable to processes for providing adhesives and additives and a further 6 % to the provision of raw wood material (both Module A1). In Module A3, electricity consumption in the works at 19 % and heat production at 13 % further influence the overall ADPF.

6.8 Renewable primary energy as energy carrier (PERE)
48 % of PERE use is attributable to incinerating wood to produce heat and 30 % to electricity consumption in the works (both Module A3). In addition, the provision of adhesives and additives contributes 13 % to PERE use (Module A1).

6.9 Non-renewable primary energy as energy carrier (PENRE)
52 % of PENRE use is attributable to the provision of adhesives and additives and 6 % to provision of the raw wood material (both Module A1). As the largest influence in Module A3, electricity consumption in the works causes some 23 % of total PENRE whilst heat production, also in Module A3, is responsible for some 12 %.

6.10 Waste
35 % 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 31 % of special waste occurs through the provision of product additives and adhesives (also Module A1). 10 % each is attributable to the transport of the wood raw material to the works (Module A2) and to heat production (module A3).

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 +27 %/18 % (GWP), +6 %/- 5 % (ODP), +20 %/-18 % (AP),
+16 %/-15 % (EP), +11 %/- 10 % (POCP), +15 %/-15 % (ADPE) and +31 %/-18 %
(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 and in the ratio of waste wood used materially.

6.12 Difference to previous versions of the EPD
The new weighting by means of current production quantities from 2017 merely leads to a slight displacement of the environmental effect indicators (+/1 %) in the weighted average and the energy used. 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 previous version of the EPD. Overall, the following changes have ensued (total of Modules A1A3) which are mainly attributable to the update of the background system:
GWP: -17 %; ODP: -99.9 %; AP: -45 %; EP: -42 %; POCP: -27 %; ADPE: -71 %; ADPF: -27 %; PERE: +71 %; PENRE: -42 %.

7. Requisite evidence

7.1 Formaldehyde
Measurement point: WKI Fraunhofer-Institut für Holzforschung Wilhelm-Klauditz-Institut, Bienroder Weg 54 E, 38108 Braunschweig
Product: P2 coated particle board
Aim of the test: Determination of the formaldehyde content
Test results: The formaldehyde content was determined without prior conditioning in accordance with EN ISO 12460-3 Wood-based panels – Determination of formaldehyde release – Part 3: Gas analysis method.

The result of the determination shows the formaldehyde values for the board tested:
Individual values: < 0.1 and < 0.1 mg HCHO / h x m2
average value: < 0.1 mg HCHO / h x m2
Thus, the material meets the requirements of regulation on prohibitions and restrictions of marketing and the supply of certain substances, mixtures, and articles referred to the Chemicals Act (/Chemicals Prohibition Regulation/, ChemVerbotsV).

In the announcement regarding analytical processes for samples and investigations for the substances and substance groups listed in Appendix 1 of the German Chemicals Prohibition Ordinance, the derived process for internal production control, the reference process of DIN EN 16516 for internal production control is approved in accordance with EN 12460-3.

7.2 MDI
With reference to Chapter 2.5 (Basic materials/ancillary materials), the use of PDMI as an adhesive system contributes <0.001 % to average formation according to the current data aggregation

7.3 Test for pre-treatment of raw materials
Measurement point:
MPA Eberswalde Materialprüfanstalt Brandenburg GmbH, Alfred-Möller-Strasse 1, H 13, 16225 Eberswalde

Investigation of board material regarding 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/ or Appendix IV /Waste Wood Ordinance/

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.

7.5 Volatile organic compounds VOC
Measurement point: Brandenburg GmbH, Alfred-Möller-Straße 1, H13, D-16225 Eberswalde
Test reports, date: Test report 31/20/4082/01 from 03.09.2020
Aim of the test: Determination of VOC emission according to RAL-UZ 76
Measurement method: DIN EN 16516 according to requirements of RAL-UZ 76
Test results: the melamine-coated chipboards examined in accordance with DIN EN 16516 keep the requirements of RAL-UZ 76 of 2016 and of 2018 AgBB schemes for VOCs after 3 days and
after 28 days.

AgBB results overview (28 days [µg/m³])

Name	Value	Unit
TVOC (C6-C16)	<1000	µg/m3
Summarized SVOC (C16-C22)	<100	µg/m3
VOC without NIK	<1	-
Carcinogenic	<100	µg/m3

AgBB results overview (3 days [µg/m³])

Name	Value	Unit
TVOC (C6-C16)	<10000	µg/m3
Summarized SVOC (C16-C22)	-	µg/m3
VOC without NIK	-	-
Carcinogenic	-	µg/m3

8. References

Institut Bauen und Umwelt e.V., Berlin (Publisher): Production of environmental product declarations (EPDs)

/IBU 2016/
IBU (2016): General EPD program instructions from Institut Bauen und Umwelt e.V. (IBU). Version 1.1, Institut Bauen und Umwelt e.V., Berlin.

/ISO 14025/
/DIN EN / ISO 14025:2011-10/, Environmental labels and declarations - Type III Environmental declarations - Principles and procedures.

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

/EN 16485/
EN 16485:2014-07, Round and sawn timber – Environmental Product Declarations – Product category rules for wood and wood-based products for use in construction.

/EN 120/
/DIN EN 120:1992-08/, Wood-based panels; determination of formaldehyde content; extraction method called perforator method.

/EN ISO 12460-3/
/EN ISO 12460-3:2015/, Wood-based panels - Determination of formaldehyde release - Part 3: Gas analysis method

/EN 13501-1/
/DIN EN 13501-1:2010-01/, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

/EN 13986/
/DIN EN 13986:2015-06/, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.

/EN 310/
/DIN EN 310:1993-08/, Wood-based panels; determination of modulus of elasticity in bending and of bending strength.

/EN 312/
/DIN EN ISO 312:2010- 12/, Particleboards - Specifications.

/EN 319/
/DIN EN 319:1993-08/, Particleboards and fibreboards; determination of tensile strength perpendicular to the plane of the board.

/EN 322/
/DIN EN 322:1993-08/, Wood-based panels; determination of moisture content.

/EN 16516/
/DIN EN 16516:2018-01/, Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air.

/CEN/TR 14823:2003/
Durability of wood and wood products. Quantitative determination of pentachlorphenol in wood. Gas chromatograph process.

Further sources:

/Waste Wood Ordinance/ (AltholzV)
/Waste Wood Ordinance/ (AltholzV)/: Ordinance on requirements for the recycling and disposal of waste wood, 2017.

/European Waste Catalogue/ (AVV)
European Waste Catalogue (AVV) of 10th December 2001 (Federal Legal Gazette I p. 3379), which was last amended by Article 2 of the ordinance of 17th July 2017 (Federal Legal Gazette I p. 2644) (date: 17/07/2017).

/BImSchG/
/Federal Immissions Control Act/: Law to protect against harmful environmental impacts through air pollution, noise, vibration, and similar processes, 2013.

/German Chemicals Prohibition Ordinance/ /German Chemicals Prohibition Ordinance/: 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.

/German Institute for Construction Technology (DIBT) guideline 100/
German Institute for Construction Technology (DIBt) guideline 100-1994-06 Guideline on the classification and monitoring of wood-based panels regarding formaldehyde emissions.

/ECHA candidate list/
Candidate list of substances of exceedingly high concern for authorisation (date: 27/06/2018) in accordance with Article 59 Paragraph 10 of the /REACH regulations/.
European Chemicals Agency.

/GaBi Professional Database 2019 Edition/
/GaBi Professional Database 2019/. Service pack 39. thinkstep AG, 2019.

/GaBi ts 2019/
/GaBi ts 2019/, Version 9.2.0.58: Software database for integrated lifecycle assessment. Service pack 39. thinkstep AG, 2019.

/IBU 2018/
PCR Product category rule guidance for building related products and services, Part B

: Requirements of the EPD for wood-based materials." Berlin: Institut Bauen und Umwelt e.V.; status 2018-12, Version 1.6.

/IBU 2019/
Product category rules for building-related products and services, Part A: Calculation rules for the LCA and requirements of the project report. Berlin: Institut Bauen und Umwelt e.V.; status 2019- 07; Version 1.8.

/REACH regulations/
EC Regulation No. 1907/2006 of the European Parliament and Council of 18th December 2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Last modified on 25/03/2014 (date: 27/06/2018).

/Rüter, Diederichs 2012/
Rüter, Sebastian; Diederichs, Stefan (2012): Ökobilanz-Basisdaten für Bauprodukte aus Holz. Final report, Hamburg: Johann Heinrich von Thünen Institut, Institut für Holztechnologie und Holzbiologie.

/Technical Instructions on Air Quality Control/ (TA Luft) Technical Instructions on Air Quality Control. Version dated 24th July 2002 and all VDI guidelines, DIN standards and statutory provisions contained therein.

/EU Regulation no. 305/2011/
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.

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