ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Tilly Holzindustrie Gesellschaft m.b.H
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-TIL-20230209-IBC1-EN
Issue date	21.06.2023
Valid to	20.06.2028

TILLY solid wood panel

TILLY Holzindustrie GmbH

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

TILLY Holzindustrie GmbH

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-TIL-20230209-IBC1-EN

This declaration is based on the product category rules:

Solid wood products, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.06.2023

Valid to

20.06.2028

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

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

TILLY solid wood panel

Owner of the declaration

Tilly Holzindustrie Gesellschaft m.b.H
Krappfelder Straße 27
9330 Althofen
Austria

Declared product / declared unit

1 m³ of average TILLY solid wood panel (473 kg/m³).

Scope:

This EPD is based on a declared unit of 1 m³ of TILLY solid wood panel, produced in Althofen, Austria. The results refer to TILLY single-layer, two-layer and three-layer solid wood panels as well as the production of special products (door blanks & door frames).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Matthias Schulz,
(Independent verifier)

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2. Product

2.1 Product description/Product definition

TILLY three-layer natural wood panels are multi-layer solid wood panels in accordance with *EN 13353*, in which two face layers running parallel to each other are glued together with a centre layer offset by 90 degrees (blocking effect). The middle layers are finger-jointed along their length. The top layers are made of joint-tight glued continuous single lamellae. The top layer and middle layer are always made of the same type of wood. Subject to changes on the production side.

In addition to the Tilly three-layer solid wood panel, single-layer solid wood panels are also produced. The single-layer solid wood panel consists of continuous (not finger-jointed) wood strips glued together butt-jointed, the top side of which is quality-graded.

All multi-layer boards produced (single-, two- and three-layer boards) including special designs (door blanks and doorframes) are part of this EPD.

Regulation (EU) No. 305/2011 dated 9 March 2011 applies to the placing on the market in the EU/EFTA (with the exception of Switzerland).
The products require a Declaration of Performance (DOP) taking into account *EN 13986:2004+A1:2015-06, Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking.*

The respective national regulations apply for usage. The associated Declarations of Performance for the TILLY natural wood panels are available at www.tilly.at.

2.2 Application

Tilly natural wood panels are used not only for visual applications in furniture construction, load-bearing and non-load-bearing interior fittings (floors, walls, ceilings), but also as load-bearing and stiffening planking in dry, wet or protected outdoor areas.

2.3 Technical Data

The thickness- and product-dependent performance data corresponds to the respective product-related Declaration of Performance in its latest valid version. The Declarations of Performance can be found online at www.tilly.at under Service/Declaration of Performance in the respective national language. Older versions of the Declarations of Performance can be requested from office.platten@tilly.at. The following structural data only applies to three-layer natural wood panels 17-60 mm:

Technical construction data

Name	Value	Unit
Wood types by trade names acc. to EN 1912	spruce, pine, larch, douglas fir, swiss stone pine, maple, birch, beech, oak, alder, ash, cherry	-
Wood moisture acc. to EN 13183-3	10 +/- 3	%
Use of wood preservatives	none	-
Compressive strength parallel acc. to EN 12369-3	10 - 18	N/mm^2
Compressive strength rectangular acc. to EN 12369-3	10 - 12	N/mm^2
Tensile strength parallel acc. to EN 12369-3	6 - 12	N/mm^2
Tensile strength rectangular acc. to EN 12369-3	3	N/mm^2
Shear strength acc. to EN 12369-3	2.5 - 4	N/mm^2
Shear modulus acc. to EN 12369-3	450	N/mm^2
Gross density load-bearing components acc. to EN 338 or DIN 1052, non-load-bearing components: acc. to DIN 68364	470 - 580	kg/m^3
Surface quality acc. to EN 13017 part 1 and 2	0, A, B, C	-
Thermal conductivity acc. to EN 13986	0.12 - 0.15	W/(mK)
Water vapour diffusion resistance factor acc. to EN 13986	67 - 208	-
Bending strength perpendicular to the board plane, 0° to EN 12369-3 acc. to EN 12369-3	20-30	N/mm^2
Bending strength perpendicular to the board plane, 90° to EN 12369-3 acc. to EN 12369-3	5-10	N/mm^2
Bending stiffness perpendicular to the board plane, 0° to EN 12369-3 acc. to EN 12369-3	7100-10000	N/mm^2
Bending stiffness perpendicular to the board plane, 90° to EN 12369-3 acc. to EN 12369-3	550 - 1500	N/mm^2
Sound insulation R to EN 13986 acc. to EN 13986	25.7 - 33.2	dB
Sound absorption coefficient α to EN 13985 acc. to EN 13985	0.1 - 0.3	1
Biological durability to EN 13986 acc. to EN 13986	Use class 2	

The performance values of the product correspond to the Declaration of Performance with regard to its essential characteristics according to *EN 13986:2004+A1:2015 – Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking.*
Strengths and stiffness in accordance with *EN 12369-3:2022, Wood-based panels – Characteristic values for structural design, Part 3: Solid wood panels.*

Other technical characteristics required by PCR, Part B are not relevant.

2.4 Delivery status

The dimensional tolerances according to *EN 13353* apply.
The surface appearance classes 0, A, B, C correspond to the harmonised standards *EN 13017-1* and *EN 13017-2*.
The delivery moisture content is 10 ± 3%, on average 8%.
Pack sizes: max. 50 cm high, max. 3000 kg

Products, wood types, dimensions, technical class

TILLY three-layer natural wood panel, softwood, acc. to DoP01b + DoP02b + DoP5a
LxWxT per type of wood and technical class
Spruce: 5000 x 1250/2050 x 13/15 mm, SWP/2 NS
Spruce: 5000/4500/4000 x 1250/2050 x 19/22/27/32/42/50/60 mm, SWP/2 S
Old spruce: 2250/2500/3000/3500/4000/5000 x 1250 x 19 mm; SWP/1 NS
Antique spruce: 5000 x 1250/2050 x 19 mm, SWP/2 S
Pine: 5000 x 1250/2050 x 19/26 mm, SWP/2 S
Larch: 5000 x 1250/2050 x 19/26 mm, SWP/2 S
Douglas fir: 5000/4000 x 2050 x 19/26 mm, SWP/2 S
Swiss stone pine: 1250/2000/3000/3500 x 1250 x 19 mm, SWP/2 S

TILLY three-layer natural wood panel, hardwood, acc. to DoP03b
Maple, birch, beech, oak, alder, ash, cherry; SWP/2 NS
Lengths: 1250/1650/1900/2050/2300/2500/ (3000/3500)
Width: 1250 mm
Thicknesses: 20/(26) mm

TILLY single-layer natural wood panel, softwood, acc. to DoP07b
Spruce: 5000/4500/4000 x 1220 x 14/18/21/24/27/32/42/52 mm, SWP/2 NS
Pine: 5000/4000 x 1220 x 18/27/42 mm, SWP2 NS
Larch: 5000/4000 x 1220 x 18/27/42 mm, SWP/2 NS

TILLY three-layer natural wood panel, FINELINE, acc. to DoP04b
Spruce: 5000 x 1250/2050 x 19/(26/42) mm, SWP/2 NS

TILLY door blank and door frame
Door blank: 2050/2150 x 755/805/855/875/905/955/1000 x 42 mm
Doorframe: 5000 x 140 x 42 mm

2.5 Base materials/Ancillary materials

TILLY three-layer natural wood panels as well as door blanks and doorframes consist of technically dried, natural solid wood components that are bonded together with the following low-formaldehyde adhesives:
Middle layer and finger joint:
polyvinyl acetate (thermoplastic PVAc, white adhesive)

Surface adhesive joint and top layer joints:
melamine-urea-formaldehyde resin adhesive (MUF aminoplast)

Ingredients 3s, proportions in % by mass:
Wood (absolutely dry) 90%
Water 7%
MUF adhesive 2.5%
PVAc adhesive < 0.5%
Based on a mean gross density of 473 kg/m³ and a mean thickness of 22 mm at u = 8%.

TILLY single-layer natural wood panels consist of technically dried, natural and continuous solid wood strips that are bonded with a polyurethane adhesive (PU) without formaldehyde.
Contents 1s, proportions in % by mass:
Wood (absolutely dry) 92%
Water 7%
PU adhesive < 0.5%
Based on a mean gross density of 474 kg/m³ and a mean thickness of 23.0 mm at u = 8%.

The product / at least one partial product contains substances from the candidate list (17.01.2023) exceeding 0.1% by mass: **no**

The product / at least one partial product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1% by mass in at least one partial product: **no**

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no**

2.6 Manufacture

Procurement of raw materials and preliminary production:
The wood used is purchased in central Europe with a sustainability certificate (PEFC-CoC-certified). The sawn timber is technically dried at temperatures up to 90 °C to a final moisture content of u = 8%.

Multi-layer solid wood panels consist of three lamella layers (facing top layers and core layer) glued together, each offset by 90°.
Top lamellas: The dried boards are cut into lamellas by band saws and then subjected to machine-quality grading and sorted into appearance classes 0, A, B and C, analogous to *EN 13017-1 Softwood* or *EN 13017-2 Hardwood*.
Core layer: Prefabrication of the finger-jointed bar core layers is carried out in a continuous press. The narrow lamella surfaces are glued with a PVAc dispersion and pressed into core layer carpets with high-frequency curing (transport gluing).
Pressing: To produce the three-layer panels, the prefabricated core layer is glued over a wide area and on both sides by means of a roller applicator with the heat-curing MUF resin system plus hardener. The lamellas of the top layers are additionally joint-glued under pressure. After pressing in a multi-layer press with additional side pressure at a press temperature of up to 115 °C, the boards are conditioned in the stack for at least 24 hours and are cooled down again in the process.

Single-layer solid wood panels consist of continuous (not finger-jointed), quality-sorted wooden slats, which are glued together butt-jointed on the narrow sides in a continuous press using a cold-curing PU adhesive.

Finishing: Subsequently, all boards are defect-repaired (knots, resin pockets) according to defined guidelines, then formatted lengthwise and crosswise and calibration-sanded with grit 60 and 100 to the respective nominal thickness. Production is in accordance with the *EN 13986, EN 13017-1* and *EN 13353* standards. Quality control during production is regulated by a quality management system according to *ISO 9001*. No chemical wood preservatives are used.

2.7 Environment and health during manufacturing

No negative impacts on groundwater or soil are to be anticipated during manufacturing. The waste water from the production process is fed into the local sewage system and treated in accordance with regulations. The exhaust air produced is also cleaned in accordance with regulations; there are no odour emissions in production or for those living near

the production facilities. The noise generated by the industrial plants is damped in accordance with regulations by means of structural noise protection measures. Personal protection during the production process meets the legal requirements. The employees are equipped with personal protective equipment and regularly trained under the supervision of a company doctor with regard to health protection and occupational safety.

2.8 Product processing/Installation

TILLY natural wood panels can be processed manually or mechanically (planing, sawing, drilling, milling) with all standard woodworking tools suitable for solid wood processing. When machining, the use of a dust extraction system and personal noise protection measures are recommended.

2.9 Packaging

TILLY natural wood panels are usually delivered in a large package with the following packaging:

- Wooden underlay lamellas and underlay timbers
- PE film and strapping (PET and steel)
- Paper pallet slips

In addition, panels can also be delivered to the customer individually wrapped (LD-PE).

Country-specific procedures must be applied for the disposal of packaging made of PE plastic (waste code 15 01 02). Packaging made of wood is mostly shredded and thermally recycled (waste code 15 01 03). Packaging made of wood complies with the ISPM15 Standard and can also be reused as packaging wood.

2.10 Condition of use

The composition of the TILLY natural wood panels corresponds to the composition according to section 2.5 throughout the entire service life. Intensive exposure to UV radiation may cause the untreated wood surface to yellow, but without changing the product composition.

2.11 Environment and health during use

The TILLY **three-layer panel** releases formaldehyde during its life cycle; emissions decrease linearly with increasing service life. Formaldehyde emissions are continuously monitored with tests according to the test chamber method in accordance with *EN 717-1*. The legal limit value E1 according to the Chemicals Prohibition Ordinance is 0.1 ppm. The formaldehyde emission values of TILLY natural wood panels from MUF gluing are to be regarded as 'low formaldehyde glued' with max. 0.03 ppm (ml/m³).

TILLY **single-layer panels** are glued with a PU adhesive without formaldehyde; the emissions from the natural wood raw material are to be assessed as < 0.01 ppm.

2.12 Reference service life

TILLY natural wood panels have been in use in buildings for more than 40 years and are comparable to cross-laminated timber with 100 years of experience in practical applications.

Accordingly, if used as intended, there is no known or anticipated end to the durability.
Thus, the total service life of the respective building is assumed for the service life of TILLY natural wood panels when used as intended. Influences caused by ageing can be minimised by constructive and, if necessary, chemical wood preservation according to the state of the art.

2.13 Extraordinary effects

Fire

The reaction to fire class according to *EN 13501-1* of TILLY natural wood panels is classified as follows according to *2007/348/EC* and *EN 13986*:

Reaction to fire

Name	Value
Building material class	D
Smoke gas development	s2
Burning droplets	d0

The associated end-use conditions can be found in the Declaration of Performance or *EN 13986*.
Floor coverings are classified as D-Fl-s1.

Water

In the event of unforeseen water impact, no ingredients are washed out that could affect the groundwater.

Mechanical destruction

TILLY natural wood panels are made of solid wood, which is why they have a typical breakage pattern for solid wood. No environmental consequences are known in the event of unforeseen mechanical destruction.

2.14 Re-use phase

In the case of targeted deconstruction, TILLY natural wood panels can be easily reused, even after the service life of the structure has expired. The preferred use in the after-use phase is reuse in accordance with the respective country-specific requirements. If they are not reused, TILLY natural wood panels with a lower calorific value Hu = 17 MJ/kg (at a moisture content of u = 8%) or a primary energy yield of 4.84 kWh/kg can be thermally recycled, also in compliance with the respective country-specific regulations.

2.15 Disposal

If the wood waste has no other use, it must be disposed of and recycled in accordance with the respective country-specific regulations. Untreated TILLY natural wood panels are assigned waste code 17 02 01 of the *European Waste Catalogue 2014/955/EU*; on-site surface-treated natural wood panels correspond to waste code 17 02 04.

2.16 Further information

Detailed information can be found at www.tilly.at in the respective national language.

3. LCA: Calculation rules

3.1 Declared Unit

This EPD refers to a declared unit of 1 m³ of TILLY solid wood panels with an average density of 473 kg/m³.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	473	kg/m^3
Grammage	10.4	kg/m^2
Wood moisture at delivery	8	%

This EPD refers to a weighted average of 100 % of TILLY natural wood panels made of softwood and hardwood. The different design variants of the solid wood panels go through the same production process.

The composition of the panels varies regarding the content of binding agent, but the range of the binder content of the multi-layer products and the special products is small. As the three-layer softwood panels represent more than 80 % of the total production, the declared average can be considered as representative. For the single-layer solid wood panels, an overestimation of the environmental impacts can be assumed due to the lower binder content.

The annual average data also includes the production of special products such as door blanks and door frames. As special products account for a very small share of the total production volume and due to the similar share of adhesive, the declared results are also considered as representative for the special products.

3.2 System boundary

The life cycle assessment of average TILLY solid wood panels refers to a cradle-to-gate analysis of the environmental impacts with modules C1–C4 and module D (A1–A3 + C + D). The following life cycle phases are part of the analysis:

Module A1–A3 | Production stage
The production stage includes upstream burdens of raw materials (sawn timber, adhesive system, etc.) and the corresponding transports to the TILLY production site in Althofen (Austria). Drying, ripping of sawn timber, visual sorting, pressing of the boards, the grinding plant as well as the board cutting including the packaging of the product are taken into account. Althofen is supplied with 100 % green electricity. In addition, electrical energy is generated at the site via a photovoltaic system, a hydroelectric power plant and an in-house biomass plant. Thermal energy is provided at the site via the biomass plant.

Module C1 | Deconstruction and demolition
Manual removal was assumed for the solid wood panels. Associated impacts are negligible, therefore no environmental impacts from the deconstruction of the products are declared.

Module C2 | Transport to disposal
Module C2 includes the transport to waste treatment. In this case, transport by truck over a transport distance of 50 km is assumed.

Module C3 | Waste processing
In Module C3, the chipping after the removal of the products is considered. The wooden products and with them the material-inherent properties leave the product system as secondary combustibles in module C3.
During energy recovery at the product's end-of-life, biogenic carbon bound in the product is released. The associated biogenic carbon dioxide emissions are accounted for in Module C3. Thus, the carbon balance within the system boundary of the product system is closed.

Module C4 | Disposal
The applied scenario declares the energetic recovery of the wooden products; therefore, no environmental impacts are to be expected from waste processing of the products in C4.

Module D | Benefits and loads beyond the system boundary
Applying an European average scenario, module D describes the energetic recovery of the product at the end-of-life including the associated emissions (except biogenic carbon declared in C3) as well as corresponding energy substitution potentials.

3.3 Estimates and assumptions

Assumptions and approximations are applied in case of a lack of representative data. All assumptions and approximations are documented precisely and represent a best-guess representation of reality.
A large part of the wood processed by TILLY represents softwood. A generic data set from the *GaBi* database for spruce round timber was used as background data set. For other wood species used, the data set for spruce is regarded as an approximation.

3.4 Cut-off criteria

The LCA model covers all available input and output flows, which can be represented based on robust data and from which a significant contribution can be expected. Data gaps are filled with conservative assumptions of average data or generic data if available and are documented accordingly. Only data with a contribution of less than 1 % were cut off. Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cut-off material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows.

3.5 Background data

This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi* database 2022.2 as well as recognised literature such as *Rüter & Diederichs 2012*.

3.6 Data quality

Data collection is based on product-specific questionnaires. It follows an iterative process clarifying questions via email, telephones calls or in personal and online meetings, respectively.
Intensive discussions between TILLY and Daxner & Merl result in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to *ISO 14044*.
The technological, geographical, and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented *GaBi* background datasets refer to the latest versions available (not more than ten years old) and are carefully chosen.

The assessment of the robustness of the average can be found in chapter 3.1.

3.7 Period under review

Foreground data were collected in the 2021/2022 business year (01.04.2021–31.03.2022), and the data are based on the volumes produced on an annual basis.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Austria

3.9 Allocation

Carbon content and primary energy content of the products were assessed based on their material inherent properties according to underlying physical relationships. The allocation in

the upstream supply chain of wooden products is based on the publication by *Hasch 2002* and its update by *Rüter & Albrecht 2007*.

During the production of solid wood panels, wooden residues that are sold as co-products are produced in addition to the declared product. Since the income from the sale of wood residues represents a low contribution to the total income, no co-product allocation is applied. Nevertheless, carbon content and primary energy content of the products were assessed based on their material inherent properties.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

The *GaBi* background database was used to calculate the LCA (*GaBi* 10; 2022.2).

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

During tree growth, the wood assimilates carbon dioxide and stores biogenic carbon. The carbon stored in the product is declared in the following table.

Information on the biogenic carbon content at the gate

Name	Value	Unit
Biogenic carbon content in product	214	kg C
Biogenic carbon content in accompanying packaging	0.03	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Installation into the building (A5)

The end-of-life of the product packaging is not declared in module A5.

Name	Value	Unit
Packaging (kraftliner)	0.01	kg
Packaging (chipboard)	0.05	kg
Packaging (polyethylene foil)	0.67	kg
Packaging (straps polyethylene terephthalate)	0.06	kg
Packaging (straps steel)	0.05	kg

The carbon stored in the packaging was taken into account as "CO_2-neutral". Thus the storage effect of the carbon bound in the packaging is not included in the calculation but is considered as emitted immediately.

End-of-life (C1–C4)

Name	Value	Unit
Energy recovery	473	kg/m³

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

Name	Value	Unit
Moisture at energy recovery	12	%
Processing rate	100	%
Efficiency of the plant	61	%

The TILLY solid wood product reaches the end of its waste status after removal from the building, transport to processing and chipping of the product. For the end-of-life of the products, energy recovery as secondary fuel in a biomass power plant is assumed. As the main sales market for TILLY products is concentrated in the European region, plant-specific characteristic values correspond to a European average scenario (EU28). The scenario considers a reprocessing rate of 100 % for the solid wood products after removal from the building. This assumption has to be adjusted accordingly when applying the results in the building context.

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5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m³ of TILLY solid wood panels with an average density of 473 kg/m³.

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

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ TILLY solid wood panel (473 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Global Warming Potential total (GWP-total)	kg CO_2 eq	-6.64E+02	0	1.43E+00	7.87E+02	0	-4.03E+02
Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq	1.14E+02	0	1.42E+00	3.49E+00	0	-4.01E+02
Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq	-7.78E+02	0	0	7.83E+02	0	-2.29E+00
Global Warming Potential luluc (GWP-luluc)	kg CO_2 eq	2.97E-01	0	9.56E-03	7.38E-04	0	-4.9E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	8.42E-10	0	1.39E-13	5.11E-11	0	-3.18E-09
Acidification potential of land and water (AP)	mol H^+ eq	6.74E-01	0	4.74E-03	7.66E-03	0	3.58E-01
Eutrophication potential aquatic freshwater (EP-freshwater)	kg P eq	2.24E-03	0	5.07E-06	1.02E-05	0	-6.4E-04
Eutrophication potential aquatic marine (EP-marine)	kg N eq	3.17E-01	0	2.17E-03	1.72E-03	0	8.45E-02
Eutrophication potential terrestrial (EP-terrestrial)	mol N eq	2.95E+00	0	2.43E-02	1.8E-02	0	9.91E-01
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	1.05E+00	0	4.26E-03	4.65E-03	0	3.51E-01
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	4.63E-05	0	1.43E-07	9.5E-07	0	-6.77E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	1.88E+03	0	1.86E+01	6.33E+01	0	-6.95E+03
Water use (WDP)	m^3 world eq deprived	1.59E+01	0	1.59E-02	7.95E-01	0	-2.22E+01

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ TILLY solid wood panel (473 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier (PERE)	MJ	2.46E+03	0	1.29E+00	7.94E+03	0	-2.19E+03
Renewable primary energy resources as material utilization (PERM)	MJ	7.9E+03	0	0	-7.9E+03	0	0
Total use of renewable primary energy resources (PERT)	MJ	1.04E+04	0	1.29E+00	3.51E+01	0	-2.19E+03
Non renewable primary energy as energy carrier (PENRE)	MJ	1.64E+03	0	1.87E+01	2.74E+02	0	-6.95E+03
Non renewable primary energy as material utilization (PENRM)	MJ	2.42E+02	0	0	-2.11E+02	0	0
Total use of non renewable primary energy resources (PENRT)	MJ	1.88E+03	0	1.87E+01	6.33E+01	0	-6.95E+03
Use of secondary material (SM)	kg	8.99E-03	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	7.9E+03
Use of non renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	2.11E+02
Use of net fresh water (FW)	m^3	1.1E+00	0	1.49E-03	3.35E-02	0	-1.46E+00

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ TILLY solid wood panel (473 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	3.27E-07	0	9.9E-11	5.48E-09	0	-4.28E-07
Non hazardous waste disposed (NHWD)	kg	2.57E+00	0	3.05E-03	4.77E-02	0	1.69E-01
Radioactive waste disposed (RWD)	kg	2.54E-02	0	3.47E-05	1.01E-02	0	-6.3E-01
Components for re-use (CRU)	kg	0	0	0	0	0	0
Materials for recycling (MFR)	kg	0	0	0	0	0	0
Materials for energy recovery (MER)	kg	0	0	0	4.73E+02	0	0
Exported electrical energy (EEE)	MJ	0	0	0	0	0	0
Exported thermal energy (EET)	MJ	0	0	0	0	0	0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ TILLY solid wood panel (473 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Incidence of disease due to PM emissions (PM)	Disease	ND	ND	ND	ND	ND	ND

	incidence						
Human exposure efficiency relative to U235 (IR)	kBq U235 eq	ND	ND	ND	ND	ND	ND
Comparative toxic unit for ecosystems (ETP-fw)	CTUe	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (carcinogenic) (HTP-c)	CTUh	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (noncarcinogenic) (HTP-nc)	CTUh	ND	ND	ND	ND	ND	ND
Soil quality index (SQP)	SQP	ND	ND	ND	ND	ND	ND

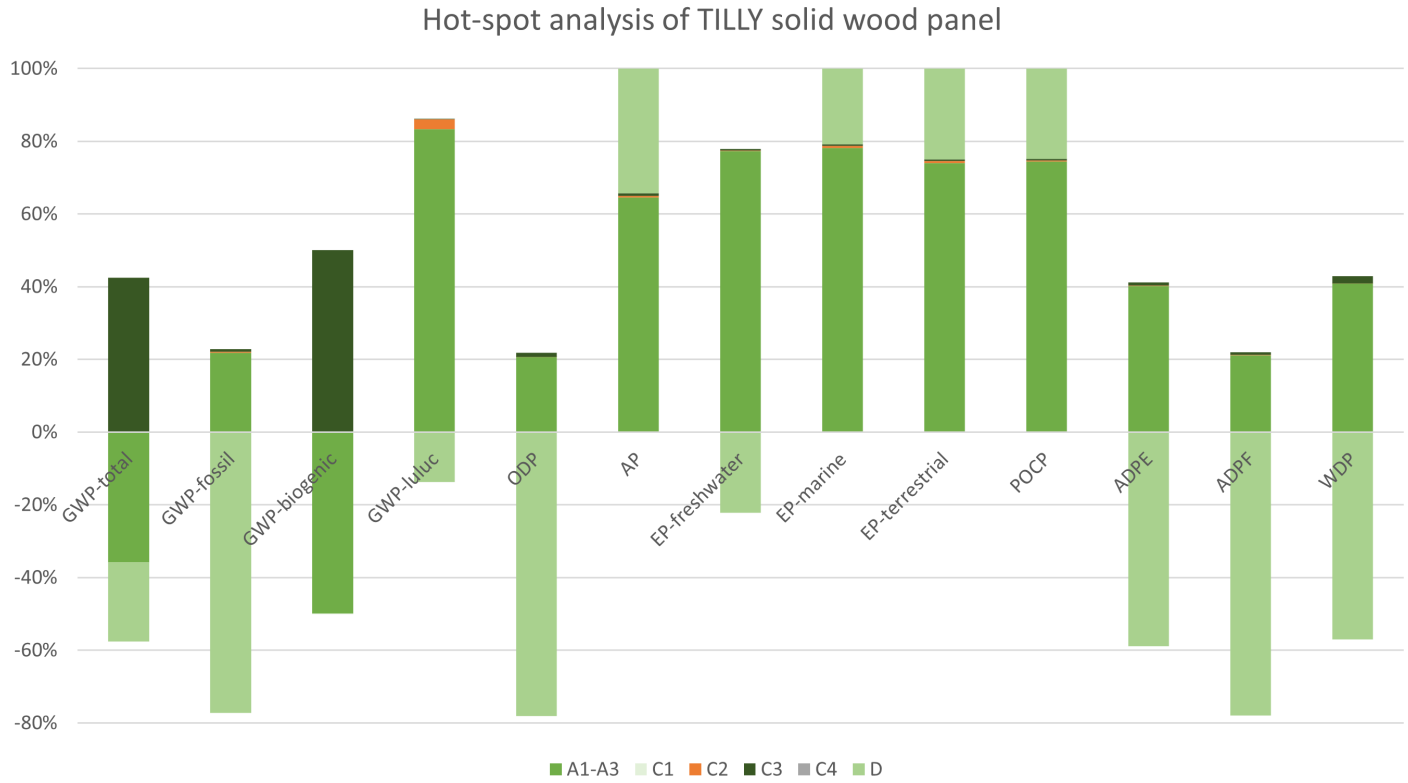
The additional and optional impact categories according to *EN 15804*+A2 are not declared, as the uncertainty of these indicators is to be classified as high.

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'.
The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results related to a declared unit of 1 m³ of average TILLY solid wood panel.



Global warming potential (**GWP**) shows a negative value in the production phase (modules A1–A3) of the solid wood panels. This is due to the material use of wood in the production and the sequestration of biogenic carbon in wood. Trees use carbon dioxide from the atmosphere in order to grow and thus bind carbon in their biomass (negative GWP). During the energetic treatment in a combined heat and power plant at the End-of-Life (module C3) the bound biogenic carbon is released to the atmosphere as carbon dioxide and thus contributes to potential global warming.

The negative values in module D can be explained by the fact that the energy generated by the energetic utilization of the product can replace the combustion of fossil energy sources. Thus, more emissions of (mainly fossil) energy sources are avoided than are emitted by using the energy stored in the wood. Environmental burdens in module D are mainly caused by emissions from the combustion of biomass.

The main drivers in the environmental profile of the solid wood panel production are the impacts from the upstream supply chain of sawn timber and the adhesive system, as well as the provision of electrical and thermal energy at the site. In the upstream supply chain of sawn timber, the environmental impacts from forestry play an important role.

The use of renewable primary energy is based on the material use of biomass in the product and the use of renewable energy

sources for the production of electrical and thermal energy. Non-renewable primary energy is mainly used for energy supply in the sawn timber production and forestry as well as in the production of the adhesive systems.

The presented results are considered to be representative for the entire production of TILLY Holzindustrie (100 %). A good representativeness of the declared average is considered.

Due to the different binder contents of different solid wood panel products, there is a certain variance in the results to be expected. Three-layer boards account for the majority of the total production of TILLY solid wood panels.

For single-layer panels, tending to contain a lower proportion of adhesive, a potential overestimation of the environmental impacts can be assumed.
Since the wood species processed is dominated by spruce, the variation associated with the forestry of different wood species is considered to be small.

7. Requisite evidence

All test reports are available for download at the following link: https://www.tilly.at/en/service/downloads
The following test reports were used for ecological and health concerns:

7.1 Formaldehyde

All test reports were prepared by EPH Dresden (Entwicklungs- und Prüflabor Holztechnologie, DE-Dresden).

7.1.1 Formaldehyde single-layer panels

TILLY single-layer panels are glued with a PU adhesive system free of formaldehyde; no formaldehyde emissions arise from the gluing process, only from the naturally grown wood raw material.
Test report no. 2522576/1 dated 13.03.2023
Formaldehyde emission in accordance with *EN 16516* on a panel thickness of 52 mm: 0.005 ppm or 0.006 mg/m³

7.1.2 Formaldehyde three-layer panels

TILLY three-layer natural wood panels are considered to be glued with a low level of formaldehyde; the emission requirements of class E1 with 0.124 mg/m³ or 0.1 ppm according to *EN 13986* are fallen well short of.
Test report no. 2522576/2 dated 13.03.2023
Formaldehyde emission in accordance with *EN 16516* on a panel thickness of 60 mm: 0.012 ppm or 0.015 mg/m³
Test report no. 211706/QDF/2022/1 dated 24.05.2022
Formaldehyde emission in accordance with *EN 717-1* on a panel thickness of 19 mm: 0.02 ppm or 0.025 mg/m³

7.2 MDI

During the production of TILLY natural wood panels, no substances containing isocyanates are introduced into the wood-based material, thus no MDI emissions can be released.

7.3 Fire gas toxicity

Due to the heterogeneous structure of TILLY natural wood panels and the non-applicability of the *DIN 53436* standard, no relevant measurement results are available and the geometry of the test specimen does not allow the real gas composition to be depicted for a representative cross-section.

7.4 VOC emissions

Two test reports (single-layer panel 14-52 mm, test report no. 2522576/1 dated 13.03.2023 and three-layer panel 13-60 mm, test report no. 2522576/2 dated 13.03.2023) with emission analyses according to *AgBB scheme 2021*, the *French VOC Directive 'Arrêté étiquetage 2011'*, the *French CMR Directive* and *Baubook.info* are available for verification of the VOC emissions. The tests were carried out and evaluated by EPH Dresden according to *ISO 16000-3, -6 and -9* as well as *EN 16516*.

AgBB overview of results for single-layer panels 14-52 mm, 28 days

Name	Value	Unit
TVOC (C6 - C16)	289	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³
R (dimensionless)	0.457	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	-	µg/m³

AgBB overview of results for three-layer panels 13-60 mm, 28 days

Name	Value	Unit
TVOC (C6 - C16)	327	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³
R (dimensionless)	0.407	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	-	µg/m³

All test results meet the requirements of *AgBB scheme 2021*, the French VOC Directive 'Arrêté étiquetage 2011', the *French CMR Directive* and *Baubook.info*.

8. References

Standards

DIN 1052
DIN 1052:2012, Design of timber structures - General rules and rules for buildings.

DIN 53436
DIN 53436:2015, Generation of thermal decomposition products from materials for their analytic-toxicological testing.

DIN 68364
DIN 68364:2003, Properties of wood species – Density, modulus of elasticity and strength.

EN 338
EN 338:2016, Structural timber – Strength classes.

EN 717-1
EN 717-1:2005, Wood-based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by the chamber method.

EN 1912
EN 1912:2013-10, Structural timber – Strength classes – Assignment of visual grades and species.

EN 12369-3
EN 12369-3:2022, Wood-based panels – Characteristic values for structural design – Part 3: Solid wood panels.

EN 12775
DIN EN 12775:2001, Solid wood panels – Classification and terminology.

EN 13017-1
EN 13017-1:2001, Solid wood panels – Classification by surface appearance – Part 1: Softwood.

EN 13017-2
EN 13017-2:2001, Solid wood panels – Classification by surface appearance – Part 2: Hardwood.

EN 13183-3
EN 13183-3:2005-06, Moisture content of a piece of sawn timber – Part 3: Estimation by capacitance method.

EN 13353
EN 13353:2022, Solid wood panels (SWP) – Requirements.

EN 13501-1
EN 13501-1:2019-05, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

EN 13986
EN 13986:2004+A1:2015, Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking.

EN 15804
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

EN 16516
EN 16516:2020-10, Construction products: Assessment of release of dangerous substances – Determination of emissions into indoor air.

ISO 9001
ISO 9001:2015-09, Quality management systems – Requirements.

ISO 14025
EN ISO 14025:2011-10, Environmental labels and declarations – Type III environmental declarations – Principles and processes.

ISO 14044
ISO 14044:2006-10, Environmental management – Life Cycle Assessment – Requirements and guidelines.

ISO 16000-3
ISO 16000-3:2013-01, Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air – Active sampling method.

ISO 16000-6
ISO 16000-6:2022-03, Indoor air – Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID.

ISO 16000-9
EN ISO 16000-9:2008-04, Indoor air – Part 9: Determination of emission of volatile organic compounds from building products and furnishing – Emission test chamber method.

Other literature

2007/348/EC
Commission Decision dated 15 May 2007 amending Decision 2003/43/EC specifying the reaction to fire classes for certain building products (wood-based panels).

AgBB scheme 2021
AgBB Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (Committee for Health-related Evaluation of Building Products, AgBB): Evaluation scheme for VOC emissions from building products; last revised June 2021.

Baubook.info
Database for building products. Baubook.info

Chemical Restriction Regulation
Regulation of the Federal Minister of Agriculture, Forestry, Environment and Water Management on further prohibitions and restrictions of certain dangerous substances, preparations and finished products (Chemical Restriction Regulation 2003 – ChemVerbotsV 2003).

European Waste Catalogue
European Waste Catalogue (EWC) Commission Directive (EU) No. 849/2010 dated 27 September 2010 amending Directive (EC) No. 2150/2002 of the European Parliament and Council on waste statistics, version 2014/955/EU.

French CMR Directive
French CMR Directive no. DEVP0908633A of 30.04.2009.

French VOC Directive
French VOC Directive 'Arrêté étiquetage 2011', No. DEVL1101903D of 23.03.2011 and No. DEVL1104875A of 19.04.2011.

GaBi
GaBi 10 software system and database for life cycle engineering: DB 2022.2 Stuttgart, Echterdingen: Sphera Solutions GmbH, 1992-2022; available at: https://gabi.sphera.com/deutsch/index

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Ökologische Betrachtung von Holzspan und Holzfaserplatten (Ecological analysis of wood chip and wood fibre boards), Dissertation, University of Hamburg, revised in 2007: S. Rueter, (BFH HAMBURG; Wood Technology), S. Albrecht, (University of Stuttgart, GaBi).

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Institut Bauen und Umwelt e.V.: General instructions for the EPD range of Institut Bauen und Umwelt e.V. (IBU), version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021, www.ibu epd.com

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Product category rules for building-related products and services Part B: Requirements on the EPD for solid wood products Version v2. Berlin: Institut Bauen und Umwelt e.V., 31.05.2023.

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Basic LCA data for building products made of wood Working report from the Institute for wood technology and wood biology, No. 2012/1 Hamburg: Johann Heinrich von Thünen-Institut.

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