ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Überwachungsgemeinschaft Konstruktionsvollholz e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SHL-20240272-IBG1-EN
Issue date	21.07.2026
Valid to	20.07.2031

KVH®Structural timber

Überwachungsgemeinschaft Konstruktionsvollholz e.V.

Institut Bauen und Umwelt e.V.

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1. General Information

Überwachungsgemeinschaft Konstruktionsvollholz e.V.

Programme holder

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

Declaration number

EPD-SHL-20240272-IBG1-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

21.07.2026

Valid to

20.07.2031

KVH®Structural timber

Owner of the declaration

Überwachungsgemeinschaft Konstruktionsvollholz e.V.
Heinz-Fangman-Str. 2
42287 Wuppertal
Germany

Declared product / declared unit

1m³ structural timber KVH®

Scope:

The content of this declaration is based on data representing 38% of the total production volume of the members of the Überwachungsgemeinschaft Konstruktionsvollholz e.V., and the technology described herein is representative of all members.
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 evidence.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard is abbreviated 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
☐ internal ☒ external

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

Dr. Martina Bender
(Managing Director Institut Bauen und Umwelt e.V.)

Matthias Klingler,
(Independent verifier)

2. Product

2.1 Product description/Product definition

KVH® structural timber is an industrial-made product for load-bearing structures. It consists of finger-jointed – i.e. frictionally joined lengthwise using finger joints – or non-finger-jointed squared timber made from coniferous wood, which is subject to requirements that go beyond those stipulated by building regulations.
KVH® structural timber is generally manufactured from spruce, fir, pine, larch or Douglas fir. The adhesives listed under 2.5 are used for bonding.
KVH structural timber is manufactured with a maximum wood moisture content of 18%.

KVH® structural timber is supplied with the dimensions listed under 2.4 and with dimensional tolerances in accordance with the KVH® Agreement of the Überwachungsgemeinschaft Konstruktionsvollholz e.V.

KVH® structural timber is highly dimensionally stable, especially due to stricter specifications regarding the cutting scheme and wood moisture content, and has a low tendency to crack.
KVH® structural timber can be manufactured to higher surface quality standards than standard finger-jointed or non-finger-jointed sawn timber.

In addition to the monitoring required by building authorities, its production is subject to additional monitoring under private law in accordance with the provisions of the Überwachungsgemeinschaft Konstruktionsvollholz e.V.
Regulation (EU) No 305/2011 (CPR) applies to the placing of the product on the market in the EU/EFTA (except Switzerland). The product requires a declaration of performance in accordance with *EN 15497, Timber Structures – Structural finger-jointed timber – Requirements*, and CE labelling.

2.2 Application

KVH® structural timber is used in load-bearing components in the field of building and bridge construction. Its use is subject to the relevant national regulations, in particular the national application standard *DIN 20000-7*.

The use of chemical wood preservatives in accordance with *DIN 68800-3*, *Wood preservation – Part 3* is uncommon and only permitted where constructive wood preservation measures in accordance with *DIN 68800-2, Wood preservation – Part 2,* alone is not sufficient. In exceptional cases where a preservative chemical wood treatment is used, it must be authorised in accordance with the Biocidal Products Directive.

2.3 Technical data

The key technical data for structural finger-jointed timber made from softwood or poplar, in accordance with *DIN EN 15497*, are listed below.

Structural properties

Name	Value	Unit
Timber species according to EN 1912 and letter codes, where available, in accordance with EN 13556	Various timber species¹⁾	-
Wood moisture content according to DIN EN 13183-1²⁾	≤ 15	%
Timber preservative treatment (the test label according to DIN 68800-3 must be indicated³⁾	Iv, P and W	-
Characteristic bending strength value parallel to grain	18-30	N/mm²
Characteristic compressive strength parallel to grain according to DIN EN 338⁴⁾	18-24	N/mm²
Characteristic compressive strength perpendicular to grain according to DIN EN 338⁴⁾	2,2-2,7	N/mm²
Characteristic tensile strength parallel to grain according to DIN EN 338⁴⁾	10-19	N/mm²
Characteristic tensile strength perpendicular to grain according to DIN EN 338⁴⁾	0,4	N/mm²
Mean modulus of elasticity parallel to grain according to DIN EN 338⁴⁾	9.000-12.000	N/mm²
Characteristic shear strength according to DIN EN 338⁴⁾	3,4-4,0	N/mm²
Mean shear modulus according to DIN EN 338⁴⁾	560-750	N/mm²
Dimensional deviations according to DIN EN 336	Dimensional tolerance class 2: Width and height ≤ 100 mm: +/- 1 mm. Width and height > 100 mm: +/- 1.5 mm.	mm or %
Average density according to DIN EN 338⁴⁾	320-460	kg/m³
Finish quality according to the KVH Agreement	Non-visual quality (NSi), visual quality (Si)	-
Suitability for use class (UC) according to DIN 68800-1⁵⁾	All wood species: UC 0. Southern Pine heartwood: Also UC 1. Pine heartwood: Also UC 1 and 2. Douglas fir, larch, yellow cedar heartwood: Also UC 1, 2 and 3.1	-
Thermal conductivity (perpendicular to grain) according to DIN EN 12664⁴⁾	0,13	W/(mK)
Specific thermal capacity according to DIN EN 12664	1600	kJ/kgK
Water vapour diffusion resistance factor according to DIN EN ISO 12572⁷⁾	Dry at a bulk density of 500 kg/m³: 50	-

1) Norway spruce (Picea abies, PCAB), silver fir (Abies alba, ABAL), Scots pine (Pinus sylvestris, PNSY), Douglas fir (Pseudotsuga menziesii, PSMN), Hemlock (Tsuga heterophylla, TSHT), Corsican black pine and Austrian black pine (Pinus nigra, PNNL), European larch (Larix decidua, LADC), Siberian larch (Larix sibirica, LASI), Dahurian larch (Larix gmelinii (Rupr.) Kuzen.), maritime pine (Pinus pinaster, PNPN), poplar (applicable clones: Populus x euramericana cv 'Robusta', 'Dorskamp', 'I214' and 'I4551' (POAL), Monterey pine (Pinus radiata, PNRD), Sitka spruce (Picea sitchensis, PCST), Bog pine (Pinus palustris, PNPL), Western red cedar (Thuja plicata, THPL), Nootka cypress (Chamaecyparis nootkatensis, CHNT). Norway spruce and silver fir may be treated as one and the same wood species.
2) DIN EN 15497 permits other equivalent measurement methods.
3) Timber preservative treatment is only permitted under DIN 68800-1 where structural measures have been exhausted, and is thus uncommon.
4) Under DIN EN 15497 with EN 338, more elastomechanical properties, most notably bending strengths, can be declared. It is common practice to specify strength classes. The strength classes C18, C24 and C30 are common. The ranges specified herein refer to mean or characteristic values of the stated strength classes. Other values may be declared. The declared bulk density values may deviate from these mean values due to differences in the densities of the wood species used.
5) As DIN 68800-1 requires maximum utilisation of structural measures before the application of preventive chemical wood preservation, only classifications for untreated glued laminated timber are given here.
6) Design values for thermal conductivity must be determined based on the declared values in accordance with DIN 4108-4.
7) The water vapour diffusion equivalent air layer thickness is calculated as the product of the layer thickness and the water vapour diffusion resistance factor.

The performance characteristics of the product can be found in the relevant declaration of performance in accordance with *DIN 15497:2014, Timber structures – Finger-jointed timber – Requirements*.

Voluntary information for the product is provided based on the agreement on KVH® (structural timber) made from spruce, fir, pine, larch and Douglas fir between Holzbau Deutschland and the Überwachungsgemeinschaft KVH, in its currently valid version. They are not part of the CE label.

2.4 Delivery status

The products are manufactured to the following preferential dimensions:

Min. height: 100 mm
Max. height: 240 mm
Min. width: 60 mm
Max. width: 140 mm

Stock lengths: 13 m (for finger-jointed KVH®, greater lengths available on request)

2.5 Base materials/auxiliary materials

Name	Value	Unit
Coniferous timber, mainly fir	87,46	%
Water	12,46	%
PUR adhesive	0,043	%
MUF adhesive	0,028	%
EPI adhesive	0,004	%

The product has an average bulk density of 480 kg/m³ (averaged across all strength classes and bulk densities).

The product/at least one part product contains ECHA Candidate List (23/01/2024) substances at more than 0.1 mass %: no.
The product/at least one part product contains further CMR Category 1A or 1B substances which are not on the ECHA Candidate List at more than 0.1 mass % in at least one part product: no.

The construction product in question has biocides added or was treated with biocidal products (making it a treated good in the meaning of the Biocidal Products Regulation (EU) No. 528/2012): no.
KVH® finger-jointed structural timber consists of kiln dried coniferous timber planks or square timbers glued together in parallel to the grain.

Polyurethane (PUR) adhesives or melamine-urea-formaldehyde (MUF) adhesives are generally used for the thermosetting bonding process. In very rare cases, emulsion-polymer-isocyanate (EPI) adhesives are used.

Formaldehyde emissions are declared in accordance with DIN EN 15497.

2.6 Manufacture

For the manufacture of KVH® structural timber, conventional sawn timber is first dried to a moisture content of less than 18%, pre-planed and graded by strength either visually or by machine.

Areas identified as having strength-reducing defects are cut out depending on the desired strength class. In the case of finger-jointed KVH® structural timber, the resulting sawn timber sections are finger-jointed into lamellae.

After hardening, or in the case of non-finger-jointed KVH® structural timber after cutting out the defective areas, the cross-sections are planed, chamfered, bundled, and packed.

If required, the timber can be treated with wood preservatives.

2.7 Environment and health during manufacturing

Exhaust air is purified as prescribed in the statutory regulations.

There is no impact on water or soil.

The resulting wastewater is discharged into the local sewerage system.

2.8 Product processing/Installation

KVH® structural timber can be worked using standard tools suitable for timber working.

2.9 Packaging

Polyethylene (AVV 15 01 02) is used, as well as small quantities of other plastics (AVV 15 01 02).

2.10 Condition of use

The composition for the period of use corresponds to the base material composition shown in Section 2.5 'Base materials'

2.11 Environment and health during use

Environmental protection:
Based on current scientific knowledge, there is no risk to water, air or soil when the products are used as intended.

Health protection:
Based on current understanding, no adverse health effects or impairments are to be expected.
With regard to formaldehyde, KVH® structural timber has low emissions due to its adhesive content, structure and method of use.

KVH® structural timber bonded with MUF adhesives releases formaldehyde over time. Measured against the limit value of 0.0815 ppm (0.1 mg/m³) stipulated by the Chemicals Prohibition Ordinance, the values obtained following testing to *EN 15497* are classified as very low.

KVH® structural timber bonded with PUR adhesives or EPI adhesives or KVH® structural timber without finger joints has formaldehyde emission values in accordance with *EN 15497* in the range of untreated timber, at approximately 0.004 ppm.
MDI emissions from KVH® structural timber bonded with PUR adhesives or EPI adhesives are not measurable within the detection limit of 0.00012 ppm (0.05 µg/m³). Due to the high reactivity of MDI with water (air and wood moisture), it can be assumed that KVH® structural timber bonded in this way exhibits MDI emissions in the range of zero shortly after manufacture.

2.12 Reference service life

KVH® structural timber is similar in its components and manufacturing process to the lamellae used in glued laminated timber (glulam). Glulam has been in use for around 120 years.

Thus, KVH® structural timber, when used as intended, has a longer service life than that typically assumed for buildings. When used as intended, particularly in compliance with the rules for structural timber preservation in accordance with *DIN 68800-1* and *DIN 68800-2*, there is no known or expected limit to its durability.

2.13 Extraordinary effects

Fire
According to *DIN EN 13501-1* the following classes have been defined:

- Fire class D according to DIN EN 13501-1
- smoke class s2 – normal smoke emission
- d0 – no droplets

Fire protection
The fire class of finger-jointed timber is D d0, s2

Name	Value
Fire classification	D
Burning droplets	d0
Smoke gas development	s2

Water
No substances that could be harmful to water are leached out.

Mechanical destruction
The fracture surface of KVH® structural timber has the appearance typical of timber.

2.14 Re-use phase

KVH® structural timber can be easily reused or recycled following selective dismantling at the end of its service life.
It can be processed into components such as square-edged timber or planks and boards for the manufacture of new glued products.
It can be processed into wood chips or wood fibres for use as raw material in wood-based panels or wood-based insulation materials.

If KVH® structural timber cannot be recycled, it is sent to thermal utilisation to generate process heat and electricity due to its high calorific value of approx. 16 MJ/kg (at a moisture content of u=12%).
In the case of energetic utilisation, the requirements of the *Federal Immission Control Act* (BImSchG) must be observed: Untreated KVH® structural timber is classified under waste code 17 02 01 of the AVV in accordance with Annex III of the *Waste Wood Ordinance* (AltholzV) (treated KVH® structural timber is classified under the waste code 17 02 04, depending on the type of timber preservative used).

2.15 Disposal

Landfilling of waste wood is not permitted according to Section 9 *AltholzV.*
The packaging materials used can be sent to thermal waste treatment. The following waste codes are assigned in accordance with the AVV: 15 01 02 (Plastic packaging).

2.16 Further information

Additional information can be found at www.kvh.de.

3. LCA: Calculation rules

3.1 Declared unit

The unit used for environmental assessment is the supply of 1 m³ of KVH® structural timber with a density of 480 kg/m³ at 15% wood moisture content or 12.5% water content and 0.08% adhesive content. All data relating to the adhesives used were calculated based on specific data. Averages were calculated on a weighted basis according to the production volume of the product and the annual volume of the factories taken into consideration.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Bulk density	480	kg/m^3
Conversion factor to 1 kg	0.0020833	-
Wood moisture on delivery	15	%
Wood moisture content on delivery	0,08	%
Water content by total mass	12,50	%

3.2 System boundary

The declaration type is a 'cradle-to-gate with options' EPD. It covers the stage of production, i.e. from the provision of raw materials up to the production plant gate (cradle-to-gate, modules A1 to A3), as well as module A5 and parts of the end of life (modules C1 to C4). In addition, the potential credits and encumbrances are assessed beyond the product's life cycle (module D).

Specifically, module A1 covers the supply of timber from the forest, the supply of other pre-processed timber products, and the supply of adhesives. Transport of these materials are accounted for in module A2. Module A3 covers the provision of fuels, operating materials, and electricity, as well as on-site manufacturing processes. These essentially consist of debarking, cutting, drying, planing and profiling processes, bonding, and the packaging of the products. Module A5 solely covers the disposal of product packaging, which includes the release of the primary energy contained therein (PERM and PENRM).
Module C1 accounts for dismantling, specifically manual dismantling, in which no encumbrances are incurred. Module C2 covers transport to the disposal facility and module C3 covers the processing and sorting of waste wood. Moreover, in module C3, in accordance with *DIN EN 16485,* the CO_2 equivalents of the wood-inherent carbon contained in the product, as well as the renewable and non-renewable primary energy (PERM and PENRM) contained in the product, are included as outputs. As wood retains its energy content when treated as waste and can be used for thermal utilisation, it was recorded as MER in module C3. Module C4 accounts for the landfilling of waste.
Module D accounts for the thermal utilisation of the product at the end of its life cycle, as well as the resulting potential credits and encumbrances in the form of a system extension.

3.3 Estimates and assumptions

All material and energy flows associated with the production processes were generally measured on-site. However, emissions from combustion and other processes occurring on-site could only be estimated on the basis of data from the literature. All other data is based on average values.
Detailed information on all estimates and assumptions made is documented in *Rüter, S; Diederichs, S* (2012).
The calculated use of fresh water resources is based on 'blue-water-consumption'.

3.4 Cut-off criteria

No known material or energy flows were disregarded, including those falling below the 1% threshold. This means that the total sum of the disregarded input flows is well below 5% of the energy and material inputs. This also ensures that no material and energy flows were disregarded which have particular potential to exert a significant influence on the environmental indicators. Detailled information on the cut-off criteria can be found in *Rüter, S; Diederichs, S* (2012).

3.5 Background data

All background data was taken from the *Sphera* (2024) MLC CUP 2024 database and the final report *"Ökobilanz-Basisdaten für Bauprodukte aus Holz" Rüter, S; Diederichs, S (*2012).

3.6 Data quality

The data requested from the plants was validated on a bulk basis and according to plausibility criteria. The background data for wood raw materials used for material and energy utilisation, except forest wood, is from the years 2008 to 2012. The supply of forest wood was gleaned from a publication from 2008 which is essentially based on data from 1994 to 1997. All other data was taken from the *Sphera* (2024) MLC CUP 2024 database.
Thanks to a written confirmation from the Überwachungsgemeinschaft Konstruktionsvollholz e.V. that the primary data used is up to date, as well as the updating of all background data used, the overall data quality can be described as good.

3.7 Period under review
Data for the primary system was collected over the period from 2020 to 2023, with data being compiled for each full calendar year. The data therefore covers the years 2020 to 2022. All information is based on the average figures for 12 consecutive months. A document from the Überwachungsgemeinschaft Konstruktionsvollholz e.V. is available which confirms that the data used continues to be representative of the association.

3.8 Geographic representativeness
Country or region in which the declared product system is manufactured, used or handled at the end of the product's life span: Germany

3.9 Allocation
- The allocations carried out comply with the requirements of *DIN EN 15804* and *DIN EN 16485* and are explained in detail in *Rüter, S; Diederichs, S* (2012). Essentially, the following system extensions and allocations were carried out.

General information

Flows of material-inherent properties (biogenic carbon and embodied primary energy) were generally allocated according to physical causality. All other allocations in the case of associated co-productions were made on an economic basis. One exception is the allocation of the heat required in combined heat and power systems, which was allocated on the basis of the exergy of the products electricity and process heat.

Module A1

Forest: All encumbrances incurred in the upstream forestry sector were allocated to the products sawlogs and pulpwood using economic allocation factors based on their prices.
The provision of waste wood includes no encumbrances from the previous lifecycle.

Module A3

Woodworking industry: In the case of linked co-productions, encumbrances were allocated economically to the main products and residual materials on the basis of their prices.
The disposal of waste generated during production, with the exception of wood-based materials, is accounted for using a system extension. Heat and electricity generated are credited to the system through substitution processes. The credits achieved here are well below 1% of total encumbrances.
In the case of combined heat and power generation, all combustion costs were allocated to these two products according to their exergy.

Module D

The system space extension carried out in module D corresponds to a wood waste energetic utilisation scenario.

3.10 Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all data sets to be compared were created according to *EN 15804* and the building context and product-specific performance characteristics are taken into account. The life cycle assessment modelling was carried out using the *Sphera* (2026) LCA for Experts software, version 10.9.4.13. All background data was taken from the *Sphera* (2024) MLC CUP 2024 database or derived from references, all of which are from the scientific literature.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Information describing the biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon contained in product	210.3	kg C
Biogenic carbon contained in packaging		kg C

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

The scenarios on which the life cycle assessment is based are described in more detail below.

Installation in building (A5)
Module A5 is declared, but only contains information about the disposal of the product packaging and no information on the actual installation of the product in the structure. The quantity of packaging material generated in module A5 per declared unit as waste for thermal utilisation, and the resulting exported energy, are set out below as technical scenario information.

Name	Value	Unit
PE film sent to thermal waste treatment	0.41	kg
Overall efficiency of waste combustion process for packaging material	38 - 44	%
Share of electricity generation in exported energy	27 - 28	%
Total exported electric energy	4.0	MJ
Total exported thermal energy	1.53	MJ

A forwarding distance of 50 km is assumed for the disposal of the product packaging. Using a conservative approach, it is assumed that all packaging components are disposed of as waste in a waste-to-energy plant without sorting out waste wood for energy recovery in a biomass combined heat and power plant. The overall combustion efficiency for the respective packaging components, as well as the proportions of electricity and heat generation via combined heat and power, correspond to the processes assigned in the Sphera database (2024) and are, implicitly, R1>0.6.

End of life (C2-C4)

Name	Value	Unit
Waste wood sent to energy recovery	480	kg
Wood waste redistribution transport distance (module C2)	50	km

For the thermal utilisation scenario, a collection rate of 100% without wastage caused by shredding of the material is assumed.

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

Name	Value	Unit
Electricity generated (per t atro of waste wood)	406.43	kWh
Waste heat generated (per t atro of waste wood)	2961.16	MJ

The product is recycled at the end of its life cycle in the form of waste wood with the same composition as the declared unit described above. It is assumed that the product is subjected to thermal utilisation in a biomass power plant with an overall efficiency of 54.69% and an electrical efficiency of 18.09%. The combustion of 1 t of atro wood (mass specified in atro, but efficiency accounts for ~18% wood moisture content) generates approximately 968.37 kWh of electricity and 7053.19 MJ of usable heat. The gross flow here is the net flow of the dry wood fraction entering module D; taking into account the adhesive content in the waste wood, module D produces 406.43 kWh of electricity and 2961.16 MJ of thermal energy per declared unit. The exported energy substitutes fuels from fossil sources, assuming that the thermal energy would be generated from natural gas and that the substituted electricity corresponds to the German electricity consumption mix from 2021.

5. LCA: Results

Environmental effects of 1 m³ of structural timber.

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	X	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 KVH®

Parameter	Unit	A1	A2	A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	-7.48E+02	1.64E+01	1.49E+02	1.18E+00	0	7.42E-01	7.8E+02	0	-1.93E+02
GWP-fossil	kg CO_2 eq	2.35E+01	1.64E+01	1.49E+02	1.18E+00	0	7.4E-01	9.25E+00	0	-1.93E+02
GWP-biogenic	kg CO_2 eq	-7.71E+02	7.09E-02	9.36E-02	6.47E-05	0	2.08E-03	7.71E+02	0	-3.03E-01
GWP-luluc	kg CO_2 eq	ND	ND	ND	ND	ND	ND	ND	ND	ND
ODP	kg CFC11 eq	3.35E-11	4.35E-12	2.67E-11	1.09E-13	0	7.5E-14	2.9E-10	0	1.23E-10
AP	mol H^+ eq	1.79E-01	4.51E-02	2.44E-01	1.89E-04	0	4.44E-03	1.45E-02	0	3.38E-02
EP-freshwater	kg P eq	4.36E-03	1.87E-03	8.55E-02	4.74E-06	0	1.26E-05	1.24E-02	0	5.13E-03
EP-marine	kg N eq	8.61E-02	2.02E-02	8.78E-02	3.32E-05	0	2.17E-03	4.52E-03	0	-1.1E-02
EP-terrestrial	mol N eq	9.51E-01	2.28E-01	9.81E-01	8.91E-04	0	2.41E-02	4.66E-02	0	1.29E-01
POCP	kg NMVOC eq	2.45E-01	4.49E-02	2.92E-01	8.66E-05	0	4.17E-03	1.09E-02	0	-4.47E-02
ADPE	kg Sb eq	5.54E-06	1.93E-06	1.61E-06	1.07E-09	0	6.34E-08	1.95E-06	0	-3.65E-06
ADPF	MJ	2.91E+02	2.06E+02	1.71E+03	1.95E-01	0	9.71E+00	1.3E+02	0	-3.11E+03
WDP	m^3 world eq deprived	1.25E+00	2.01E-01	2.71E+00	1.08E-01	0	1.11E-02	3E-01	0	8.32E+01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ KVH®

Parameter	Unit	A1	A2	A3	A5	C1	C2	C3	C4	D
PERE	MJ	7.84E+03	2.19E+01	6.49E+03	5.45E-02	0	8.21E-01	1.39E+02	0	5.53E+01
PERM	MJ	8.11E+03	0	0	0	0	0	-8.11E+03	0	0
PERT	MJ	1.59E+04	2.19E+01	6.49E+03	5.45E-02	0	8.21E-01	-7.97E+03	0	5.53E+01
PENRE	MJ	3.23E+02	2.06E+02	1.7E+03	5.1E+00	0	9.71E+00	1.3E+02	0	-3.1E+03
PENRM	MJ	7.76E+00	0	4.9E+00	-4.9E+00	0	0	-7.76E+00	0	0
PENRT	MJ	3.31E+02	2.06E+02	1.71E+03	1.95E-01	0	9.71E+00	1.22E+02	0	-3.1E+03
SM	kg	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	5.82E+03	0	0	0	0	0	8.11E+03
NRSF	MJ	0	0	0	0	0	0	0	0	7.76E+00
FW	m^3	8.69E-02	2.34E-02	2.85E-01	2.53E-03	0	9.22E-04	4.39E-02	0	1.95E+00

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ KVH®

Parameter	Unit	A1	A2	A3	A5	C1	C2	C3	C4	D
HWD	kg	4.36E-03	1.87E-03	8.55E-02	4.74E-06	0	1.26E-05	1.24E-02	0	5.13E-03
NHWD	kg	8.27E-02	5.69E-02	1.88E+00	7.93E-03	0	1.51E-03	1.31E-01	0	4.67E+00
RWD	kg	1.74E-07	8.99E-09	3.08E-08	1.23E-10	0	3.14E-10	3.2E-07	0	8.57E-08
CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	0
MER	kg	0	0	8.77E-03	4.1E-01	0	0	4.8E+02	0	0
EEE	MJ	0	0	0	1.53E+00	0	0	0	0	0
EET	MJ	0	0	0	4E+00	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m³ KVH®

Parameter	Unit	A1	A2	A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	8.72E-06	3.62E-07	1.9E-06	1.19E-09	0	2.83E-08	1.14E-07	0	1.58E-07
IR	kBq U235 eq	6.84E-01	1.66E-01	6.67E+00	5.05E-04	0	1.75E-03	1.32E+00	0	5.33E-01
ETP-fw	CTUe	2.12E+02	1.38E+02	2.55E+02	8.17E-02	0	7.15E+00	4.81E+01	0	2.93E+01
HTP-c	CTUh	1.64E-08	2.83E-09	3.62E-08	8.15E-12	0	1.44E-10	2.75E-09	0	-8.84E-09
HTP-nc	CTUh	1.81E-07	1.24E-07	5.46E-07	7.96E-11	0	6.39E-09	3.79E-08	0	-1.38E-06
SQP	SQP	6.59E+03	1.08E+02	5.81E+01	6.45E-02	0	4.81E+00	9.08E+01	0	5.58E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential human exposure efficiency relative to U235; ETP-fw = Potential comparative toxic unit for ecosystems; HTP-c = Potential comparative toxic unit for humans (carcinogenic); HTP-nc = Potential comparative toxic unit for humans (not carcinogenic); SQP = Potential soil quality index

Qualifier 1 – applies to the indicator 'potential effects through human exposure to U235': This impact category mainly covers the potential impact of low-dosage ionising radiation on human health in the nuclear fuel cycle. It does not account for effects caused by possible nuclear accidents and occupational exposure nor for the disposal of radioactive waste in subterranean installations. This indicator also does not cover the potential ionising radiation emitted by the ground, radon, and certain construction materials.

Qualifier 2 – applies to the indicators: abiotic resource depletion potential – non-fossil resources, abiotic resource depletion potential – fossil fuels, water deprivation potential (user), potential toxicity reference unit for ecosystems, potential toxicity reference unit for humans – carcinogenic effect, potential toxicity reference unit for humans – non-carcinogenic effect, and potential soil quality index: Diligence must be applied when using the results of the environmental impact indicator because they are fraught with high uncertainties or experience with the indicator is limited.

The indicator **GWP-luluc** was not declared because it contributes less than 5% to GWP-total through the declared modules A–C. First, as part of the primary data gathering process, detailed information on the origin of raw materials was gathered; according to this, in the case of the product in question, a total of 91% of the sawn softwood used originates from Germany, Austria, and neighbouring EU countries. Second, as part of international greenhouse gas reporting under the United Nations Framework Convention on Climate Change (UNFCCC) and the EU Regulation (EU 2018/841), the annual volume of timber harvested from existing forests in Germany is estimated, including the proportion of timber volumes resulting from the land-use change 'deforestation', cf. Federal Environmental Agency (2023). For the reference year 2020, the share of the wood outflows associated with deforestation was 1.86% at the national level. At the same time, it must be assumed that timber assortments associated with a change in land use type can hardly be utilised by wood-processing companies due to the irregular supply (unpredictable in terms of location, timing and therefore logistics), as these companies rely on a continuous supply of specific raw timber assortments of consistent quality and dimensions (in this case: coniferous logs for sawn timber production).

6. LCA: Interpretation

The energy interpretation focuses on the production phase (modules A1 to A3), as it builds on specific data provided by the company. The interpretation is done performing a dominance analysis of environmental impacts (GWP, ODP, AP, EP, POCP, ADPE, ADPF, WDP) and renewable/non-renewable primary energy inputs (PERE, PENRE), as well as the resource fresh water (FW) and hazardous special waste (HWD).

6.1 Dominance analysis

The following section lists the most significant factors influencing the environmental impacts associated with each module.

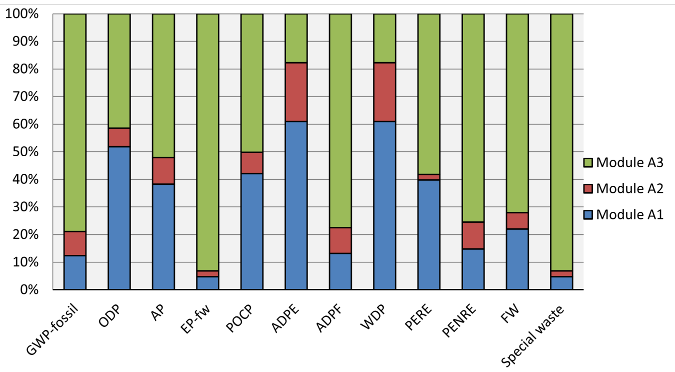


Fig. 1: Relative contributions of the included modules to individual environmental impacts.

6.2 Global warming potential (GWP)

Wood-inherent CO_2 product system inputs and outputs require special examination with regard to global warming potential. In total, approximately 771.1 kg of CO_2 enters the system in the form of carbon stored in the biomass. Of this, 793.8 kg of CO_2 is emitted along the upstream supply chains and during on-site heat generation. A further 1.18 kg of CO_2 is emitted in module A5.

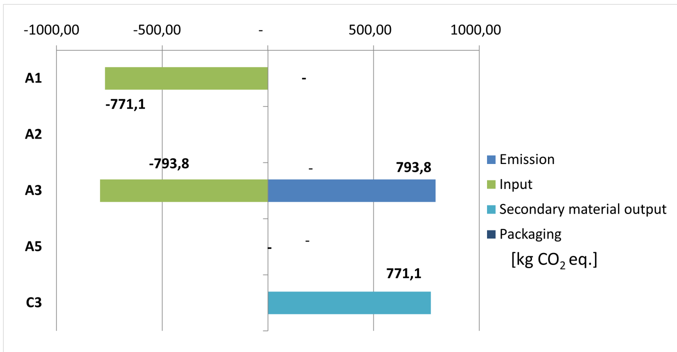


Fig. 2:Wood-inherent CO_2 product system inputs and outputs. The use of inverse signsfor inputs and outputs takes account of the CO_2 flow analysis in life cycleassessment from the perspective of the atmosphere.

Global warming potential fossil (GWP-f)

Global warming potential fossil (GWP-f) [kg CO_2 eq.]: 32.4% – electricity
Cutting process (A3); 18.7% – electricity for longitudinal gluing process (A3); 12% – electricity for drying process (A3); 10.3% – round timber upstream chain (A1); 6.2% – round timber transport (A2); 4.6% – debarking process (A3); remaining 15.8%.

6.2 Additional indicators

The composition and key drivers of the environmental and resource indicators are reflected as percentages for the most important indicators.
Ozone depletion potential (ODP) [kg CFC11 eq.]: 37.6% – sawn timber (dry) upstream chain (A1); 15% – electricity for infrastructure (A3); 10.9% – round timber supply chain (A1); 7.5% – electricity for sawing process (A3); 4.9% – packaging (A3); 4.5% – electricity for longitudinal gluing process (A3); remaining 19.6%

Acidification potential (AP) [mol H+ eq.]: 34.1% – round timber supply chain (A1); 14.8% – sawing process (A3); 9.7% – mill logistics (A3); 8.5% – electricity for longitudinal gluing process (A3); 7.3% – heating (A3); 5.7% – sawn timber transport (A2); remaining 19.8%

Eutrophication, freshwater (EP-fw) [kg P eq.]: 38.3% – electricity for sawing process (A3); 24.8% – electricity for longitudinal gluing process (A3); 14.2% – electricity for drying process (A3); 5.4% – electricity for debarking process (A3); 4.1% – sawn timber (dry) upstream chain (A1); 3.6% – planing process (A3); remaining 9.6%

Photochemical ozone formation (POCP) [kg NMVOC eq.]: 37.6% – round timber supply chain (A1); 10.7% – electricity for sawing process (A3); 10.3% – mill logistics (A3); 7.9% – drying process (A3); 6.6% – heat (A3); 6.2% – electricity for longitudinal gluing process (A3); remaining 20.8%

Potential for the abiotic degradation of non-fossil resources (ADPE) [kg Sb eq.]: 31.7% – round timber upstream chain (A1); 20.7% – operating materials (A1); 16% – round timber transport (A2); 6.3% – mill logistics (A3); 5.6% – PUR adhesives (A1); 5.1% – sawn timber (dry) upstream chain (A1); remaining 14.6%

Potential for the abiotic depletion of fossil fuels (ADPF) [MJ]: 31% – electricity for cutting process (A3); 18.3% – electricity for longitudinal gluing process (A3); 11.5% – electricity for drying process (A3); 10.4% – round timber upstream chain (A1); 6.6% – round timber transport (A2); 4.4% – electricity debarking process (A3); remaining 17.9%

Water use (WDP) [m³ world eq. deprived]: 33.5% – electricity for sawing process (A3); 20.2% – electricity for longitudinal gluing process (A3); 17.4% – operating materials (A1); 12.4% – electricity for drying process (A3); 8.3% – sawn timber (dry) upstream chain (A1); 4.8% – electricity for debarking process (A3); remaining 3.5%

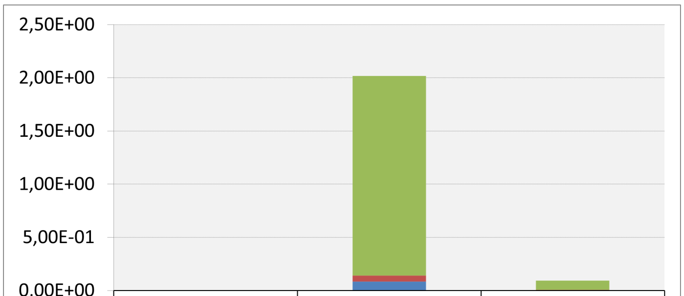
Renewable primary energy as energy carrier (PERE) [MJ]: 41.2% – heat (A3); 35.3% – sawn timber (dry) upstream chain (A1); 6.9% – electricity for cutting process (A3); 4.2% – electricity for longitudinal gluing process (A3); 4.1% – round timber upstream chain (A1); 2.6% – electricity for drying process (A3); remainder 5.7%

Non-renewable primary energy as energy carrier (PENRE) [MJ]: 31% – electricity for cutting process (A3); 18.3% – electricity for longitudinal gluing process (A3); 11.5% – electricity for drying process (A3); 10.4% – round timber upstream chain (A1); 6.6% – round timber transport (A2); 4.4% – electricity debarking process (A3); remaining 17.9%

Freshwater resources utilisation (FW) [m³]: 31.3% – electricity for cutting process (A3); 18.6% – power for longitudinal gluing process (A3); 13.3% – round timber upstream chain (A1); 11.6% – electricity for drying process (A3); 4.4% – electricity for debarking process (A3); 4.4% – round timber transport (A2); remaining 16.5%

6.3 Waste
For the waste categories, the detailed dominance analysis focuses on hazardous (special) waste:

Hazardous waste for landfill (HWD) [kg]: 43.1% – sawn timber (dry) upstream chain (A1); 36.2% – round timber upstream chain (A1); 6.4% – electricity for cutting process (A3); 3.6% – electricity for longitudinal gluing process (A3); 2.4% – electricity for drying process (A3); 1.7% – sawn timber transport (A2); remaining 6.8%.



	RWD [kg/m³]	NHWD [kg/m³]	HWD [kg/m³]
Module A3	3,08E-08	1,88E+00	8,55E-02
Module A2	8,99E-09	5,69E-02	1,87E-03
Module A1	1,74E-07	8,27E-02	4,36E-03

Fig. 3: The modular components of the waste categories radioactive waste (RWD), non-hazardous waste (NHWD) and hazardous waste (HWD).

6.4 Range of results

The individual results of the participating companies differ from the average results in the environmental product

The maximum deviations in the environmental impacts were: Dev +710.7/-67.7% (GWP fossil); dev +4110.1/-64.9% (ODP); dev +877.6/-49.7% (AP); dev +-97.6/-100% (EP freshwater); dev +911.8/-58.9% (EP saltwater); dev +910.4/-59.3% (EP terrestrial); dev +893.3/-61.3% (POCP); dev +1057.6/-78.4% (ADPE); dev +742.7/-64.7% (ADPF); dev +834/-63% (WDP); dev +2798.3/-79.4% (PERE); dev +742.7/-64.7% (PENRE); dev +762.5/-60.7% (FW); dev +1991.9/-86% (HWD); calculated in relation to the results described in Chapter 5. The main reason for these deviations is differences in the fuels used, primarily wood residues from cutting and further processing of the product or natural gas for heat generation. The specific electricity consumption of the individual processing steps per plant and the types of adhesives used are a further reason for the deviations. The quality of the results can be regarded as robust and sound, as the correlations and significant influences are plausible and largely correspond to the observations from the life cycle inventory.

The results of the previous EPD for structural timber (EPD-SHL-20180036-IBG1-DE, according to +A1) are not directly comparable with this updated version of the EPD due to the update of the *Sphera* (2024) background database and the underlying characterisation methodology in accordance with *DIN EN 15804 (+A2)*.

The assumptions and estimates made are based, as far as possible, on the scientific literature. It is not possible to precisely quantify the influence of the assumptions on the life cycle assessment results, as the deviations of the assumptions from reality are, by their very nature, unknown. If measurable values were available for the assumptions made, no assumptions would be needed.
However, thanks to the detailed data collection carried out, the need for assumptions and estimates can be reduced to a minimum. Against this background, the influence of the assumptions and estimates on the life cycle assessment results is minor compared to the data basis collected in the foreground system and made quantifiable by background processes.

7. Requisite evidence

Measurements of glulam, which has a significantly higher adhesive content, are generally used to declare formaldehyde and MDI emissions.
The following environmental and health-related assessments were carried out:

7.1 Formaldehyde

Formaldehyde emissions must be determined in accordance with *DIN EN 15497* and are calculated with reference to *DIN EN 717-1*. *DIN EN 15497* prescribes that structural finger-jointed timber must be tested using a loading factor of 0.3 m^2/m^3. Formaldehyde emissions are declared as class E1 or E2. For use in Germany, only structural finger-jointed timber of formaldehyde class E1 is permitted under *DIN 20000-7*.
Emission values for KVH® structural timber bonded with formaldehyde-containing adhesives are not available. For glued laminated timber tested with a higher proportion of formaldehyde-containing adhesives, the values are around one-tenth of the limit value under the Chemicals Prohibition Ordinance (0.1 ml $HCHO/m^3$ indoor air).
For structural timber, a value well below the limit value under the Chemicals Prohibition Ordinance can therefore be assumed.

Emission values for KVH® structural timber bonded with formaldehyde-free adhesives or for KVH® structural timber without finger joints result in area-specific emission rates in the range of unglued wood.

7.2 MDI

When KVH® structural timber is bonded, the MDI contained in the moisture-curing single-component polyurethane adhesives used reacts completely. MDI emissions from the cured KVH® structural timber are thus not possible.
In tests based on the measurement methodology for determining formaldehyde emissions from DIN EN 717-2, no MDI emissions are detectable (detection limit: 0.05 µg/m).

7.3 Fire gas toxicity

The toxicity of the fumes produced by burning structural finger-jointed timber is equivalent to that of fumes produced when untreated wood burns.

7.4 VOC

Measurements carried out in accordance with *DIN EN 16516* on two samples taken from finger-jointed spruce timber, at a loading factor of 0.3 m^2/m^3, yielded TVOC values after 28 days ranging from 0.058 mg/m^3 to 0.070 mg/m^3, which were significantly lower than the limit value of 1 mg/m^3.

8. References

Standards and other sources:

Waste Wood Ordinance (AltholzV)
Waste Wood Ordinance (AltholzV): Ordinance on requirements for the recycling and disposal of waste wood, 2022, last amended on 19/06/2020.

AVV
Waste Index Ordinance of 10 December 2001 (Federal Gazette of Laws and Ordinances I p. 3379) last amended by article 2 of the Ordinance of 30 June 2020 (Federal Gazette of Laws and Ordinances I p. 1533).

Federal Immission Control Act (BImSchG) Federal Immission Control Act (BImSchG): Act on the Control of Harmful Environmental Effects Caused by Air Pollution, Noise, Vibrations and Similar Phenomena, 2013, last amended on 26/07/2023.

CPR
Regulation (EU) No 305/2011 of the European Parliament and Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

ECHA Candidate List
Candidate List of Substances of Very High Concern (as of 15/01/2018) according to Article 59 (10) of the REACH Regulation. European Chemicals Agency.

EU 2018/841
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Product category rules for building-related products and services, Part A: Calculation rules for the LCA and requirements of the project report in accordance with EN 15804+A2:2019.

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2023 Projection Report for Germany; according to Article 18 of Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance System for the Energy Union and for Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009.

KVH Agreement
The agreement on KVH® (structural timber) made from spruce, fir, pine, larch and Douglas fir between Holzbau Deutschland and the KVH Supervisory Association, in its current version.
DIN 4108-4
DIN 4108-4:2020-11, Thermal insulation and energy economy in buildings - Part 4: Hygrothermal design values

DIN 68800-1
DIN 68800-1:2019-06 Wood preservation – Part 1: General

DIN 68800-2
DIN 68800-2:2022-02 Wood preservation – Part 2: Preventive constructional measures in buildings

DIN 68800-3
DIN 68800-3:2019-06 Wood preservation – Part 3: Preventive protection of wood with wood preservatives

DIN EN 717-1
DIN EN 717-1:2005-01, Wood-based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by the chamber method

DIN EN 717-2
DIN EN 717-2:1995-01, Wood-based panels – Determination of formaldehyde release – Part 2: Formaldehyde emission by the gas analysis method (retracted from the standards)

DIN EN 1912
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DIN EN 13183-1
DIN EN 13183-1:2002-07, Moisture content of a piece of sawn timber – Part 1: Determination by oven dry method

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

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