

# ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A2

Owner of the Declaration	Rubner Holding AG - S.p.A.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-RUB-20230230-IBC1-EN
Issue date	27.06.2023
Valid to	26.06.2028

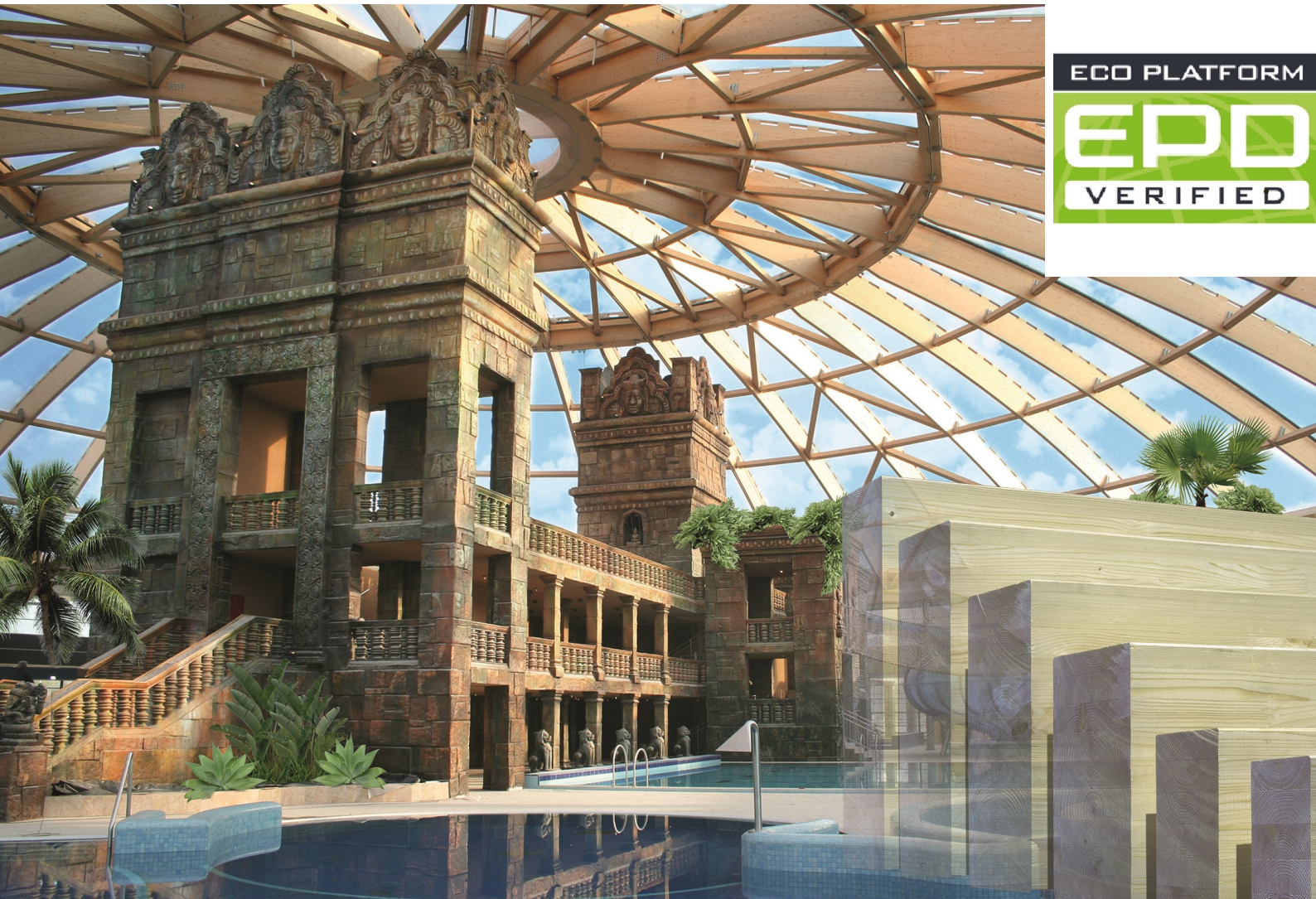
## Glued laminated timber (Update) Rubner Holding AG - S.p.A

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ECO PLATFORM

EPD  
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## 1. General Information

### Rubner Holding AG - S.p.A

#### Programme holder

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

#### Declaration number

EPD-RUB-20230230-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

27.06.2023

#### Valid to

26.06.2028



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



Dipl.-Ing. Hans Peters  
(Managing Director Institut Bauen und Umwelt e.V.)

### Glued laminated timber (Update)

#### Owner of the declaration

Rubner Holding AG - S.p.A.  
Handwerkerzone 2  
39030 Kiens  
Italy

#### Declared product / declared unit

1 m<sup>3</sup> of glued laminated timber [glulam] with an average density of 464 kg/m<sup>3</sup>

#### Scope:

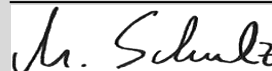
This EPD is based on a declared unit of 1 m<sup>3</sup> of glued laminated timber (moisture of 10 % at a raw density of 464 kg/m<sup>3</sup>). The results refer to a representative average of RUBNER glued laminated timber including standard beams as well as sophisticated 3D-beam components. The LCA covers 100 % of the RUBNER group's production referring to its sites located at Rohrbach (Austria), Ober-Grafendorf (Austria) and Brixen (Italy).

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	
<input type="checkbox"/>	internally
<input checked="" type="checkbox"/>	externally



Matthias Schulz,  
(Independent verifier)

## 2. Product

### 2.1 Product description/Product definition

RUBNER glued laminated timber and glued solid timber (RUBNER glulam) is a homogenized unidirectional wood-based material that is used in engineered structural timber constructions. RUBNER glulam consists of at least two boards/laminations made from kiln dried coniferous wood according to EN 1912 which are glued together at their wide faces. Due to the multi-layer cross-sectional structure combined with the technically supported strength and stiffness classification of the raw materials, RUBNER glulam is characterized by a high product quality. As a result of the industrial manufacturing process, RUBNER glulam exhibits steady mechanical characteristics. In addition to straight standard beams, RUBNER glulam also includes architecturally sophisticated 3D-beam components which are curved arbitrarily in space. Rubner glulam has a high dimensional stability and can be characterized as a largely crack-minimized building material. For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011/PCR applies. The product needs a Declaration of Performance taking into consideration hEN 14080 and the CE-marking. For use, the respective national provisions apply.

### 2.2 Application

RUBNER glulam is mainly used as a structural component for buildings and bridges.

### 2.3 Technical Data

The performance data of the product are in accordance with the Declaration of Performance with respect to its essential characteristics according to hEN 14080.

RUBNER glulam is produced in accordance with hEN 14080 with different strength classes. For the strength class GL 24h the following applies:

### Constructional data

Name	Value	Unit
Wood types by trade names acc. to EN 1912	spruce, pine, larch, Douglas fir	-
Wood moisture acc. to EN 14080	< 15	%
Use of wood preservatives (the wood preservative test mark to DIN 68800-3 must be indicated)	Where other preservative means are insufficient	-
Bending strength acc. to EN 14080	24	N/mm <sup>2</sup>
Compressive strength parallel acc. to EN 14080	24	N/mm <sup>2</sup>
Compressive strength rectangular acc. to EN 14080	2.5	N/mm <sup>2</sup>
Tensile strength parallel acc. to EN 14080	19.2	N/mm <sup>2</sup>
Tensile strength rectangular acc. to EN 14080	0.5	N/mm <sup>2</sup>
Modulus of elasticity acc. to EN 14080	11500	N/mm <sup>2</sup>
Shear strength acc. to EN 14080	3.5	N/mm <sup>2</sup>
Shear modulus acc. to EN 14080	650	N/mm <sup>2</sup>
Dimensional deviation acc. to EN 14080	depending on geometrical dimensions	mm
Length	< 55	m
Width (min. - max.)	0.06 to 0.3	m
Height (min. - max.)	0.012 to 4	m
Gross density acc. to EN 14080	445	kg/m <sup>3</sup>
Surface quality (Possible characteristic features must be indicated)	n.r.	-
Risk class acc. to DIN 68800-3	4	-
Thermal conductivity acc. to EN 12664	0.12	W/mK
Specific heat capacity acc. to EN 12664	1.6	kJ/kgK
Calculation value for thermal conductivity	n.r.	W/mK
Water vapor diffusion equivalent air layer thickness acc. to ISO 12572	n.r.	m
Water vapour diffusion resistance factor acc. to ISO 12572	20 - 50	-
Formaldehyde emissions acc. to EN 14080	< E1	µg/m <sup>3</sup>

RUBNER glulam is manufactured in accordance with hEN 14080 from coniferous species, with priority being given to spruce, fir, pine, larch or Douglas fir. Other coniferous species are permissible but not typical.

RUBNER glulam is produced from kiln-dried coniferous wood with an average wood moisture content of around 10 % to 11 % at delivery. For bonding, only approved modern low-emission adhesives according to chapter 2.5 are used.

The mechanical characteristics of RUBNER glulam are in accordance with strength classes specified in hEN 14080. For determination of the technical specifications, the declarations of performance (DOP) in the currently valid versions apply. The dimensional tolerances are defined in accordance with hEN 14080 and *Glued Laminated Timber Data Sheet*.

RUBNER glulam is also produced in the form of wide cross-

sections with brick-bonded assembling of the single layers. The products are manufactured in domestic visual quality, visual quality or industrial quality according to *Glued Laminated Timber Data Sheet*.

Use of preventive chemical wood preservatives in accordance with *DIN 68800-3* is unusual and permitted only if other preservative measures given in *DIN 68800-2* are not sufficient on their own.

## 2.4 Delivery status

RUBNER glulam is produced with the dimensions according to chapter 2.3 and is delivered in accordance with *Glued Laminated Timber Data Sheet* in domestic visual quality, visual quality or industrial quality. The tolerances according to *EN 14080* are met.

## 2.5 Base materials/Ancillary materials

RUBNER glulam comprises at least two unidirectional bonded kiln-dried coniferous boards/laminations according to *hEN 14081*.

The following types of adhesive systems are used for bonding the individual components (finger jointing and surface bonding):

- Melamine-urea-formaldehyde adhesives (MUF)
- Melamine adhesives
- Emulsion polymer isocyanate (EPI)

RUBNER glulam contains the following proportions of ingredients per m<sup>3</sup> on average:

- Coniferous wood (atro), mainly spruce approx. 88-90 %
- Water approx. 9-10 %
- Adhesive about 1 - 2.5 %, The proportions of the adhesives used are based on: About 40 % MUF, 20 % melamine and about 40 % EPI.

In addition, about 85 g/m<sup>2</sup> of water-based wood stain are applied. This corresponds to about 0.1 % of the product weight.

The product has an average density of 464 kg/m<sup>3</sup>.

This product/article/at least one partial article contains substances listed in the *candidate list* (date: 17.01.2023) exceeding 0.1 percentage by mass: **no**.

This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the *candidate list*, exceeding 0.1 percentage by mass: **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

RUBNER glulam is manufactured from sustainable sawn timber (PEFC, FSC) sourcing from sustainable forestry. Wet sawn timber is kiln dried to a moisture content of about 10 % and subsequently pre-planed. To ensure the characteristic values of the RUBNER glulam, all individual boards are visually- or machine-graded regarding strength and stiffness. Weak parts of planks, which reduce the strength and stiffness properties due to the natural growth characteristics of wood, are cut out depending on the grading class. The graded boards are subsequently bonded by finger jointing to endless laminations. These laminations with infinite length and a thickness up to 90 mm are subsequently planed and cut to the required length for further production. After applying the adhesive to the wide faces of boards/laminations, RUBNER glulam is pressed in a straight or curved press to at least 2-layer glulam blanks. After curing

the blanks are planed. If necessary, these single components are bonded together to composite beams with oversized final cross-section geometry. If necessary the blanks are cut to their final complex shapes. To ensure the product quality, a treatment with weathering or wood preservatives may be required for transport to the construction site, storage, and during assembly.

## 2.7 Environment and health during manufacturing

During production, there are no negative impacts on water and soil. The resulting process wastewater is fed into the local sewage system and cleaned according to legal regulations. The resulting exhaust air is cleaned according to the legal regulations.

Noise emissions from industrial plants are reduced by structural measures and comply with the legal requirements.

The manufacturing process applies to all production facilities covered by this EPD.

Two thirds of the production volume are produced in facilities with an environmental management system *ISO 14001* and a quality management system *ISO 9001* in place.

A third of the production volume is produced in facilities with an occupational health and safety management system *OHSAS 18001*.

The employee protection in the manufacturing process complies with the respective country-specific requirements, employees are provided with personal protective equipment.

## 2.8 Product processing/Installation

RUBNER glulam can be processed with commercially available tools. The instructions for occupational safety/assembly are to be observed.

## 2.9 Packaging

Polyethylene foils and polypropylene film are used in small quantities during transportation.

## 2.10 Condition of use

The composition of RUBNER glulam corresponds to the composition according to Section 2.5 for the entire period of use.

## 2.11 Environment and health during use

Environmental protection: According to current knowledge, the intended use of RUBNER glulam does not present any hazards or impairments to water, air and soil.

Health protection: Under normal conditions of use, RUBNER glulam is not expected to cause any damage or impairments to health.

RUBNER glulam subsequently releases formaldehyde during life cycle.

RUBNER glulam bonded with PU and EPI based adhesives has formaldehyde emission values in the range of the untreated raw material wood (sawn timber, by 0.004 ml/m<sup>3</sup>, Meyer, 1994).

RUBNER glulam bonded with MUF or PRF based adhesives has low emissions of formaldehyde, due to the low level of adhesive in its internal structure and due to its particular use. Measured against the limit value of 0.1 ml/m<sup>3</sup> (0.124 mg/m<sup>3</sup>) of the Reach Regulation 1907/2006/EG, the measured values in accordance with *EN 717-1* can be classified as low. Rubner glulam with melamine-based adhesive systems (MUF, PRF) gives an average emission in the range of 0.01 to 0.02 mg/m<sup>3</sup> (Prüfbericht PB/2117078/CT/2021/4/A1). In individual cases, they can amount to about 0.04 mg/m<sup>3</sup>.

## 2.12 Reference service life

Glulam has been used in structural timber construction for more than 100 years. When used as designated, no end of durability must be expected due to its natural durability (protection against moisture). When used as designated, the lifetime of RUBNER glulam is equal to the duration of use of the building.

## 2.13 Extraordinary effects

### Fire

RUBNER glulam is classified in accordance with 2005/610/EC and hEN 14080 as follows:

### Fire protection

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

### Water

No ingredients are washed out which could be hazardous to water.

### Mechanical destruction

The fracture behavior of RUBNER glulam is appearance typical for solid wood.

## 2.14 Re-use phase

In the event of selective de-construction, RUBNER glulam can easily be re-used after the end of the structures service life. The preferred use of RUBNER glulam is in the form of reuse based on the applicable country-specific requirements. If it is not re-used, it will be subjected to thermal utilization for the production of heat and electricity due to the high calorific value of approx. 16.5 MJ/kg (at a humidity of  $u = 12\%$ ) in compliance with the applicable country-specific requirements.

## 2.15 Disposal

If the residues are not used for any other cascading use, waste wood is disposed according to the applicable country-specific requirements. Disposal represents a possible but unusual case. RUBNER glulam is assigned to waste code 17 02 01 in the European list of waste 2014/955/EU. (Treated glued laminated timber is assigned to waste code 17 02 04).

## 2.16 Further information

More detailed information is available at: [www.rubner.com](http://www.rubner.com)

## 3. LCA: Calculation rules

### 3.1 Declared Unit

This EPD refers to a declared unit of 1 m<sup>3</sup> of glued laminated timber produced by the RUBNER group. The declared unit refers to an average density of 464 kg/m<sup>3</sup> and a wood moisture at delivery of 10 %.

### Declared unit

Name	Value	Unit
Declared unit	1	m <sup>3</sup>
Gross density	464	kg/m <sup>3</sup>
Wood moisture at delivery	10	%

The analysed products represent an average of RUBNER glued laminated timber produced at the sites Rohrbach (AT), Brixen (IT) and Ober-Grafendorf (AT). It includes straight standard beams as well as 3D-beam components which are curved arbitrarily in space. As production amounts of both variants are balanced within the RUBNER group, the analysed average is considered a realistic representation.

The declared unit was calculated on a volume-weighted basis. This EPD refers to an average product manufactured at several sites. All products undergo the same processing steps. A possible variability is only expected due to the use of different wood species. The upstream chain for spruce is considered representative. The robustness of the declared LCA values can thus be classified as high.

Brixen and Ober-Grafendorf do not only produce glued laminated timber but also cross laminated and solid structural timber, respectively. The allocation of product-specific material and energy flows is based on physical relationships when possible. Where necessary, the allocation is based on the production volumes of each product line manufactured at the referring site.

### 3.2 System boundary

The life cycle assessment of average glued laminated timber produced by RUBNER 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 (lamellae, adhesive system, etc.) and the corresponding transports to the RUBNER production sites (Rohrbach, Ober-Grafendorf and Brixen). As the production site in Rohrbach delivers lamellae to the other RUBNER sites, resulting environmental impacts refer to RUBNER's specific production process including drying. Direct emissions from drying are based on worst-case approximations and are included in the study. Upstream emissions from the use of adhesive systems rely on supplier-specific data. RUBNER produces thermal energy in its own biomass boilers at the Rohrbach and Ober-Grafendorf sites, Brixen uses district heating from the municipal utilities. The Austrian sites are supplied with 100 % green electricity, Brixen is supplied with electricity from the Italian grid. Additionally all sites are provided by their own photovoltaic systems.

#### Module C1 | Deconstruction and demolition

After the removal of building components overlying the product, the joints can simply be loosened by screwing or sawing and lifted by cranes to the place of removal. Required energy demand can be neglected. The actual energy demand depends on the installation of the products and can therefore vary greatly in the building context.

#### 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.

#### 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 corresponding energy substitution potentials.

### 3.3 Estimates and assumptions

All assumptions are verified through detailed documentation and correspond to the best possible representation of reality based on the available data. Background data for wood logs refer to generic data for spruce logs in bark derived from *GaBi* database. Spruce represents the majority of wood processed at RUBNER. The used dataset represents an approximation for all other species.

Regional applicability of the used background data refers to average data under European or German conditions taken from the *GaBi* database. German data were used for the Austrian and Italian market whenever European or regionalised average data were not available.

Emissions from wood drying were included in the calculations according to *Rüter & Diederichs 2012*.

### 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. Cutoff 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. Environmental impacts of machines, plant and infrastructure were not included.

### 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*.

A large amount of the lamellae processed for glued laminated timber at group level is delivered of the RUBNER RHI located in Rohrbach. Thus, the supply chain for lamellae input is based on primary data.

The analysis of the major amount of adhesives used for glulam production is based on primary data from RUBNER's suppliers. Where necessary, this information was complemented with estimates ensuring the completeness of the component's representation in the LCA.

### 3.6 Data quality

Data collection is based on product-specific questionnaires. It follows an iterative process of clarifying questions via e-mail, telephone calls or in personal/web meetings. Intensive discussions between the RUBNER group and Daxner & Merl results 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 representation of the main raw materials used for the production of glued laminated timber is based on supplier-specific primary data (lamellae, adhesive systems) leading to a high data quality.

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 and are carefully chosen.

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

### 3.7 Period under review

Foreground data were collected in the 2022 production year, 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: Europe

### 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.

### 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 describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in product	208	kg C

### Installation into the building (A5)

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

Name	Value	Unit
Packaging (polypropylene)	0.298	kg
Packaging (polyethylene)	0.148	kg

The end-of-life scenario used in this LCA study is based on the following assumptions:

## End of life (C1-C4)

Name	Value	Unit
Energy recovery	464	kg

## Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Processing rate	100	%
Efficiency of power plant	68	%

The product reaches the end-of-waste status after removal from the building, transport to processing and chipping of the product. For the end of life of the glued laminated timber product, energy recovery as secondary fuel in a biomass power plant is assumed. As the main sales market for the solid wood products is concentrated in the European region, plant-specific characteristic values correspond to a European average scenario (EU). 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. At the end of life of the product, the equilibrium moisture is comparable to the moisture content at delivery. This value can vary depending on the storage of the product before energy recovery.

## 5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m<sup>3</sup> of glued laminated timber produced by the RUBNER group (464 kg/m<sup>3</sup>).

### DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = 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 m<sup>3</sup> glued laminated timber (464 kg/m<sup>3</sup>)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Global Warming Potential total (GWP-total)	kg CO <sub>2</sub> eq	-6.87E+02	0	1.47E+00	7.71E+02	0	-4.16E+02
Global Warming Potential fossil fuels (GWP-fossil)	kg CO <sub>2</sub> eq	7.62E+01	0	1.4E+00	3.42E+00	0	-3.85E+02
Global Warming Potential biogenic (GWP-biogenic)	kg CO <sub>2</sub> eq	-7.63E+02	0	6.09E-02	7.67E+02	0	-3.06E+01
Global Warming Potential luluc (GWP-luluc)	kg CO <sub>2</sub> eq	2.56E-01	0	9.39E-03	7.24E-04	0	-4.61E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	2.57E-09	0	1.37E-13	5.01E-11	0	-2.98E-09
Acidification potential of land and water (AP)	mol H <sup>+</sup> eq	6.5E-01	0	4.65E-03	7.52E-03	0	3.19E-01
Eutrophication potential aquatic freshwater (EP-freshwater)	kg P eq	3.99E-03	0	4.98E-06	9.99E-06	0	-6.02E-04
Eutrophication potential aquatic marine (EP-marine)	kg N eq	2.61E-01	0	2.13E-03	1.69E-03	0	6.92E-02
Eutrophication potential terrestrial (EP-terrestrial)	mol N eq	2.3E+00	0	2.38E-02	1.77E-02	0	8.2E-01
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	7.77E-01	0	4.18E-03	4.56E-03	0	2.94E-01
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	4.21E-05	0	1.4E-07	9.33E-07	0	-6.4E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	1.05E+03	0	1.83E+01	6.21E+01	0	-6.66E+03
Water use (WDP)	m <sup>3</sup> world eq deprived	2.51E+01	0	1.56E-02	7.81E-01	0	-2.19E+01

### RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m<sup>3</sup> glued laminated timber (464 kg/m<sup>3</sup>)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier (PERE)	MJ	4.08E+03	0	1.27E+00	7.71E+03	0	-2.06E+03
Renewable primary energy resources as material utilization (PERM)	MJ	7.67E+03	0	0	-7.67E+03	0	0
Total use of renewable primary energy resources (PERT)	MJ	1.18E+04	0	1.27E+00	3.45E+01	0	-2.06E+03
Non renewable primary energy as energy carrier (PENRE)	MJ	9.06E+02	0	1.84E+01	1.92E+02	0	-6.67E+03
Non renewable primary energy as material utilization (PENRM)	MJ	1.49E+02	0	0	-1.3E+02	0	0
Total use of non renewable primary energy resources (PENRT)	MJ	1.06E+03	0	1.84E+01	6.22E+01	0	-6.67E+03
Use of secondary material (SM)	kg	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	7.67E+03
Use of non renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	1.3E+02
Use of net fresh water (FW)	m <sup>3</sup>	1.09E+00	0	1.46E-03	3.29E-02	0	-1.4E+00

### RESULTS OF THE LCA - WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m<sup>3</sup> glued laminated timber (464 kg/m<sup>3</sup>)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	4.27E-07	0	9.71E-11	5.37E-09	0	-8.25E-07
Non hazardous waste disposed (NHWD)	kg	3.54E+00	0	2.99E-03	4.68E-02	0	2.31E-01
Radioactive waste disposed (RWD)	kg	1.88E-02	0	3.41E-05	9.93E-03	0	-5.9E-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	4.64E+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 m<sup>3</sup> glued laminated timber (464 kg/m<sup>3</sup>)

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 lowdose 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, from 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

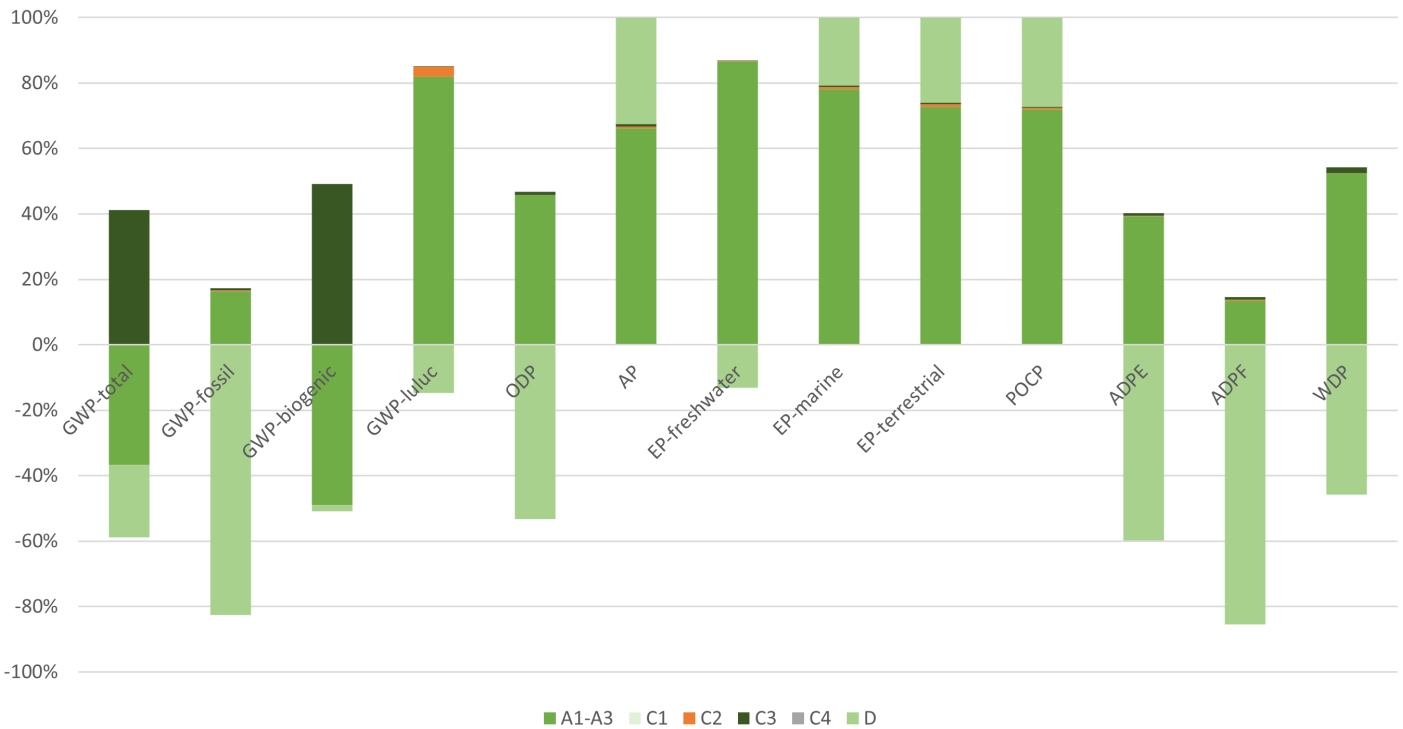
The following interpretation contains a summary of the LCA results referenced to a declared unit of 1 m<sup>3</sup> of glued laminated timber.

The global warming potential (**GWP**) of glued laminated timber shows negative values in the production phase (modules A1–A3). These negative impacts results from the use of wood as raw material. Wood sequesters biogenic carbon during tree growth. The sequestered carbon does not contribute to global warming as long as it is stored in the biomass.

After its use in the building, the product is assumed to be incinerated in a biomass power plant. As a result, the incorporated carbon is emitted again to the atmosphere representing biogenic carbon dioxide emissions (module C3).

The negative values in the end-of-life (module D) result from the energetic treatment of the product. As the energy produced at the biomass power plant can substitute (mainly fossil) fuels, an environmental net benefit is generated.

Hot-spot analysis of RUBNER glued laminated timber



Potential global warming (**GWP**) due to the production of Rubner glulam mainly stems from the provision of round wood and associated impacts due to forestry. The processing of the products includes the use of all wooden residues for heat production. Its thermal treatment is taken into account as

carbon neutral, as the wood is derived from sustainably managed forests.

What's more, the electricity demand at the Italian production site (mainly fossil fuels in the Italian residual mix) and the

production of the adhesive system represent main drivers of global warming potential.

Due to the use of green electricity in the production sites of Rohrbach and Ober-Grafendorf, the external supply of electricity at the sites represents a minor factor in the environmental profile of the product.

The presented results are considered to be representative for all RUBNER production sites. It refers to an average product based on the weighted production volumes of each site.

The results of the previous EPD (EPD-RUB-20180058-IBB1-EN) are not directly comparable with the present updated version due to the update of the underlying methodology according to *EN 15804+A2*.

## 7. Requisite evidence

The following evidence of environmental and health relevance was provided.

### 7.1 Formaldehyde

The emissions (melamine-based adhesive systems) listed in section 2.11 are based on test results of emission measurements in accordance with *EN 717-1* at a temperature of 23 °C, a relative humidity of 45 % and an air change rate of 1.0 per hour. Within the framework of the tests, the adhesives were investigated in combination with the types of wood species. The test results all meet the requirements of emission class E1 according to *hEN 14080: 2013* of 0.124 mg/m<sup>3</sup>.

One test report (No 16F6001, 2016) defines a formaldehyde emission of 0.01 mg/m<sup>3</sup> for Rubner glulam with melamine-based adhesive.

One test report (E-CMP / KT T410 405, 2016) defines a formaldehyde emission depending on the wood species with 0.022 mg/m<sup>3</sup> for spruce, 0.037 mg/m<sup>3</sup> for pine, 0.010 mg/m<sup>3</sup> for larch and 0.007 mg/m<sup>3</sup> for Douglas fir for Rubner glulam with melamine-based adhesive.

One test report in accordance with *EN 717-1* (2117078/CT/2021/4/A1, 2021) defines a formaldehyde emission confirms a formaldehyde emission below the technical detection limit.

There is a test report for proof of occupational exposure (according to *EN 689* (date 31. 3. 2016), the maximum allowed workplace concentration of 0.246 mg/m<sup>3</sup> is significantly higher than two measurements with 0.0075 and 0.086 mg/m<sup>3</sup> have shown.

There is a test report for proof of occupational exposure (according to *EN 689* (date 8. 8 2022), the maximum allowed workplace concentration of 0.369 mg/m<sup>3</sup> is significantly higher than the measured with concentration of 0.12 mg/m<sup>3</sup> have shown.

For RUBNER glulam glued with EPI adhesives, according to the manufacturer of the glue, no formaldehyde is added to the glulam system via the adhesive; the emissions are in the range of natural wood.

### 7.2 MDI

When gluing RUBNER glulam with MDI-based adhesive, the contained MDI will react completely. Thus, a MDI emission from the finished Rubner glulam is not possible. As there is no standardised measurement process defined in test standards, no test reports are available.

For the verification of the workplace concentration of MDI (acc. to *EN 689*), a test report is available (date 8.8 2022), the maximum allowed workplace concentration of 0.005 mg/m<sup>3</sup> is significantly higher than a measurement with <0.0005 mg/m<sup>3</sup> has shown.

### 7.3 Fire gas toxicity

Due to the heterogeneous structure of glued laminated timber, combined with the non-applicability of the test standard *DIN 53436*, no relevant measurement results are available, the test specimen geometry is not able to represent the real gas composition for a representative cross-section.

### 7.4 VOC emissions

For the verification of VOC emissions, a test report (51005-001 (III), 2016) of an emission analysis according to *AgBB-Scheme 2015* is available. Analysis was performed in accordance with *ISO 16000-3* and *ISO 16000-6*.

Additionally a test report (PB/2117078/CT/1, 2021) of an emission analysis according to *AgBB-Scheme 2018* is available. Analysis was performed in accordance with *DIN EN 16516*.

### VOC emissions

Name	Value	Unit
Overview of Results (28 days)	-	µg/m <sup>3</sup>
TVOC (C6 - C16) acc. to AgBB 2018	125	µg/m <sup>3</sup>
Sum SVOC (C16 - C22) acc. to AgBB 2015	< 5	µg/m <sup>3</sup>
R (dimensionless) acc. to AgBB 2018	0,18	-
VOC without NIK acc. to AgBB 2015	<5	µg/m <sup>3</sup>
Carcinogenic Substances	<1	µg/m <sup>3</sup>

## 8. References

### Standards

#### DIN 53436

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

#### DIN 68800-2

DIN 68800-2:2012-02, Wood preservation – Part 2: Preventive constructional measures in buildings.

#### DIN 68800-3

DIN 68800-3:2012-02, Wood preservation – Part 3: Preventive protection of wood with wood preservatives.

#### EN 689

EN 689:1995, Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy.

#### EN 717-1

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

#### EN 1912

EN 1912:2013-10-15, Structural timber - Strength classes - Assignment of visual grades and species.

## EN 12664

EN 12664:2001, Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products with medium and low thermal resistance.

## EN 15804

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

## hEN 14080

hEN 14080:2013, Timber structures — Glued laminated timber and glued solid timber — Requirements.

## hEN 14081

hEN 14081-1:2016-06-01, Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.

## ISO 9001

EN ISO 9001:2015, Qualitätsmanagementsysteme - Anforderungen.

## ISO 12572

EN ISO 12572:2016, Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method.

## ISO 14001

EN ISO 14001:2015, Environmental management systems - Requirements with guidance for use.

## ISO 14025

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

## ISO 14044

DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines.

## ISO 16000-3

ISO 16000-3:2011, Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air - Active sampling method.

## ISO 16000-6

ISO 16000-6:2011, Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID.

## OHSAS 18001

OHSAS 18001:2018, Occupational Health- and Safety Assessment Series.

## Further references

### AgBB-Scheme 2015

German Committee for Health Related Evaluation of Building Products (AgBB): Approach to health assessment of emissions of volatile organic compounds (VOCs and SVOCs) from building products.

### Candidate List

List of substances of very high concern considered for approval (status 17.01.2023) according to Article 59 para. 10 of the

REACH Regulation. European Chemicals Agency.

## GaBi

GaBi 10, Software-System and Database for Life Cycle Engineering. 2022.2. Stuttgart, Echterdingen: Sphera, 1992-2022. Available at: <https://sphera.com/product-sustainability-gabi-data-search/>

## Glued Laminated Timber Data Sheet

(BS-Holz-Merkblatt), der Studiengemeinschaft Holzleimbau e.V., 2019 (in German).

## IBU 2021

Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V. (IBU). Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021. [www.ibuepd.com](http://www.ibuepd.com)

## Meyer, 1994

Meyer, B, Boehme, C: 1994, Formaldehydabgabe von natürlich gewachsenem Holz, Holzzentralblatt 122 (Formaldehyd release of naturally grown wood), S 1969-1972.

## Ordinance on Biocide Products

Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

## PCR part A

Product category rules for building-related products and services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019. Version 1.3. Berlin: Institut Bauen und Umwelt e.V., 2022.

## PCR: Solid wood products

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

## PCR 305/2011 (EU)

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

## Rüter & Diederichs 2012

Ökobilanz-Basisdaten für Bauprodukte aus Holz. Work report from the Institut für Holztechnologie und Holzbiologie Nr. 2012/1. Hamburg: Johann Heinrich von Thünen-Institut.

## 2005/610/EG

2005/610/EG, COMMISSION DECISION of 9 August 2005 establishing the classes of reaction-to-fire performance for certain construction products.

## 2014/955/EU

2014/955/EU, COMMISSION DECISION of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council.

## 1907/2006/EG

VERORDNUNG (EG) Nr. 1907/2006 DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 18. Dezember 2006 zur Registrierung, Bewertung, Zulassung und Beschränkung chemischer Stoffe (REACH).



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