ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	Rubner Holding AG - S.p.A.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
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Glued laminated timber – Brettschichtholz

Rubner Holding AG - S.p.A.

Institut Bauen und Umwelt e.V.

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ECO PLATFORM EPD EN 15804 VERIFIED

1. General Information

Rubner Holding AG - S.p.A.	Glued laminated timber
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** Rubner Holding AG - S.p.A. Handwerkerzone 2 - Zona Artigianale 39030 Kiens - Chienes Italy
Declaration number EPD-RUB-20180058-IBB1-EN	**Declared product / Declared unit** 1 m³ of glued laminated timber [glulam]
This Declaration is based on the Product Category Rules: Solid wood products, 07.2014 (PCR tested and approved by the SVR)	**Scope:** This EPD is based on a declared unit of 1 m³ of glued laminated timber (moisture of 10% at a raw density of 464 kg/m³). 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), Brixen (Italy) and Calitri (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.
Issue date 11.06.2018	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Valid to 10.06.2023	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Dr. Burkhart Lehmann (Managing Director IBU)	Matthias Schulz (Independent verifier appointed by SVR)

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 EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 /CPR/ 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 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 24 h 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/mm²
Compressive strength parallel acc. to /EN 14080/	24	N/mm²
Compressive strength rectangular acc. to /EN 14080/	2.5	N/mm²
Tensile strength parallel acc. to /EN 14080/	19.2	N/mm²
Tensile strength rectangular acc. to /EN 14080/	0.5	N/mm²
Modulus of elasticity acc. to /EN 14080/	11500	N/mm²
Shear strength acc. to /EN 14080/	3.5	N/mm²
Shear modulus acc. to /EN 14080/	650	N/mm²
Dimensional deviation acc. to /EN 14080/	depending on geometrical dimensions	mm
Length (min. - max.)	0 to >50	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/m³
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 /EN ISO 12572/	n.r.	m
Water vapour diffusion resistance factor acc. to /EN ISO 12572/	20 - 50	-

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: 2013/ 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 m³ 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/m² 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/m³.

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 wood 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 and 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/m³, /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/m³ (0.124 mg/m³) 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/m³. In individual cases, they can amount to about 0.04 mg/m³.

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 reused, 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

3. LCA: Calculation rules

3.1 Declared Unit
This EPD refers to a declared unit of 1 m³ of glued laminated timber produced by the Rubner group. The declared unit refers to an average density of 464 kg/m³ and a wood moisture at delivery of 10%.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	464	kg/m^3
Wood moisture at delivery	10	%
Conversion factor to 1 kg	0.002155	-

The analysed products represent an average of Rubner glued laminated timber produced at the sites Rohrbach (AT), Brixen (IT), Calitri (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.
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 with options. The following lifecycle phases are taken into consideration in the analysis:

Module A1–A3 | Product stage
The product stage includes upstream burdens of raw materials (lamellae, adhesive system, etc.) and the corresponding transports to the Rubner production sites (Rohrbach, Ober-Grafendorf, Brixen and Calitri). 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 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. Electricity is provided by the regional electricity grid and Rubner's photovoltaic systems.

Module C3 | Waste treatment
Module C3 declares the release of biogenic carbon bound in the wooden products. During the energetic recovery at end of life, biogenic carbon dioxide is emitted.

Module D | Credits and loads beyond the system boundary
Module D refers to the energetic recovery of Rubner products at their end of life. It includes the resulting emissions (excluding biogenic carbon declared in C3) as well as the substitution of electricity and thermal energy due to the energetic recovery (European average scenario).

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.

3.4 Cut-off criteria

All inputs and outputs for which data are available are included in the LCA model. Data gaps are filled with conservative assumptions from average data (when available) or with generic data and are documented accordingly. Only data with a contribution of less than 1 % were cut off. Ignoring such data is justified based on the insignificance of the expected effect. Processes, materials or emissions known to make a significant contribution to the environmental effects of the products under examination have not been neglected. It is assumed that the data have been completely recorded and that the overall total of ignored input flows do not amount to more than 5 % of the total energy and mass flows. Environmental impacts of machines, plant and infrastructure were not included.

3.5 Background data

Secondary data are used to depict the background system in the LCA model. These data originate from the /GaBi 8/ database developed by thinkstep AG.
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 clarifying questions via e-mail, telephone calls or in personal 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. Due to a lack of primary data concerning the emissions from chamber and channel drying of fresh wood, this study refers to the data published by /Rüter & Diederichs 2012/.
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.

3.7 Period under review

Foreground data were collected in the 2016 production year, and the data are based on the volumes produced on annual basis.

3.8 Allocation

The life cycle assessment considers the material inherent properties of wood (carbon content and primary energy content) and relies on its physical relations. Allocation of the forestry processes is based on published background data by /Hasch 2002/ and its update by /Rüter & Albrecht 2007/.

3.9 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.

4. LCA: Scenarios and additional technical information

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 [moisture of 12%]	472	kg

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

Name	Value	Unit
Moisture at thermal treatment	12	%
Processing rate	100	%
Efficiency of power plant	68	%

The product reaches the end-of-waste state after deconstruction from the building. At its end-of-life, the product is considered a secondary fuel as the end-of-life scenario is based on the energetic treatment of the product. Therefore, the product is incinerated in a biomass power plant. Due to the product placement on the European market, the power plant's specifications refer to a European average. The scenario includes a recycling rate of 100% after deconstruction of the building. This assumption needs to be case specific adjustment in the building context.
At end of life the product reaches an equilibrium moisture of 12%. This value may vary significantly depending on case specific storage conditions.

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m³ of glued laminated timber produced by the Rubner group.

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

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	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m³ glued laminated timber

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	-6.46E+2	7.67E+2	-4.12E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.56E-5	0.00E+0	-1.08E-9
Acidification potential of land and water	[kg SO_2-Eq.]	8.40E-1	0.00E+0	4.77E-1
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.70E-1	0.00E+0	1.29E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.03E-1	0.00E+0	8.97E-2
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.01E-4	0.00E+0	-1.40E-4
Abiotic depletion potential for fossil resources	[MJ]	1.34E+3	0.00E+0	-5.52E+3

RESULTS OF THE LCA - RESOURCE USE: 1 m³ glued laminated timber

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	3.65E+3	0.00E+0	-1.71E+3
Renewable primary energy resources as material utilization	[MJ]	7.67E+3	-7.67E+3	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.13E+4	-7.67E+3	-1.71E+3
Non-renewable primary energy as energy carrier	[MJ]	1.37E+3	0.00E+0	-7.42E+3
Non-renewable primary energy as material utilization	[MJ]	1.30E+2	-1.30E+2	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.50E+3	-1.30E+2	-7.42E+3
Use of secondary material	[kg]	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	7.67E+3
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	1.30E+2
Use of net fresh water	[m³]	2.49E+0	0.00E+0	-1.73E+0

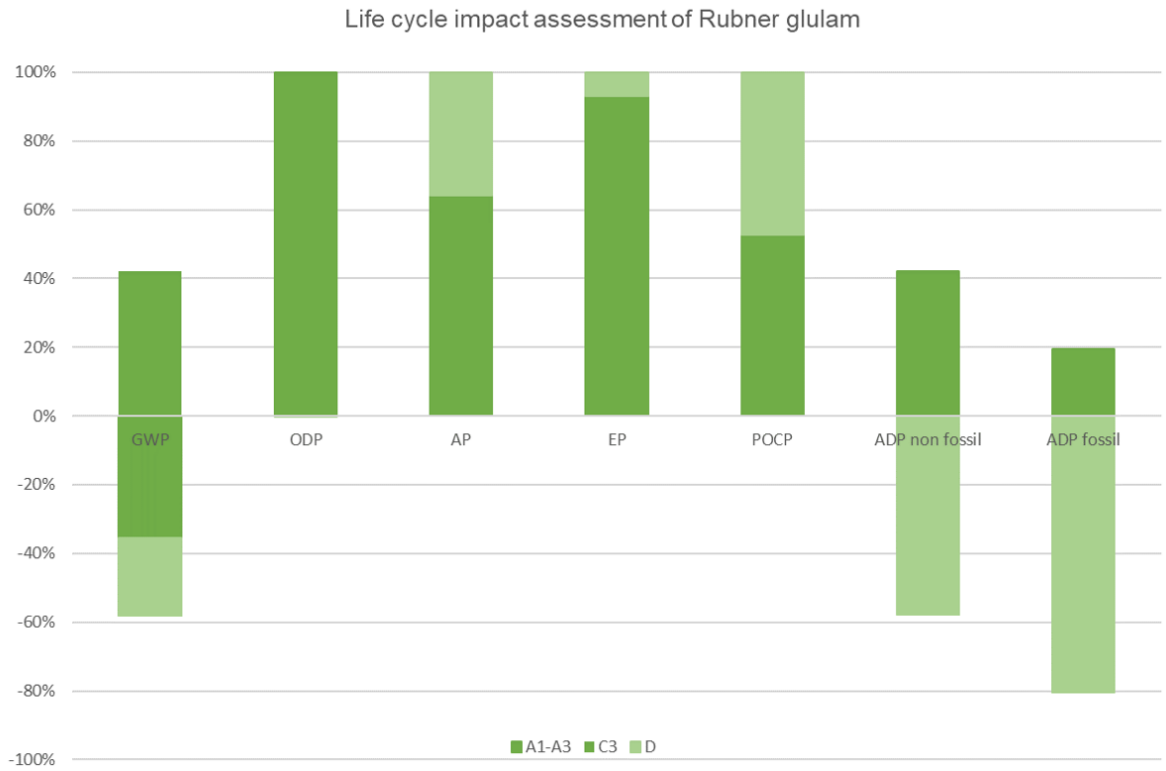
RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ glued laminated timber

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	3.68E-5	0.00E+0	2.21E-6
Non-hazardous waste disposed	[kg]	3.84E+0	0.00E+0	1.71E-1
Radioactive waste disposed	[kg]	5.16E-2	0.00E+0	-7.55E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	4.64E+2	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a functional unit of 1 m³ of glued laminated timber.

The global warming potential (**GWP**) of glued laminated timber shows negative values in the production phase (module 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.



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 production sites as well as the production of the adhesive system represent main drivers of global warming potential. Also the use of fossil resources (**ADP fossil**) is mainly determined by electricity use (mainly fossil fuels in the Italian grid mix). The electricity generated from photovoltaic at some sites of Rubner represents an important factor for non fossil resource use (**ADP non fossil**).

Acidification (**AP**) and eutrophication potential (**EP**) mainly results from the forestry processes for roundwood provision as well as emissions of the heat production for the drying of the lamellae. Beyond that, the emissions (esp. nitrous oxides and sulphur dioxide) of the thermal treatment of wooden residues at the production sites account for acidification and eutrophication as well.

Direct emissions from drying of lamellae as well as the heat provision for the drying chamber and channels represent key drivers of the formation potential of tropospheric ozone (**POCP**).

The stated results for stratospheric ozone depletion (**ODP**) are not representative for the product itself, as some flows in the background data aggregated to represent environmental impacts of the adhesive system blurry the given results.

Primary energy from renewables (**PERE**) is mainly used as material input (wood) as well as for energy provision (Austrian grid mix and thermal energy from biomass).
Non renewable primary energy (**PENRE**) input mainly refers to the share of fossil fuels in the Italian electricity grid mix and the upstream forestry processes.

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. Given average results may be recalculated for product-specific applications based on the mass of the declared unit.

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/m³.
One test report (No 16F6001, 2016) defines a formaldehyde emission of 0.01 mg/m³ 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/m³ for spruce, 0.037 mg/m³ for pine, 0.010 mg/m³ for larch and 0.007 mg/m³ for Douglas fir for Rubner glulam with melamine-based adhesive.
There is a test report for proof of occupational exposure (according to /EN 689/ (date 31. March2016), the maximum allowed workplace concentration of 0.246 mg/m³ is significantly higher than two measurements with 0.0075 and 0.086 mg/m³ 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 31. March 2016), the maximum allowed workplace concentration of 0.005 mg/m³ is significantly higher than a measurement with <0.0005 mg/m³ 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/.

VOC emissions

Name	Value	Unit
Overview of Results (28 days)	-	µg/m³
TVOC (C6 - C16) acc. to /AgBB 2015/	70	µg/m³
Sum SVOC (C16 - C22) acc. to /AgBB 2015/	< 5	µg/m³
R (dimensionless) acc. to /AgBB 2015/	0.17	-
VOC without NIK acc. to /AgBB 2015/	<5	µg/m³
Carcinogenic Substances	<1	µg/m³

8. References

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin (pub.): Generation of Environmental Product Declarations (EPDs);
General Principles
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www.ibu-epd.de

/ISO 14025/
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