ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	**Studiengemeinschaft Holzleimbau e.V.**
Publisher	Institut Bauen und Umwelt (IBU)
Programme holder	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-SHL-2012211-EN
Issue date	20.09.2014
Validity	19.09.2015

Cross-laminated timber (X-Lam)

Studiengemeinschaft Holzleimbau e.V.

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com

BSP Holz

1 General information

Studiengemeinschaft Holzleimbau e.V.	Cross-laminated timber (X-Lam)
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 D-10178 Berlin	**Holder of the Declaration** Studiengemeinschaft Holzleimbau e.V. Elfriede-Stremmel-Straße 69 D-42369 Wuppertal
Declaration number EPD-SHL-2012211-EN	**Declared product/unit** 1m³ cross-laminated timber
This Declaration is based on the Product Category Rules: PCR Part B Solid Wood, 2011-06 (PCR examined and approved by the independent Expert Committee, SVA)	**Area of applicability:** In Germany, approx. 50,000 m³ of cross-laminated timber were manufactured in 2009, of which 100% was accounted for by members of Studiengemeinschaft Holzleimbau e.V. The contents of this Declaration are based on information from 90% of the members, whereby the technology presented here is representative for all members.
Issue date 20.09.2014	**Verification** The CEN DIN EN 15804 standard serves as the core PCR.
Valid to 19.09.2015	Verification of the EPD by an independent third party in accordance with ISO 14025 ☐ internal ☒ external

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of the Expert Committee (SVA))

Dr. Frank Werner
(Independent auditor appointed by the SVA)

2 Product

2.1 Product description

Cross-laminated timber (X-Lam) is an industrially-manufactured plane timber product for load-bearing purposes. It is used as plate or panel elements. Cross-laminated timber generally displays a symmetrical layup and comprises at least three layers of coniferous timber glued at right angles. Please refer to the manufacturer-specific approvals for further details on cross-sectional layups.

Owing to their crosswise structure, cross-laminated timber elements are very dimensionally stable on the one hand and can also transfer loads both lengthwise and transverse to the main load-bearing direction.

2.2 Application

X-Lam is used as load-bearing components in structural engineering and bridge construction.

2.3 Technical data

X-Lam is manufactured from spruce, fir, pine, larch or Douglas fir. Other coniferous woods are permissible, albeit not typical.

Adhesives in accordance with 2.6 are used for gluing.

X-Lam is manufactured with a maximum moisture content of 15%.

X-Lam is manufactured in sizes as per 2.5 and manufacturer-specific dimensional tolerances.

The building component’s mechanical resistance at normal temperature and resistance to fire are dependent on the properties of the layers, cross-sectional layup, static system and load distribution. Mechanical resistance and resistance to fire must be established for the respective building in accordance with the applicable design rules.

X-Lam is supplied in various manufacturer-specific surface qualities.

X-Lam can be used in service classes 1 or 2 in accordance with DIN 1052: 2008, *Design of timber structures - General rules and rules for buildings*, or DIN EN 1995-1-1: 2010, *Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.*

The use of a preservative treatment in accordance with DIN 68800-3:2012-02, *Wood preservation - Part 3: Preventive protection of wood with wood preservatives* is not typical as in most cases, preventive constructional measures in accordance with DIN 68800-2:2012-02, *Wood preservation - Part 2: Preventive constructional measures in buildings* are sufficient.

2.4 Placing on the market / Application rules

The products are subject to the manufacturer-specific technical approvals (abZ) of the Deutsches

Institut für Bautechnik or European technical approvals (ETAs) which contain information on manufacturing, quality control and marking as well as the product features and design.

2.5 Delivery status

The products can be manufactured in the following sizes. The permissible sizes can vary depending on the manufacturer and the respective abZ or ETA:

Min. thickness: 51 mm

Max. thickness: 500 mm (standard thickness to 300 mm)

Max. width 2.95 m – 4.80 m

Max. length 16 m – 20 m

2.6 Base materials / Auxiliaries

X-Lam comprises at least three layers of kiln-dried coniferous wood boards or plank laminations glued together crosswise. Polyurethane (PUR) or melamine-urea-formaldehyde adhesives (MUF) are used for basic duroplastic gluing as well as smaller quantities of emulsion-polymer-isocyanate (EPI) adhesives.

The percentage averages of ingredients per cubic metre of X-Lam established for the Environmental Product Declaration:

- Coniferous wood, primarily spruce: approx. 87.5%
- Water: approx. 10.5%
- PUR adhesives: approx. 0.5%
- MUF adhesives: approx. 1.4%
- EPI adhesives: approx. 0.1%

The product has an average gross density of 491.65 kg/m³.

2.7 Manufacture

The manufacture of X-Lam involves drying coniferous boards and timbers to less than 15% moisture content, followed by pre-planing and visual or machine-strength grading. Board sections identified as having strength-reduced areas are removed depending on the requisite strength class and the ensuing board sections jointed by finger-joints to form lamellas of infinite length.

During the subsequent pre-planing process, the lamellas are planed on four sides to thicknesses ranging from 17 mm to 45 mm. Some manufacturers use edge gluing to glue the lamellas to form a single-layered solid wood panel.

If the X-Lam manufacturer produces single-layered solid wood panels first, they are planed after hardening, glued and then arranged crosswise in the press.

Manufacturers working without edge gluing directly arrange the lamellas crosswise in the press.

Depending on the manufacturer, individual layers can be manufactured from wood-based panels which can be jointed.

After pressing and hardening, the blank is planed, bevelled, bound and packed. Preservative treatment is possible if necessary.

2.8 Environment and health during manufacturing

Waste air generated during production is cleaned in accordance with statutory specifications. Water and soil do not incur any pollution. The process waste water incurred is fed into the local waste water system. Noise-intensive machinery is encapsulated accordingly by way of structural measures.

2.9 Product processing / Installation

X-Lam can be processed using the standard tools suitable for processing solid wood.

The information concerning industrial safety must also be observed during processing/assembly.

2.10 Packaging

Polyethylene foils are used.

2.11 Condition of use

Composition for the period of use complies with the compilation of base materials in accordance with section 2.6. "Base materials".

During usage, around 216 kg of carbon are bound in the product. This complies with approx. 789 kg of CO_2.for full oxidation.

2.12 Environment and health during use

Environmental protection: In accordance with the current state of knowledge, no hazards are incurred for water, air or soil when the products are used as designated.
Health protection: In accordance with the current state of knowledge, no damage to or impairments of health are to be anticipated.
With regard to formaldehyde, X-Lam is low-emission thanks to its adhesive content, structure and form of use.

X-Lam glued with PUR or EPI adhesives displays formaldehyde emission values in the range of natural wood (around 0.004 ml/m³). MDI emissions by X-Lam glued with PUR or EPI adhesives can not be measured within the framework of the detection limit of 0.05 µg/m³. On account of the high reactivity of MDI towards water (air and wood moisture), it can be assumed that X-Lam glued this way already displays MDI emissions in the zero-value range shortly after manufacture.

X-Lam glued with MUF adhesives emits formaldehyde subsequently. Measured at the limit value of 0.1 ml/m³ of the Chemical Restriction Regulation, the values can be classified as low after testing (DIN EN 717-1). Average emissions are 0.04 ml/m³. In individual cases, they can account for approx. 0.06 ml/m³.

2.13 Reference service life

X-Lam complies with glued laminated timber in terms of its components and manufacturing process. Glued laminated timber has been used for more than 100 years. When used as designated, there is no known or anticipated limit to its durability.

The service life of X-Lam is therefore in line with the service life of the respective building when used as designated.

2.14 Extraordinary effects

Fire

- Fire class D in accordance with DIN EN 13501-1
- Smoke class s2 – normal smoke development
- d0 – non-dripping

- The toxicity of combustion gases complies with that of natural wood.

Water

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

Mechanical destruction

X-Lam breakage features display an appearance which is typical for solid wood.

2.15 Re-use phase

In the event of selective rebuilding after the end of the usage phase, X-Lam can be easily re-used.

If X-Lam can not be recycled, it is directed towards thermal recycling for generating process heat and electricity on account of its high calorific value of approx. 19 MJ/kg.

In the case of energetic recycling, the requirements outlined in the German Pollution Act must be observed. In accordance with Annex III of the directive governing requirements on recycling and disposing of waste wood (Waste Wood Act) dated 15.08.2002, untreated X-Lam is allocated to waste key 17 02 01 (depending on the type of wood protection agent used, treated X-Lam is allocated to waste key 17 02 04).

2.16 Disposal

Waste wood may not be used for landfilling in accordance with §9 of the Waste Wood Act (AltholzV).

2.17 Further information

More detailed information can be found at www.brettsperrholz.org.

3 LCA: Calculation rules

3.1 Declared unit

The declared unit under ecological review is one cubic metre of cross-laminated timber taking consideration of the mix of adhesives used as outlined in 2.6 and a mass of 491.65 kg/m³ with wood moisture of 12% which in turn complies with a water content of approx. 10.5%. Adhesives account for 2%.

3.2 System limit

The Declaration type conforms with an EPD "from cradle to factory gate with options". Contents include the stage of production, i.e. from the provision of raw materials to the production gate (cradle to gate, Modules A1 to A3), as well as parts of the end-of-life stage (Modules C2 to C4). Furthermore, the credits and encumbrances are considered over and beyond the product life cycle (Module D).

Module A1 analyses the provision of wood from forestry, the provision of additional modified wood products as well as the provision of adhesives. Transport of these materials is considered in Module A2. Module A3 comprises the provision of fuels, operating resources and electricity as well as the manufacturing processes on site. These essentially involve debarking, cutting, drying, planing and profiling processes, as well as gluing and packing the products.

Module C2 takes consideration of transport to the disposal company; Module C3 deals with preparing and sorting the waste wood; Module D analyses thermal recycling as well as the ensuing credits in the form of a system extension.

3.3 Estimates and assumptions

As a general rule, all material and energy flows for the processes required for production are established specifically on site. The emissions from combustion and other processes arising on site could only however be estimated on the basis of literary references. All other data is based on average values. Detailed information on all estimates and assumptions made can be referenced in (S. Rüter, S. Diederichs: 2012).

3.4 Cut-off criteria

The choice of material and energy flows considered depends on their use of renewable and non-renewable primary energy per unit process. A decision on the flows to be observed is the result of existing studies for analysing wood products. At least those material and energy flows were assessed which account for 1% of the use of renewable or non-renewable primary energy, whereby the total sum of flows not considered is not greater than 5% of the indicators referred to. No material or energy flows already detected have been ignored which fell below the 1% limit.

The inputs and outputs arising from information provided by the company were examined for plausibility.

The expenses associated with providing the infrastructure (i.e. machinery, buildings etc.) for the entire primary system were not taken into consideration. This is based on the assumption that the total expenses associated with building and maintaining the infrastructure do not exceed the 1% of overall expenses referred to above. The energetic expenses in the form of heat and electricity required for operating the infrastructure were taken into consideration. Detailed information on the cut-off criteria can be found in (S. Rüter, S. Diederichs: 2012).

3.5 Background data

All background data has been taken from the GaBi Professional data base.

3.6 Data quality

With the exception of forest wood, the background data used for wooden raw materials for material and energetic use originates from the years 2008 to 2010. The power mix originates from 2009; the provision of forest wood was taken from a publication dated 2008 which is essentially based on information from the years 1994 to 1997. All other information was taken from the GaBi Professional data base which does not permit any exact containment of quality. As the essential information originates from highly-representative primary data surveys, the data quality can be rated as being very good.

3.7 Period under review

The data survey was performed over a period from 2009 to 2011, whereby data was established for the respective full calendar year. The data is therefore based on the years 2008 to 2010. Hence, all information is based on the data for 12 consecutive months.

3.8 Allocation

The allocations performed comply with the requirements outlined in EN 15804:2012 and are explained in detail in (S. Rüter, S. Diederichs: 2012). Essentially, the following system area extensions and allocations were performed.

General information

All properties inherent to materials were allocated in accordance with physical causalities; all other allocations were performed on an economic basis. An exception is presented by the allocation of heat required in heat and power combinations which were allocated on the basis of exergy of electricity and process heat products.

Module A1

- Forestry: Forestry expenses were allocated to logs and industrial wood on the basis of their prices.
- The provision of waste wood does not take consideration of any expenses from the previous life cycle.

Module A3

- Wood-processing industry: Expenses were allocated to the primary products and residuals on the basis of their prices.
- With the exception of wood-based materials, the waste incurred by disposal in production is based on a system extension. The heat and electricity generated are credited to the system via substitution processes. The credits achieved here are significantly less than 1% of the overall expenses.
- In the case of combined generation of heat and electricity, all firing expenses were allocated to these two products after exergy.
- The provision of waste wood does not take consideration of any expenses from the previous life cycle (analogue to Module A1).

Module D

The system area extension performed in Module D complies with an energetic recycling scenario for waste wood.

3.9 Comparability

As a general rule, EPD data can only be compared or evaluated when all of the data records to be compared have been drawn up in accordance with EN 15804:2012 and the building context or product-specific performance features are taken into consideration.

4 LCA: Scenarios and further technical information

End of life (C2-C4)

For energy recovery	Waste wood 491.65 kg

In the form of waste wood, the product is recycled at the end of the life cycle in the same composition as the declared unit described. 23% thermal recycling is assumed in a biomass power plant with a total supply level of 35% and combined heat and power efficiency of 35%, whereby one tonne of wood (atro) (with approx. 18% moisture), approx. 1231 kWh electricity and 2313 MJ useful heat are generated during incineration.

Reuse, recovery and recycling potential (D)

The exported energy substitutes fossil fuels, whereby it is alleged that the thermal energy was generated from natural gas, and the substituted electricity complies with the German power mix for 2009.

5 LCA: Results

SYSTEM LIMITS (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
Production stage			Building construction stage		Usage phase							Disposal stage				Credits and encumbrances outside the system limit
Provision of raw materials	Transport	Manufacture	Transport to the site	Installation in the building	Use / Application	Maintenance	Repairs	Substitution	Renewal	Energy used for operating the building	Water used for operating the building	Rebuilding / Demolition	Transport	Waste treatment	Landfilling	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X

LIFE CYCLE ASSESSMENT RESULTS - ENVIRONMENTAL EFFECTS: 1m³ X-Lam

Parameter	Unit	A1 (Production)	A2 (Production)	A3 (Production)	C2 (Disposal)	C3 (Disposal)	C4 (Disposal)	D (Credit)
GWP	[kg CO_2 equiv.]	-7.31E+02	7.23E+00	1.22E+02	4.45E-01	7.93E+02	0.00E+00	-3.60E+02
ODP	[kg CFC11 equiv.]	4.29E-06	7.71E-08	2.84E-05	8.89E-10	1.19E-06	0.00E+00	-8.23E-05
AP	[kg SO_2 equiv.]	2.41E-01	3.12E-02	4.00E-01	1.91E-03	6.98E-03	0.00E+00	-3.70E-01
EP	[kg PO_4^{3-} equiv.]	5.83E-02	7.10E-03	6.75E-02	4.42E-04	5.89E-04	0.00E+00	-3.55E-03
POCP	[kg ethene equiv.]	5.19E-02	3.18E-03	8.01E-02	2.07E-04	4.64E-04	0.00E+00	-2.48E-02
ADPE	[kg Sb equiv.]	4.97E-04	2.23E-07	1.19E-04	9.39E-09	1.23E-07	0.00E+00	-6.23E-06
ADPF	[MJ]	8.55E+02	1.00E+02	1.32E+03	6.28E+00	4.62E+01	0.00E+00	-4.05E+03

Legend: GWP = Global Warming Potential; ODP = Ozone Depletion Potential; AP = Acidification Potential; EP = Eutrification Potential; POCP Ozone Creation Potential; ADPE = Abiotic Depletion Potential for Non-fossil Resources; ADPF = Abiotic Depletion Potential for Fossil Fuels

LIFE CYCLE ASSESSMENT RESULTS - USE OF RESOURCES: 1m³ X-Lam

Parameter	Unit	A1 (Production)	A2 (Production)	A3 (Production)	C2 (Disposal)	C3 (Disposal)	C4 (Disposal)	D (Credit)
PERE	[MJ]	8.29E+02	3.67E-01	1.69E+03	8.31E-03	4.70E+00	0.00E+00	-3.28E+02
PERM	[MJ]	8.29E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	9.12E+03	3.67E-01	1.69E+03	8.31E-03	4.70E+00	0.00E+00	-3.28E+02
PENRE	[MJ]	9.04E+02	1.03E+02	2.29E+03	6.31E+00	8.78E+01	0.00E+00	-7.39E+03
PENRM	[MJ]	9.95E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	1.00E+03	1.03E+02	2.29E+03	6.31E+00	8.78E+01	0.00E+00	-7.39E+03
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	6.39E+01	0.00E+00	3.84E+00	0.00E+00	0.00E+00	0.00E+00	4.28E+03
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	8.06E+02	4.51E+00	1.42E+03	1.18E-01	4.99E+01	0.00E+00	3.36E+03

Legend: PERE = Primary Energy, Renewable; PERM = Primary energy, non-renewable; PERT = Primary energy, renewable, total; PENRE = Primary energy, non-renewable; PENRM = Primary energy, non-renewable, for material usage; PENRT = Primary energy, non-renewable, total; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Use of fresh water resources

LIFE CYCLE ASSESSMENT RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1m³ X-Lam

Parameter	Unit	A1 (Production)	A2 (Production)	A3 (Production)	C2 (Disposal)	C3 (Disposal)	C4 (Disposal)	D (Credit)
HWD	[kg]	9.02E-02	0.00E+00	6.32E-02	0.00E+00	0.00E+00	0.00E+00	1.47E+00
NHWD	[kg]	2.36E-02	0.00E+00	5.83E-03	0.00E+00	0.00E+00	0.00E+00	4.46E-05
RWD	[kg]	5.22E-02	9.67E-04	3.47E-01	1.11E-05	1.49E-02	0.00E+00	-1.03E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E+02	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E+02	0.00E+00	-4.93E+02
EE electricity	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE heat	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Legend: HWD = Hazardous waste for landfilling; NHWD = Non-hazardous waste disposed of; RWD = Radioactive waste disposed of; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy per type

6 LCA: Interpretation

6.1 General information

The results are essentially interpreted for the production phase, i.e. Modules A1 to A3, as they are based on specific company data. To this aim, the results established in Modules A1 to A3 are summarised and put in the context of national emissions, i.e. standardised. The relevance of the global warming potential (GWP) for globally effective emissions and that of the acidification potential (AP) and the potential formation of summer smog (POCP) becomes apparent for the emissions with local effects (Fig. 1).

(*) Standardisation of the greenhouse gas potential performed here exclusively relates to the emissions from fossil sources. The three essential indicators referred to here are outlined in more detail below.

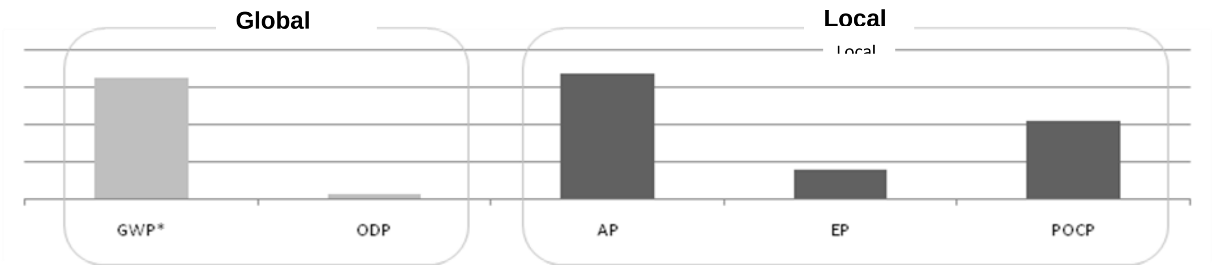

Fig. 1: Relative extent of impact indicators after standardisation to overall German emissions

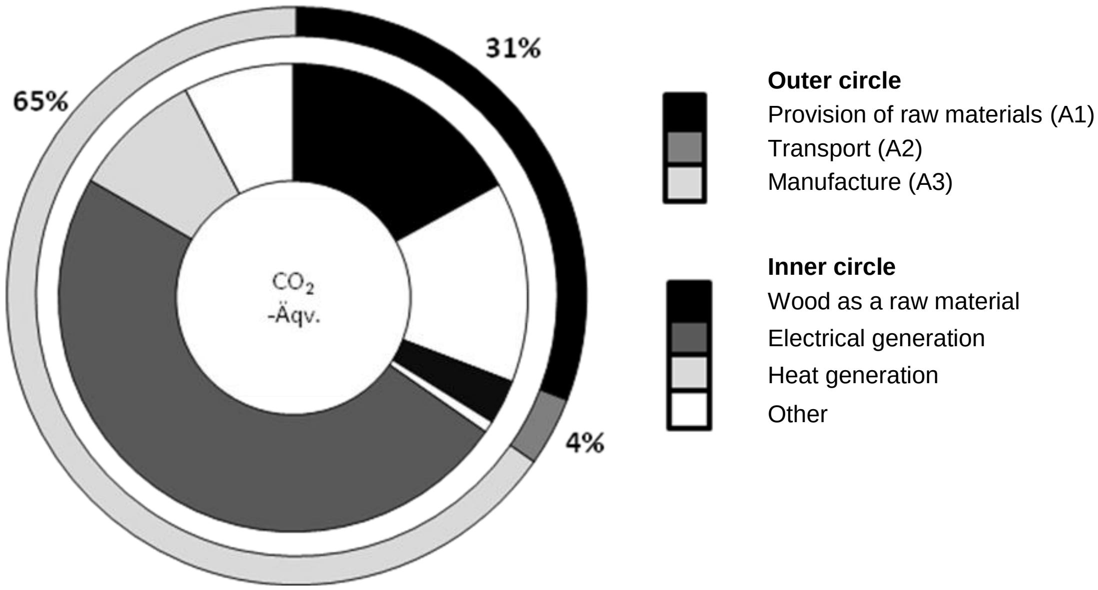

Fig. 2: Sources of fossil greenhouse gas emissions by module

Of the fossil greenhouse gases analysed in Modules A1 to A3, 31% is attributed to the provision of raw materials, 4% is accounted for by transport and 65% by manufacture, whereby the provision of wooden raw materials also includes extensive areas of the finishing chain as the corresponding finished products are bought in for production. Electricity consumption in the plant is an essential influential factor (49%). The contribution made by transporting the raw materials, generating heat and other emissions essentially comprising the combustion of diesel fuel on the plant site account for a total of 17% of cradle-to-gate emissions (Fig. 2).

Fig. 3 depicts an analysis of carbon from biomass. In total, approx. 1016 kg CO_2 enter the system in the form of carbon stored in biomass, of which 77 kg CO_2 are emitted along the preliminary chains and 150 kg CO_2 are emitted within the framework of heat generation on site. The carbon ultimately stored in the product is withdrawn again from the system during recycling in the form of waste wood.

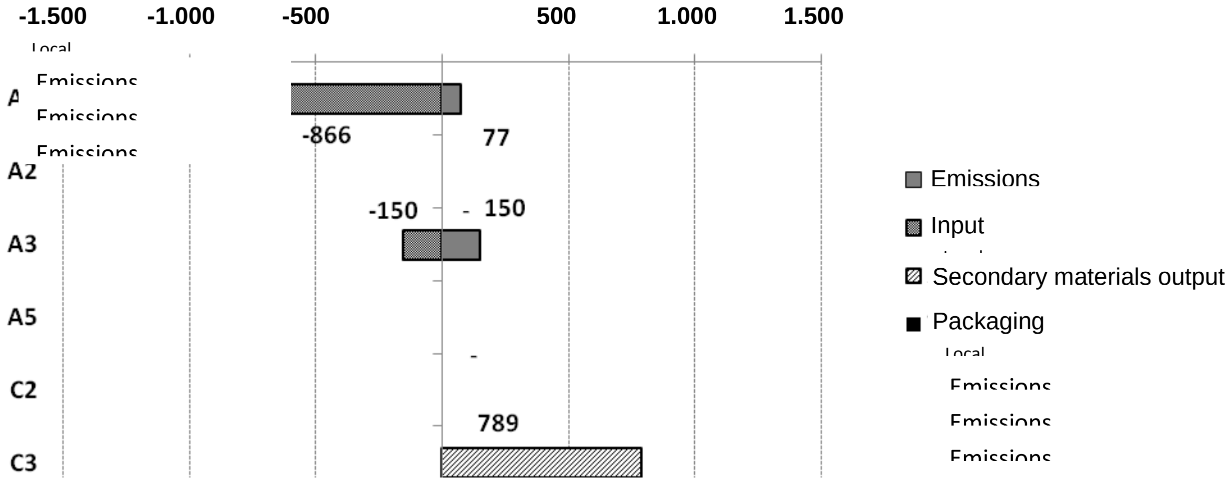

Fig. 3: Analysis of carbon flows from wooden raw materials and products

6.2 Acidification potential

The combustion of wood and diesel are essentially the relevant sources for emissions making a potential contribution towards the acidification potential. Drying bought-in products as well as the provision of heat required for this process and the use of fuels in forestry ensure a relatively high contribution by Module A1 (30%) (wood products) although emissions from the provision of adhesives are not insignificant (6%). Accounting for 4%, the transport of raw materials only makes up for a low percentage of overall cradle-to-gate emissions. Within the framework of manufacturing on site (A3), the provision of heat (26%), electricity consumption (22%) and combustion of diesel play an essential role.

6.3 Summer smog formation potential

Emissions contributing towards the formation of near-ground ozone are primarily incurred during the wood drying process. All in all, 35% is emitted during provision in Module A1, 3% during transport and 59% within the framework of Module A3.

6.4 Use of primary energy

Renewable fuels are primarily used in the form of wood for generating process heat. Of a total of 2583 MJ, 68 MJ is attributable to the combustion of waste wood.

Non-renewable energy is primarily used for generating electricity and in the form of fuels for the transport processes. Smaller quantities are also required for the manufacture of adhesives.

6.5 Range of results

The individual results of the participating companies are distinguished from the average results in the Environmental Product Declaration. In total, deviations of +2%/-17%, +12%/-1% and +16%/-2% were measured in relation to the results described here for the three indicators GWP, AP and POCP, respectively. These deviations are primarily attributable to differences in the fuels used and specific electricity consumption levels incurred by the various processes.

7 Requisite evidence

7.1 Formaldehyde

The formaldehyde emissions are established in accordance with the European standard draft prEN 16351: 2011, Timber structures – *Cross-laminated timber – Requirements*, with reference to DIN EN 717-1, *Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method.*.

Emission values from X-Lam glued with adhesives containing formaldehyde account for less than 60% of the limit value in accordance with the Chemical Restriction Regulation (0.1 ml HCHO/m^3 indoor air).

Emission values from X-Lam glued with adhesives which do not contain formaldehyde result in area-specific emission rates in the area of unglued wood (approx. one-twentieth of the limit value in accordance with the Chemical Restriction Regulation (0.1 ml HCHO/m^3 indoor air).

7.2 MDI

During the X-Lam gluing process, the MDI contained in the moisture-binding single-component polyurethane adhesives used is cured in full. MDI emissions from the cured X-Lam are therefore not possible; there is no test standard in place.

In tests based on the measuring method for determining formaldehyde emissions from DIN EN 717-2, *Wood-based panels - Determination of formaldehyde release - Part 2: Formaldehyde release by the gas analysis method*, MDI emissions can not be detected (detection limit: 0.05 µg/m^3).

7.3 VOC

Evidence of VOC is optional when the EPD is valid for a shorter period of time (1 year).

8 References

Institut Bauen und Umwelt e.V., Königswinter (pub.):

General principles for the EPD Programme of Institut Bauen und Umwelt e.V. (IBU), 2011-06.

Product Category Rules for Building Products, Part A: Calculation rules for the life cycle assessment and requirements on the background report, 2011-07.

Product Category Rules for Building Products, Part B: Requirements on the EPD for solid wood products, 2011-06.

www.bau-umwelt.de

DIN EN ISO 14025:2009-11, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

DIN EN 1

5804:2012-04, Sustainability of buildings – Environmental Product Declarations – Basic regulations for the building products product category; German version EN 15804:2012

DIN EN 717-1:2005-01, Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method; German version EN 717-1:2004

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	Publisher Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	 Tel. Fax E-mail Web	 +49 (0)30 30 87 74 8 - 0 +49 (0)30 30 87 74 8 -29 info@bau-umwelt.com www.bau-umwelt.com
	Program holder Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	 Tel. Fax E-mail Web	 +49 (0)30 30 87 74 8 - 0 +49 (0)30 30 87 74 8 -29 info@bau-umwelt.com www.bau-umwelt.com
	Owner of the Declaration Studiengemeinschaft Holzleimbau e.V. Elfriede-Stremmel-Straße 69 D-42369 Wuppertal Germany	 Tel: Fax: E-mail: Web	 +49 (0)202 978 35-81 +49 (0)202 978 35-79 info@brettsperrholz.org www.brettsperrholz.org
	Author of the Life Cycle Assessment Johann Heinrich von Thünen Institut Leuschnerstrasse 91 21031 Hamburg Germany	 Tel. Fax: Web	 +49 (0)40 73962-600 +49 (0)40 73962-699 www.vti.bund.de