ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	Schilliger Holz AG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD--SLH--20180066--IBC1--EN
Issue date	28.05.2018
Valid to	27.05.2024

Schilliger glued laminated timber (Glulam) as per EN 14080:2013

Schilliger Holz AG

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

Schilliger Holz AG

Programme holder

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

Declaration number

EPD--SLH--20180066--IBC1--EN

This declaration is based on the product category rules:

Solid wood products, 01.01.0001
(PCR checked and approved by the SVR)

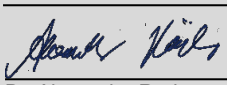
Issue date

28.05.2018

Valid to

27.05.2024

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



Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.)

Schilliger glued laminated timber (Glulam) as per EN 14080:2013

Owner of the declaration

Schilliger Holz AG
Haltikon 33
6403 Küssnacht
Switzerland

Declared product / declared unit

1m^3 Schilliger-Glulam

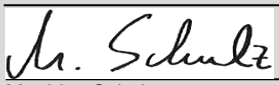
Scope:

This declaration concerns Glulam produced by Schilliger Holz AG in accordance with /EN 14080:2013/: glued laminated timber
and the following glued solid timber: "Massivholzträger (MHT)", "Lamellenbalken (LAM)", "Rigibalken (RBS)", and"Rahmenbaukanteln (RBK)". The production site is the plant in Küssnacht, Switzerland.
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+A1. In the following, the standard will be simplified as *EN 15804*.

Verification

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



Matthias Schulz,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Schilliger glued laminated timber (Glulam) is an industrially manufactured wood product for load-bearing structures. It is used in building and bridge construction. Its composition is symmetrical and consists of at least two dried boards of coniferous solid wood glued together parallel to the grain. As a result of the strength grading of the raw material and the homogenisation, it is reinforced through its layered formation and has higher load-bearing capacities than conventional timber. The glued laminated timber (Glulam) and glued solid timber product-groups are defined according to /EN 14080:2013/, (/1359-CPR-0622/).

Glulam is characterised by a lamellae thickness of 40 mm and can be utilised in a wide range of applications, due to its high strength and variable product characteristics. Glued solid timber has either thinner or thicker layers than 40 mm and is produced for special requirements: this includes the company's own products,"Massivholzträger (MHT)", "Lamellenbalken (LAM)", "Rigibalken (RBS)" and "Rahmenbaukanteln (RBK)".

A comprehensive description of Glulam and glued solid timber products can be found on the company website at "www.schilliger.ch". Regulation (EU) No. 305/2011 (CPR) applies to the marketing of the product in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance, taking into consideration /EN 14080:201/3, Timber structures - Glued laminated timber and glued solid timber - Requirements and the CE marking. Relevant national regulations apply where the product's use is concerned.

Schilliger-Glulam meets the requirements of the technical approval as per /EN 14080:2013/ (/1359-CPR-0622 /).

These are further specified in the declarations of performance for Glulam(silver fir/spruce) / SHI / 01-01012016 of 1.1.2016 and for glued solid timber(silver fir/spruce) / SHI / 04-01012016 of 1.1.2016.

Details of the cross-sectional structures and the properties of each product can also be found in the technical data sheets published by the company on its website.

2.2 Application

The Glulam is used in structural engineering as visible or concealed load-bearing elements, such as in bridges and buildings.

"MHT", "LAM" and "RBS" are also used in structural engineering, "Rahmenbaukanteln" are intended as uprights for timber frame construction and as sleepers in prefabricated-building construction.

2.3 Technical Data

Schilliger-Glulam fulfils the requirements of /EN 14080:2013/ (/1359-CPR-0622 /).

These are further elaborated in the declarations of performance for Glulam (silver fir/spruce) / SHI / 01-01012016 of 1.1.2016 and for glued solid timber (silver fir/spruce) / SHI / 04-01012016 of 1.1.2016.

Details of the cross-sectional structures and the properties of each product can also be found in the technical data sheets published by the company on its website.

Technical data

Schilliger-Glulam is made primarily of spruce and silver fir. Pine, larch and Douglas fir can also be added in small

proportions.
One-component adhesives according to 2.5 are used for the gluing.

The Glulam is produced with an average wood moisture content of 12%. It is supplied in dimensions specified by 2.4.

The Glulam is produced in the structural properties of the strength classes GL24h, GL28h, GL32h or GL28c and GL32c. The structural properties of glued solid timber meets strength class C24 according to /EN 338/.

The products can be manufacture, as per the technical data sheets, in visual surface quality or industrial surface quality. No wood preservatives as defined by /DIN 68800-3/ are used. Permissible dimensional deviations are: +/- 1 mm for dimensions <= 100, +/- 2 mm for dimensions > 100 mm. +1% / -0.5% applies to dimensions> 400 mm.

Name	Value	Unit
Wood types by trade names according to EN 1912	Spruce, silver fir	-
Wood moisture according to EN 13183-1	12	%
Use of wood preservatives (the test rating of the wood preservatives according to DIN 68800-3 must be stated)	No wood preservatives	-
Compressive strength parallel according to EN 1995	16 - 30	N/mm^2
Compressive strength rectangular according to EN 1995	2 - 3	N/mm^2
Tensile strength parallel according to EN 1995	7.2 - 33.5	N/mm^2
Tensile strength rectangular according to EN 1995	0.4	N/mm^2
Modulus of elasticity according to EN 1995	7000 - 16000	N/mm^2
Shear strength according to EN 1995	3 - 4	N/mm^2
Shear modulus according to EN 1995	440 - 1000	N/mm^2
Dimensional deviation	see below	mm
Length (min. - max.)	see below	m
Width (min. - max.)	see below	m
Height (min. - max.)	see below	m
Gross density load-bearing components according to EN 338 or DIN 1052, non-load-bearing components according to DIN 68364	350 - 520	kg/m^3
Surface quality (possible forms are to be named)	planed and chamfered on four sides	-
Risk class according to 68800-3	not relevant	-
Specific heat capacity according to EN 10456	1600	kJ/kgK
Calculation value for thermal conductivity according to EN 10456	0.12	W/mK
Water vapour diffusion resistance factor according to EN ISO 12572	20 - 50	-
Glulam: Average density for the usual strength class, GL 24h EN 14080	420	kg/m³
Glued solid timber: average density for the usual strength class, C24 EN 338	420	kg/m³

Dimensional deviation tolerances according to Swiss timber trade customs /Lignum 2010/:

Glulam

- Length: Excess-length tolerated +/- 0 mm

Largest dimension < 400 mm

- Width and height:

  - Dimension < 100 mm: Deviation +1 / -1 mm

  - Dimension > 100 mm: Deviation +2 / -2 mm

Largest dimension > 400 mm

- Width: deviation +2 / -2 mm

- Height: deviation +1 % / -0.5 %

Glued solid timber

- Length: Excess-length tolerated +/- 0 mm

- Width and height:

  - Dimension < 100 mm: Deviation +1 / -1 mm

  - Dimension > 100 mm: Deviation +1.5 / -1.5 mm

The specific physical performance characteristics can be obtained from the technical data sheets of the products.

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2.4 Delivery status

The products are produced in the following dimensions:

Glulam:

Widths from 100 mm to 280 mm

Heights from 80 mm to 2,000 mm

Lengths up to 18 m

Glued solid timber:

Widths from 100 mm to 240 mm

Heights from 60 mm to 240 mm

Lengths up to 18 m.

2.5 Base materials/Ancillary materials

Only single-component adhesives based on polyurethane (PUR) are used. No other additives are appended to the products.
Finger-jointing and surface bonding is performed according to /EN 15425/ and as per the specifications of /EN 14080:2013/.

The average weight-proportions of the components per

m³ of Schilliger-Glulam for the purpose of this EPD amount to:

- Softwood, mainly spruce: 88.5 %,

- Water: 10.6 %,

- PUR adhesives 0.9 %,

The product has an
average gross density of 424 kg/m^3.

2.6 Manufacture

Only timber sawn and produced in-house is used, which
is kiln dried to a moisture content of 12% and left untreated.

The wood moisture of each plank is measured, and following a visual pre-sorting, they are planed on all 4 sides. They then pass through the quality scanner, which
marks flaws for trimming out, and sorts the boards according to their
respective qualities. After the flaws have been cut out, the planks are
finger-jointed with adhesives into continuous lengths and thereafter shortened
according to orders. After an additional planing process, the lamellas are
glued and pressed: Five presses on a revolving cylinder are used interchangeably.
Finally, the end-product is planed once more, chamfered and proofed. The
commissioned orders are then packed for delivery by the wrapping unit.

During the production
process, the quality requirements of /ISO 9001/ are adhered to (/certificate
number 01 100 1300116 LGA-Intercert/).

2.7 Environment and health during manufacturing

No exhaust air, no gases or any other harmful
emissions for air, ground or water are generated during production.

Wood-dust is produced
during production; the plants are therefore equipped with filter systems for
the dust in accordance with legal requirements. Working conditions in the
production plant are subject to controls by the cantonal Labour Inspectorate
and the Swiss National Accident Insurance Fund (SUVA)

2.8 Product processing/Installation

Schilliger-Glulam can be processed with the usual
tools suitable for solid wood processing.

Guidelines on
occupational safety should also be observed during processing/assembly.

2.9 Packaging

Schilliger glued laminated timber is wrapped in
Polyethylene (PE) film for delivery.

The foil can either
be collected and recycled separately at the construction site or fed to waste
incineration for energy recovery.

2.10 Condition of use

The composition for the period of use corresponds to
the material composition in accordance with Section 2.5 "Raw materials".

During use, there are about 203 kg of carbon bound in
the product.

With complete
oxidation, this equates to approximately 744 kg CO_2.

2.11 Environment and health during use

Environmental protection:
According to present knowledge, using these products in the way they are
intended will not pose any threat to water, air or soil.

Health protection:
According to present knowledge, no damage or impairment to health is to be
expected. Glued wood bonded with PUR adhesives exhibits formaldehyde
emission-values in the range of natural wood (around 0.004 ml/m3).
The emissions of methylenediphenyl diisocyanate
(MDI) for laminated wood bonded with PUR adhesives found to be below the
detectability threshold of 0.05 µg/m³. Due to the high reactivity of MDI with
water (air and wood moisture), it can therefore be assumed that shortly after
production, the Glulam emits levels of MDI in the nil-value-range.

2.12 Reference service life

No reference service-life is specified,
according to /ISO 15686/ According to the /BBSR/ table on the service life of
building products, a service life of more than 50 years can be assumed for the
use of laminated wood in load-bearing applications. The service life of glued
wood generally coincides with the planning period or service life of a
building. When used as intended, no end to the durability

is known or to be expected.

2.13 Extraordinary effects

Fire

Information on the fire performance according to *EN 13501:1* or established national standards. According to *EN 13501:1*:

- The classes of building products regarding their fire performance are predefined as: A1, A2, B, C, D, E, and F;
- The classes of flaming droplets/particles are pre-defined as: d0, d1, or d2;
- The classes for smoke density are pre-defined as: s1, s2, or s3

Fire Protection

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

The toxicity of the combustion gases is equivalent to that of natural, untreated wood.

Water

No substances are washed out that could be hazardous to water.

Mechanical destruction

The fracture pattern of laminated wood reflects the typical behaviour of solid wood.

2.14 Re-use phase

In the case of selective dismantling after the end of its service life, glued wood can be reused or repurposed without any issues.

If glued wood cannot be reused, it is thermally recycled in a waste-wood furnace or a waste incineration plant for the generation of process heat and electricity, due to its high calorific value of approximately 15 MJ/kg.

2.15 Disposal

Swiss (/VVEA/, Appendix 5) and German legislation (§9 /AltholzV/) do not permit the dumping or landfilling of wood.

Classification according to European waste code: (/AVV/): 17 02 01 (treated laminated wood depending on wood preservative type Waste code: 17 02 04).

2.16 Further information

Further information can be found at: http://www.schilliger.ch

3. LCA: Calculation rules

3.1 Declared Unit

The declared environmental figures refer to 1 m^3 of glued wood in accordance with EN 14080:2013, including Glulam and solid glued timber, with all products having been glued using PUR adhesive.

For the statistical modelling of the sawing processes, the production of planks (not beams) was conservatively estimated; however, for the glue consumption, the consumption for Glulam or glued solid timber, weighted according to production volume, was used.

Description of the declared unit

Name	Value	Unit
Gross density	424	kg/m^3
Declared unit	1	m^3
Wood moisture upon delivery	12	%
Conversion factor to 1 kg	424	-

3.2 System boundary

This EPD represents a 'cradle-to-gate' analysis, with options.

The manufacturing process of the Glulam products (***modules A1-A3***) comprises the forestry processes, the transportation of the round timber to the sawmill, the production of the sawn timber and the related background processes (power generation, extraction of fossil fuels, etc.). Furthermore, the production of the glue, as well as the packaging, is also reflected in the analysis. The infrastructure required for the sawmill and the Glulam plant is estimated.

According to the applicable PCR, the content of biogenic CO_2 is accounted for as a negative input to the global warming potential (GWP).

Waste and secondary materials or secondary fuels are not used in production. Bark, wood -chips -shavings and other raw sawdust leave the product scope as co-products.

In ***module A4***, an average transport distance of over 90km for the Glulam to reach the prospective construction site is accounted for.

packaging (module A5) is calculated analogically.

3.3 Estimates and assumptions

No further assumptions and estimates that would be relevant to the result had
to be made regarding the points discussed in this chapter and in chapter 4.

Module A5 includes
the disposal of PE packaging in a waste incineration plant (WIP).The heat and
electricity generated in the WIP are offset as exported energy in module D.

3.4 Cut-off criteria

No data available from the company survey has been neglected. Airborne emissions resulting from the heating system were modelled
on a company-specific basis and supplemented by emission information drawn from
the *ecoinvent* dataset (//KBOB 2016).
VOC emissions as a result of timber processing and drying were considered
equivalent to natural emissions; the corresponding data is otherwise not
available.

Installation material is not reflected in module A5,
as the type and quantity of installation material varies depending on the use
of the glued wood; installation material must be considered accordingly when
assessing a building.

The infrastructure requirements for the sawmill and gluing facility were derived from *ecoinvent* dataset (/KBOB 2016/).

Module C2
comprises the transport of the reclaimed Glulam to a biomass power plant.

This approach also
accounted for mass and energy flows of < 1%; it can further be assumed that
no processes were neglected that would have been known to those responsible for
the study to have had a significant effect on the indicators of the impact
assessment.

3.5 Background data

Module C3 depicts
the chopping of the reclaimed Glulam; in accordance with /EN 16485/, it is
assumed that non-pressure-treated waste wood reaches the end of its waste-state
when it becomes available as wood chips. The chipped wood, including its content
of biogenic C (as CO_2 equivalent) and its content of renewable primary energy, leaves the product system as secondary fuel.

The background database employed is an updated version of the *ecoinvent 2.2* database (/KBOB 2016/; /Werner 29017/), which is used in Switzerland for the
environmental performance indicators of construction products.

3.6 Data quality

The primary data is based on extensive and detailed data collection at the production site. The primary data could be completely matched
to corresponding data records from an updated version of *ecoinvent 2.2* (/KBOB 2016/).

In ***module C4*** contains no processes/environmental impacts.

The background data -
for instance, with regard to electricity mix - was updated in 2016; some background
data records however- such as for the production of MDI - are already older,
but do not allow an update, as they are only available in aggregated form.
Subsequently, the quality of the foreground data is considered to be very good,
and the quality of the background data is regarded as sufficient.

Module D calculates the
energy recovery of the wood chips in a biomass power plant. It is assumed that
the recovered energy will replace the electricity mix in Germany and heat from
industrial natural gas firing. The exported energy recovered from the PE

3.7 Period under review

The life cycle assessment data represents the production conditions for 2016.

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: Switzerland

3.9 Allocation

The allocation of the forestry processes was adopted from *ecoinvent* data - the forestry processes are allocated by real expenditure, i.e. based on mass.

The sawmill processes at Schilliger Holz AG were allocated economically, according to the specific revenue generated by individual co-products; expenses that are directly attributable to one of the co-products were only attributed to that co-product (chopping into chips, extraction of sawdust, etc.). To simplify matters, debarking was allocated to the bark or the debarked trunk - the bark is largely used to generate heat for drying, so this allocation is of secondary significance to the final result.

Further information on secondary materials, secondary fuels, exported energy, etc. can be found in Section 3.2.

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. Die verwendete Hintergrunddatenbank ist eine aktualisierte Version der Datenbank ecoinvent 2.2 (/KBOB 2016/; /Werner 2017/), die in der Schweiz für Umweltkennzahlen für Bauprodukte verwendet wird.

4. LCA: Scenarios and additional technical information

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport to the construction site

For transport to the construction site, it is assumed (A4):

- Transport distance and mode of transport: 90 km with the average truck fleet > 28 t in Switzerland

- Transport weight: product weight of 424 kg/m^3 plus 1.9 kg of PE packaging per m^3

Disposal of packaging on site

For the modelling in module A5, the following is assumed:

- Transport distance and means of transport for the disposal of packaging: 30 km with the average truck fleet > 28 t in Switzerland

- Heat value of PE packaging: 83 MJ/m^3 product

- Efficiency of waste incineration plants: 39 % based on the lower calorific value, of which 66 % is heat and 34 % is electricity.

Service life

No reference service life is specified per /ISO 15686. According to the /BBSR/ table on the service life of building products, a service life of more than 50 years can be assumed for the use of laminated wood in load-bearing applications. The service life of glued wood generally corresponds to the design life of the building.

Name	Value	Unit
Life Span (according to BBSR)	> 50	a

End-of-life

- Chopping is done with a stationary electric wood chipper

A complete collection and subsequent utilisation as secondary fuel in a biomass power plant is assumed to be the disposal scenario
for the Glulam.

The modelling in module D assumes:

- calorific value of glued wood with a water content of 20 %: 5989 MJ/m^3

For transportation to a biomass power plant, it is assumed (C2):

- Efficiency of the biomass power plant: 68% based on the lower calorific value, of which 54 % is heat and 46 % is electricity

- Transport distance and means of transport: 30 km with the average truck fleet > 28 t in Switzerland

Substituted processes
are assumed to be: "Heat, natural gas, at boiler modulating>100kW/RER"
and "electricity, medium voltage, at grid/kWh/CH".

For chopping of waste wood, it is assumed (C3):

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE 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	X	X	MND	MND	MNR	MNR	MNR	MND	MND	MND	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 m³ glulam (424 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP	kg CO_2 eq	-6.15E+02	4.12E+00	5.75E+00	1.37E+00	6.86E+02	0	-1.96E+02
ODP	kg CFC11 eq	5.24E-06	1.35E-07	5.22E-09	4.47E-08	1.93E-07	0	-3.97E-05
AP	kg SO_2 eq	3.94E-01	2.22E-02	5.31E-04	7.36E-03	1.51E-02	0	-1.92E-01
EP	kg PO_4^3 eq	8.93E-02	5.02E-03	1.8E-04	1.67E-03	1.97E-03	0	3.13E-03
POCP	kg Ethen eq	1.23E-01	6.34E-04	6.48E-06	2.1E-04	6.4E-04	0	-1.28E-02
ADPE	kg Sb eq	2.2E-05	4.88E-09	2.61E-09	1.62E-09	1.18E-07	0	-1.04E-05
ADPF	MJ	1.1E+03	5.55E+01	7.32E-01	1.84E+01	6.54E+01	0	-3.15E+03

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

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 m³ glulam (424 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
PERE	MJ	1.64E+03	1.18E-01	8.24E-03	3.92E-02	8.26E+00	0	-8.19E+02
PERM	MJ	7.16E+03	0	0	0	-7.16E+03	0	0
PERT	MJ	8.8E+03	1.2E-01	8.24E-03	3.92E-02	-7.15E+03	0	-8.19E+02
PENRE	MJ	1.76E+03	5.6E+01	8.38E+01	1.86E+01	9.63E+01	0	-6.81E+03
PENRM	MJ	1.84E+02	0	-8.3E+01	0	-1.01E+02	0	0
PENRT	MJ	1.94E+03	5.6E+01	7.58E-01	1.86E+01	-4.71E+00	0	-6.81E+03
SM	kg	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	7.16E+03
NRSF	MJ	0	0	0	0	0	0	1.01E+02
FW	m^3	IND	IND	IND	IND	IND	IND	IND

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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 m³ glulam (424 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
HWD	kg	4.15E-04	1.51E-06	5.11E-06	5.02E-07	7.43E-05	0	-1.36E-03
NHWD	kg	2.72E+00	8.38E-04	8.41E-02	2.78E-04	4.74E-02	0	1.41E+00
RWD	kg	1.67E-02	9.7E-06	5.7E-07	3.23E-06	6.95E-04	0	-7.69E-02
CRU	kg	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0
MER	kg	0	0	0	0	4.24E+02	0	0
EEE	MJ	0	0	1.08E+01	0	0	0	0
EET	MJ	0	0	2.13E+01	0	0	0	0

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

The use of freshwater resources is not declared, since although the data set for MDI - a key driver of the results - does disclose the water input, it does not disclose the water output; thus an evaluation of this indicator is not meaningful.

6. LCA: Interpretation

6.1
Impact assessment indicators

ecological
assessment for Schilliger Holz AG's laminated wood, whereby the environmental
impact of the production is set as 100 %.

Figure 6-1 illustrates the contribution of the
individual stages of the life cycle to the overall result of the

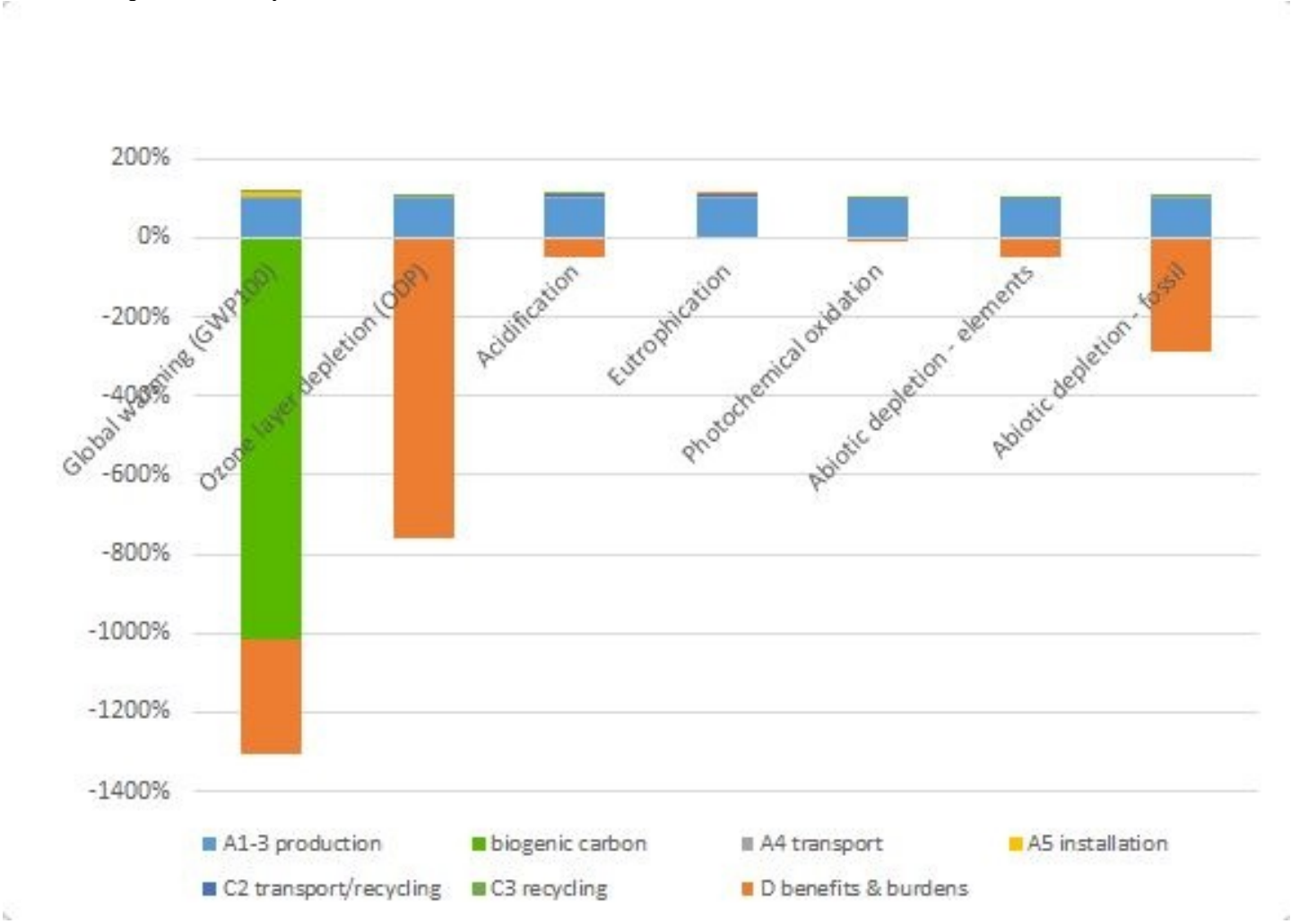

Figure
6-1: Relative contributions of the individual stages of the life cycle (module
A1-A3 = 100 %); the biogenic carbon in the product is temporarily sequestered -
considered over the life cycle, the carbon storage (represented by the green
bar)contributes a negative value to the GWP

Figure 6-1 illustrates that the benefit to GWP, ODP
and the ADPF from the energy recovered from the laminated wood is about 5 to 10
times greater than the environmental impact of its production; for the other
impact categories, the implementation of energy recovery leads to somewhere
between a 5 % additional burden and a 47 % potential benefit to the environmental
impact of the production, depending on the impact category.

The greenhouse gas potential is dominated by the

storage effect of biogenic carbon in the product, i.e. about 10 times as much biogenic carbon (in CO_2 equivalent) is stored in the product over its lifetime as is released during the production of the Glulam. This biogenic carbon leaves the product system at the end of the life cycle as a material-inherent property of the waste wood, which annuls the green bar in Figure 6-1 at the end of the life cycle. If the laminated wood is used as a secondary fuel at the end of its service life, it can prevent around 5 times as much greenhouse gas emissions as is released during production.

Since the environmental profile of laminated wood over its life cycle is largely dictated by the production-phase (ignoring module D), the following interpretation focuses on the production stage.

Global Warming Potential

The ***global warming potential*** (GWP) is an indicator of the contribution to climate change of a product and is calculated from the emissions of climate-relevant gases. The use of fuel for forestry processes accounts for around 30 % of the GWP of production (excluding biogenic CO_2). The production of MDI as the basic material for bonding contributes about 25 % (without biogenic CO_2); further contributions come from the transport of round wood from the forest to the sawmill (approx. 20 %) and from electricity generation (approx. 13 %).

Ozone Depletion Potential

The ***ozone depletion potential*** (ODP) is determined from emissions of gases that can deplete the stratospheric ozone layer. The main contributions to the ODP result from the emissions of halon 1211, halon 1301 and CFC-114, which are released upstream in the production of the gasoline used in the chainsaws (80 %). Foaming of the PE packaging contributes another 10 % to this indicator.

Considering that the use of ozone-depleting substances has been prohibited under the Montreal Protocol for decades, the values of the ODP should be regarded as highly uncertain, as they are often based on outdated or incorrect background data; this impact category is no longer relevant from an environmental perspective.

Acidification Potential

Acidification potential (AP) regards the conversion of air pollutants into acids, which can possibly impair soil fertility. About 30 % of the AP results from the combustion of the bark in order to generate heat for heating the gluing unit; a further 20 % is caused by the combustion of the bark for technical drying. The production of the MDI and the transport of the round wood to the sawmill each account for another 20 % of this impact category. The production of the MDI and the transport of the round wood to the sawmill each contribute a further 10 % to this impact category.

The AP is caused in similar proportions by ammonia, nitrogen oxides and sulphur dioxide.

Eutrophication Potential

The ***eutrophication potential*** (EP) is calculated from the accumulation of nutrients in soil and water, which can lead to increased algae growth and undesirable shifts in the species composition.
About 45 % of the EP is caused by the combustion of the bark to generate heat for heating the gluing unit; another 25 % is a result of the combustion of the bark for technical drying. The transport of the round wood to the sawmill contributes a further 10 %, and the production of the MDI an additional 6 % to this impact category.

The AP is mainly caused by atmospheric emissions of

ammonia and nitrogen oxides, as well as phosphorus/phosphate release in to groundwater.

Photochemical
Oxidant Formation Potential

The ***photochemical ozone creation potential*** (POCP) is calculated from emissions that can contribute to the formation of ozone in summer. Around 80 % of CO and VOC emissions (mainly toluene, formaldehyde and pentane) contributing to POCP originate from the exhaust gases from chainsaws in forestry processes; foaming of PE packaging is responsible for an additional 10 % of this environmental impact.

Abiotic
Resource Consumption (fossil resources)

The ***abiotic depletion potential*** of fossil energy resources (ADPF) reflects the consumption of scarce fossil fuels such as crude oil or natural gas. The main contribution to ADP-fossil here is the diesel consumption of forestry machines (around 25 %), by the production of MDI (around 30 %) and during the production of PE packaging and power generation (around 10 % each).

Abiotic
resource consumption (mineral resources)

The potential ***abiotic depletion potential*** of mineral resource elements (ADPE) refers to the depletion of scarce, non-renewable mineral resources such as ores and other raw minerals. ADP-materials is almost entirely caused by infrastructure processes, such as the production of forestry machinery (around 60 %), the construction of the sawmill (around 10 %) and the infrastructure required for the generation and distribution of electricity. The main contributors to this environmental impact are the resource consumption of chromium, sulphur and lead.

6.2 Selected Life Cycle Inventory indicators

Primary
Energy from Renewables (PERE)

The calorific value of the Glulam is the main source of renewable primary energy; the amount of primary energy stored in the Glulam is not consumed within the product system, but rather it leaves module C3 as secondary fuel, entering module D where it is used for energy purposes. Wood and water power are the main renewable energy sources used.

Primary Energy
from Non-Renewables

As mentioned in regard to ADPF, about 55 % of non-renewable primary energy is derived from fossil fuels; the remaining 45 % of this indicator represents the consumption of uranium for nuclear energy.

Disposed Waste

The 3 waste indicators describe the quantities of waste that are disposed
after any pre-treatment (e.g. in a WIP).

The largest component of disposed waste in the
production of laminated wood is non-hazardous waste (NHWD), which is mainly
generated through the disposal of infrastructure, e.g. the production halls or
roads.

Hazardous
waste (HWD) is unspecifically generated in the upstream chains of production,
such as during the disposal of ash, from production waste from the chemical
industry or during production of the Glulam.
The disposed radioactive waste (RWD) is associated
with the use of nuclear energy.

Water Consumption

The net consumption of fresh water (FW) is not
declared due to missing information in the data set for the production of MDI.

Secondary Materials

No secondary materials (SM) were utilised.

Other
Life Cycle Inventory Indicators

The remaining
indicators of the Life Cycle Inventory are individual values which are derived
from the description of the system boundary in Chapter 3.2.

7. Requisite evidence

7.1 Formaldehyde

When using adhesives containing formaldehyde, subsequent formaldehyde emissions must be evaluated by testing to EN 717-1.
The measuring procedure must be indicated.

7.1 Formaldehyde

No adhesives containing formaldehyde were used.

VOC emission measurements were performed by the "Testing Institute for Construction and Environmental Chemistry", Zurich, on
large format spruce and silver fir panels from 7 June 2011. The emission
analysis of the test cell was carried out in accordance with the AV FLEC work
specification, which is based on ISO 16000-9 and ISO 16000-11. The measuring
method is based on ISO 16000-6.

Name	Value	Unit
Formaldehyd (28 days)	6 - 8	µg/m³

The formaldehyde emission of the tested product
falls below the E1 value and requirements for low-emission building materials.

7.2 MDI

During the adhesion of the Glulam, the MDI contained
in the moisture curing one-component polyurethane adhesive reacts completely. An
MDI emission test for the finished product wood is not possible as no test
standard/standardised test exists.

In tests based on the measurement methodology for determining formaldehyde emission from /DIN EN 717-1/, Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method,
no MDI emission was detected (detection threshold: 0.05 µg/m³).

7.3 Toxicity of fumes

As an optional,
evidence regarding this was not provided. 7.3 Fire gas toxicityMeasurement to DIN 53436
Optional info; this measurement is specified for wooden

composites used in public venues.
Note: DIN 53436 is the test standard referred to in DIN 4102-1. Accordingly, PCR-conformant testing can be assumed when indicating DIN 4102-1. 7.4 VOC emissions
Optional for products which are exclusively used in outdoor applications.
Test procedure in line with the AgBB diagram indicating the measuring agency, date and results as a range of values. At least the following must be declared (VOC verification is optional if the EPD is valid for a shorter period of time (1 year)):

7.4 VOC emissions

VOC emission measurements were performed by the "Testing Institute for Construction and Environmental Chemistry", Zurich, on large
format spruce and silver fir panels from 7 June 2011. The emission analysis of the test cell was carried out in accordance with the AV FLEC work
specification, which is based on ISO 16000-9 and ISO 16000-11. The measuring
method is based on ISO 16000-6.

Name	Value	Unit
TVOC (C6 - C16)	53 - 75	µg/m^3
Sum SVOC (C16 - C22)	unverifiable	µg/m^3
R (dimensionless)	-	-
Carcinogenic Substances	unverifiable	µg/m^3

The tested large-format panels (silver fir or spruce) exhibit low levels of TVOC emissions. The products can be recommended
for indoor use.

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