Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for

Glued Laminated Timber

from

L.A. COST srl

COSTANTINI
SISTEMA LEGNO

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The International EPD® System
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Programme/ The International EPD® System

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Product category rules (PCR)/

PCR 2012:01 - Construction products and construction services. Ver 2.33, Sub-PCR to PCR 2012:01 Wood and wood-based products for use in construction (EN 16485:2014) – UN CPC 314 - Wood boards and panels

PCR review was conducted by/ Claudia A. Peña

Independent verification of the declaration and data, according to ISO 14025:2006/

☐ EPD Process Certification ☒ EPD Verification

Third party verifier/ DNV-GL

In case of accredited certification bodies:
Accredited by/ ACCREDIA

In case of recognised individual verifiers:
Approved by/ The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier/

☒ yes ☐ no

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Company information

Owner of the EPD

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Description of the organisation

L.A. COST produces wooden houses and structures guaranteeing quality and reliability, extreme attention to detail, in compliance with regulations and the environment. Following an integrated chain, which combines passion and ability of qualified personnel, it creates every element of construction from the single wooden board, ensuring constant control of the cycle from material selection, to production and processing. L.A. COST structures are the result of the know-how acquired over the years and implemented in the industrial plant in Bettona (PG), Fig. 1.
In the covered area of more than 20,000.00 square meters L.A. COST produces special glulam beams as well as cross-laminated X-lam panels of the highest quality. The reliability of the products is guaranteed by a constant control of the processing cycle and the careful selection of the raw material, ensured by high-tech control systems such as scanners and RX and by the help of staff with proven experience and skills. The high frequency gluing press guarantees the high productivity of the plant.

Name and location of production site

Bettona plant (PG)

fig. 1
Bettona site (PG) - IT

Product information

Product name
Glued Laminated Timber

Product identification and description
The glulam beams, GLT (Glue Laminated Timber), are solid wood beams made of wooden layers, composed of several layers of lamellas (or boards), overlapped and glued one on each other (fig.2).
The layers are made of coniferous wood boards (i.e. mainly spruce), dried and selected. The thickness of the boards varies between 19 and 40 mm, and they are between 80 and 260 mm wide. Beams have different sections, whose basis ranges from 8 to 24 cm, and high from 8 to 80 cm.

The production system allows to obtain a gluelam beam (content declaration tab.1), which allows to reach excellent characteristics of architectural functionality, dimensional stability and technical performance, besides versatility, lightness and naturalness of wood (solid wood).

UN CPC Code
314 - Wood boards and panels

Geographical scope:
Global

fig. 2
Glued Laminated Timber

Content declaration

Glued laminated timber is a solid wood beam made of several layers of lamellas (or boards), overlapped and glued one on top of the other (fig.2).

Single layers are made of coniferous wood planks, dried and selected, as for most of the structural elements in wood, where fir, mainly spruce, is used. The thickness of the boards varies between 19 and 40 mm, and they are between 80 and 240 mm wide, depending on the applications.

The production system allows to obtain a laminated wooden beam (content declaration tab.1), which, in addition to versatility, lightness and naturalness of wood (solid wood), allows to achieve excellent characteristics of architectural functionality, dimensional stability and technical performance.

The gluelam beams, also named "glulam", are largely used structural elements made of glued laminated timber, cohesive structures constituted of wooden layers bunded together with durable, moisture-resistant structural adhesives. Horizontal beams able to cover relevant spans are made by assembling a number of small pieces of lumber. Glulam can be manufactured to a variety of shapes thus offering a certain design freedom assuring the necessary structural requirements.

tab. 1
Content of Glued Laminated Timber

Materials / chemical substances	Unit	Quantity
material	m^3	spruce wood
density	kg/m^3	450
moisture	%	12-16%
length	mm/m^3	3000-30.000
width	mm	max 2000
thickness	mm	32-40
wood	%	96.5
glue	%	3.5 (average)
hazardous substances	-	no substance from the REACH candidates list

Packaging

Distribution/consumer packaging

The product is distributed unpacked.

LCA information

Time representativeness	data refer to the year 2018
Database used	EcoInvent Database v.3.6
LCA software used	SimaPro 9.1.1.1

The scope of the present Environmental Product Declaration is to assess potential environmental impact values for the Glued Laminated Timber production based on the Life Cycle Assessment methodology and make them explicit. A description follows with details on functional/declared unit, system boundaries, key assumptions and a flow chart describing the lifecycle stages of the product.

A comprehensive quantitative evaluation of environmental performances in the Glued Laminated Timber production chain has been provided based on Life Cycle Assessment (LCA). The considered lifecycle includes all the main processes from the withdrawing of raw materials, including the wood growing, cutting and drying, selection, assembling, gluing, drying, preservative treatment and final cutting, until its transport to building site.

Functional Unit

The Functional Unit (FU) is **1 m³ of Glued Laminated Timber 12x24 size** produced by L.A. COST in the Bettona site (PG - IT). Valid also for all sizes among 8x8, 24x48 and 20x80.

Description of system boundaries

Based on a "from cradle to gate with options" (A1-A4) approach, the Glued Laminated Timber lifecycle system boundaries concern:

UPSTREAM PROCESS (A1)

it consists in the "from cradle to gate" set of processes that includes the raw material supply:

- **production and transport of raw materials used (e.g. forestry operations for wood growing and cutting, glue, hardener and preservative agent production);**
- **carbon uptake by wood during its growth;**
- **production and transport of materials for packaging (e.g. PVC, PP);**
- **production of machineries components that are substituted for ordinary maintenance (annual or more frequent);**
- **electricity production and distribution.**

CORE PROCESS (A2-A3)

it consists in processes directly connected with the manufacturing phase most of which are performed within the production plant (from gate to gate) that include:

- **transport of raw material to the company;**
- **fuel consumption (i.e. diesel and lubricant);**
- **direct emissions from fuel use;**
- **End of Life of wasted material and packagings (e.g. wasted glue, hardener and preservative agents, material for machinery maintenance, glue, hardener and preservative agent packaging).**

The Core process is divided in the following sub-sections:

0 **TRANSPORT - A2**
Transport of materials to the company gate: transport of e.g. wood, glue, hardener and preservative agents to the gate of the production site (Bettona) .

1 **SELECTION AND LINEAR CUTTING - A3 Manufacturing**
The lamellas (or tables) are selected according to their resistance class, then they are checked by scanner and RX machines for any defect. Slats are joined at the head to reach the desired lengths.

2 **ASSEMBLY AND DRYING - A3 Manufacturing**
A series of assembly and drying processes follow, where the lamellas are glued one to the other to form the individual layers of boards (1 layer) and dried. The prepared layers of boards are glued together. The beam is finally pressed.

3 **CUTTING - A3 Manufacturing**
The beam is finally cut. 1183 m³ of glulam are produced annually.

Waste from the production process, such as wasted glue and hardener, glue and hardener packaging, plastic material for machinery maintenance were considered sent 100% to incineration, while steel from machinery maintenance was considered sent 100% to recycling, coherently to the current state of waste treatment (ARRR, 2008). Transport of waste to the waste plant was considered as 50km average distance. Rejected raw materials are not accounted, because <1% of processed wood.

Environmental impacts due to the production and use of gasoline and lubricant were based on data reported in the company annual reports and allocated to the mass processed.

DOWNSTREAM PROCESS (A4)

it consists in the "from gate to gate" process that includes:

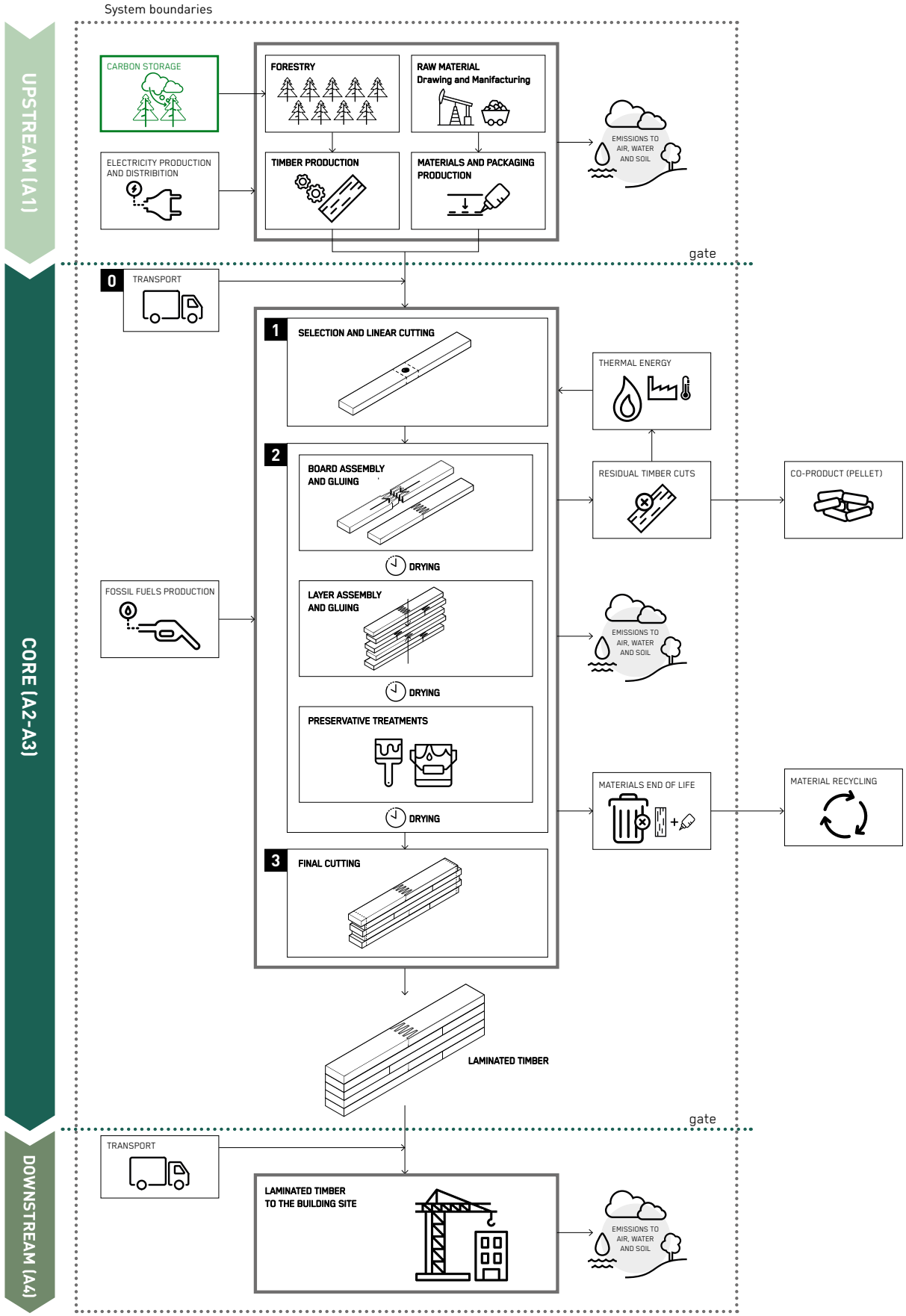
- **Transport of the product to the building site (i.e. average transport in national boundaries -roadway).**

The Downstream process does not include the packaging of the product, because it is sold unpacked.

tab. 2
Flow diagram of the processes included in the LCA (according to EN 15804:2012 standard and PCR 2012:01)
X included
MND module not declared

			Module	Modules declared
Product stage	UPSTREAM	**Raw material supply**	**A1**	**X**
	CORE	**Transport**	**A2**	**X**
Construction process stage		**Manufacturing**	**A3**	**X**
	DOWNSTREAM	**Transport**	**A4**	**X**
		Construction installation	A5	MND
Use stage		Use	B1	MND
		Maintenance	B2	MND
		Repair	B3	MND
		Replacement	B4	MND
		Refurbishment	B5	MND
		Operational energy use	B6	MND
		Operational water use	B7	MND
End of life stage		De-construction demolition	C1	MND
		Transport	C2	MND
		Waste processing	C3	MND
		Disposal	C4	MND
Recovery stage		Reuse-Recovery-Recycling potential	D	MND

fig. 3
Flow chart and system boundaries of Glued Laminated Timber production



Excluded lifecycle stages:

Based on the definition of system boundaries and cut-off criteria, a number of processes were considered not relevant or not directly referred to the glulam lifecycle.

Excluded processes are the following:

- **construction of buildings and machineries used in the Bettona site;**
- **production and maintenance of machineries with more than 5 years estimated lifetime;**
- **activity and travels of employers;**
- **A5 to D processes.**

Not significant data were neglected. The considered cut-off is under the threshold of relevance (5% of total inputs), in accordance with the maximum percentage for exclusion, recommended by the PCR 2012:01 v.2.33 and GPI 2017-12- 11 v.3.0.

More information:

The LCA has been performed in compliance with ISO 14040:2006, ISO 14025:2006 (Environmental labels and declarations - Type III) and the GPI (General Programme Instructions for the International EPD System), 2017-12-11 v.3.0.

The LCA refers to the PCR 2012:01 - Construction products and construction services. Ver 2.33 and the Sub-PCR-E 2012:01 - Wood and wood-based products for use in construction v.2.2 (EN16485:2014).

Primary data have been collected in the L.A. COST production plant of Bettona (PG – IT) based on direct interviews with the employers involved in the production processes during specific field-visits in different plant sections or derived from registered company reports. All quantities derive from primary data, as recommended by data quality requirements of reference PCR.

The agro-forestry practices, cutting and drying of wood from Austria refer to selected generic data from database processes.

Environmental impacts due to the production and use of energy (electricity and gasoline) were based on data registered in company reports. These data were referred to each phase according to company estimations and energy consumption recognition along the production chain, and allocated to the Functional Unit based on the volumes annually processed. The use of a portion of residual wood after cuts for heat energy generation within the plant has been taken into account by considering the associated impacts (this results in an energy saving in terms of avoided use of natural gas that has been fully replaced by wooden pellet incineration). The portion of residual wood after cuts used to produce pellet for sale (co-product) has been excluded form the assessment.

The electricity mix refers to the Italian residual mix (AIB, 2018)

Secondary data refer to the Ecoinvent database v.3.6. The LCA has been performed based on the SimaPro 9.1.1.1 software.

The CO2 uptake by wood during its growth in forest (Upstream phase - A1) was estimated according to the IPCC 2006 guidelines, EN 15084:2012 and EN 16485:2014 (i.e. 825 kg CO_2 absorbed per m^3 wood).

All primary and secondary data, selected database and accounting models are compliant with the PCR data quality requirements (par. 7.8).

The LCA study was performed by Riccardo M. Pulselli and Elena Neri (INDACO$_2$, Siena – Italy).

Environmental performance

Potential environmental impact

The assessed potential environmental impacts are reported in table 2, detailed into upstream, core and downstream processes. Values refer to the functional unit (1 m³ Glued Laminated Timber 12x24 size). Results are also valid for all sizes from 8x8, to 24x48 and 20x80 (i.e. variation between 4.9% and 9.5% for GWP-GHG parameter).

tab. 3
Environmental Impact Potentials referred to the Glued Laminated Timber production system per FU (2018). Downstream scenario: distribution to Italy (roadway).

Acronyms
GWP = Global Warming Potential;
GWP-luluc = Global Warming Potential land use and land use change;
ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential;
EP = Eutrophication potential;
POCP = Formation potential of tropospheric ozone;
ADP = Abiotic depletion potential;
WSP = Water scarcity potential.

Potenziali impatti ambientali

Parameter		Unit	UPSTREAM A1	CORE A2-A3	DOWNSTREAM A4	Total A1-A4
GWP	fossil	kg CO_2 eq	2.72E+02	6.61E+01	1.22E+01	3.50E+02
	biogenic	kg CO_2 eq	-8.22E+02*	2.99E-02	4.87E-03	-8.22E+02*
	luluc	kg CO_2 eq	2.28E+00	2.39E-02	3.58E-03	2.31E+00
	Total	**kg CO_2 eq**	-5.47E+02*	6.62E+01	1.22E+01	-4.69E+02*
ODP		kg CFC 11 eq	1.61E+00	3.11E-01	6.22E-02	1.98E+00
AP		mol H^+ eq	5.72E-01	5.67E-02	1.09E-02	6.39E-01
EP		kg PO_4^{3-} eq	1.51E+00	3.34E-01	6.95E-02	1.91E+00
POCP		kg NMVOCeq	3.89E-05	1.47E-05	2.88E-06	5.65E-05
ADP	elements	kg Sb eq	5.73E-03	1.69E-03	2.09E-04	7.63E-03
	fossil resources	MJ, net calorific value	4.09E+03	9.71E+02	1.91E+02	5.25E+03
WDP		m^3 eq	1.23E+02	4.50E+00	6.20E-01	1.28E+02

*biogenic carbon content in wood -825 kg CO_2-eq

Global Warming Potential - Total: due to the wood propriety of carbon uptaking during its growth, the benefit of absorption (-825 kg CO_2-eq /m³) is higher than emissions within the system boundaries (356 kg CO_2-eq /m³). Taking into account positive emissions, the upstream phase contributes by 78.5% to global warming, mainly due to electricity (44.2%) , agroforestry operation and drying for wood production (22.4%) and glue, hardener and preservative agent production (10.8%). The core phase generates 18.1% of the total emissions due to the transport of wood and materials used in the production process. The downstream phase contributes with 3.3%, due to the transport of the product to the building site. The final result highlights a negative value of -469 kg CO_2-eq /m³ as emission/absorption balance per m³ of Glued Laminated Timber.

Acidification Potential: upstream processes generate highest impacts (81.1%), mainly due to the grid electricity (36.3%), wood production (29.6%) and glue, hardener and preservative agent production (14.2%). The core phase generates 15.7% of the total impact, due to transports of material used in the production process (15.3%). The downstream phase contributes to 3.1%, due to the transport of the product to the building site.

Eutrophication Potential: upstream processes generate the highest impact (89.4%) due to electricity from grid (41.3%), wood production and drying (39.1%) and glue, hardener and preservative agent production (8.0%). The core phase generates 8.9% of the total impact, mainly due to transports of material used in the production process (8.5%). The downstream phase contributes to 1.7%, due to the transport of the product to the building site.

Photochemical Formation Oxidation Potential: upstream processes generate the most of the impact (78.9%), due to wood production and drying (57.8%), electricity from grid (16.2%) and glue, hardener and preservative agent production (4.3%). The core phase generates 17.5% of the total impact due to transports of material used in the production process (17.1%). The downstream phase contributes to 3.6%, due to the transport of the product to the building site.

The most relevant aspect in terms of environmental impact management is constituted by electricity consumption, wood production (i.e. agroforestry operations and drying) and transport, besides material consumption during the production process. The hot-spots highlighted by results constitute the starting point to identify and develop solutions to mitigate impacts and optimize the whole process, for a continuous improvement of environmental performances through company management.

Use of risources

tab. 3
Total renewable and non-renewable resources used in the Glulam production system (2018)

Acronyms
PER = Primary energy resources – Renewable;
PENR = Primary energy resources – Non-renewable;
PENRT = Total use of non-renewable primary energy re-sources;
SM = Secondary material;
RSF = Renewable secondary fuels;
NRSF = Non-renewable secondary fuels;
FW = Net use of fresh water.

Renewable and non-renewable resources						
Parameter		Unit	UPSTREAM A1	CORE A2-A3	DOWNSTREAM A4	Total A1-A4
PER	use as energy carrier	MJ, net calorific value	1.71E+04	1.52E+01	2.40E+00	1.72E+04
	use as raw materials	MJ, net calorific value	1.62E+04	3.49E+00	4.97E-01	1.62E+04
	Total	**MJ, net calorific value**	3.33E+04	1.87E+01	2.90E+00	3.34E+04
PENR	use as energy carrier	MJ, net calorific value	3.97E+03	1.03E+03	2.02E+02	5.64E+03
	use as raw materials	MJ, net calorific value	4.29E+02	0.00E+00	0.00E+00	0.00E+00
	Total	**MJ, net calorific value**	4.40E+03	1.03E+03	2.02E+02	5.64E+03
SM		kg	0	0	0	0
RSF		MJ, net calorific value	0	0	0	0
NRSF		MJ, net calorific value	0	0	0	0
FW		m^3	1.45E+00	2.22E-01	3.97E-02	1.71E+00

Waste production and output flows

tab. 4
Total waste generation for the Glulam production system (2018)

Renewable and non-renewable resources					
Parameter	Unit	UPSTREAM A1	CORE A2-A3	DOWNSTREAM A4	Total A1-A4
Hazardous waste disposed	kg	9.79E-03	2.49E-03	4.62E-04	1.27E-02
Non-hazardous waste disposed	kg	3.89E+01	6.61E+01	1.66E+01	1.22E+02
Radioactive waste disposed	kg	1.48E-02	6.56E-03	1.30E-03	2.26E-02

tab. 5
Total output flows for the Glulam production system (2018)

Output flows					
Parameter	Unit	UPSTREAM A1	CORE A2-A3	DOWNSTREAM A4	Total A1-A4
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	2.18E-02	0.00E+00	2.18E-02
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Data and impact assessment results can be considered as rapresentative for all glulam size produced in the Bettona site, from 8x8 to24x48 and 20x80 (i.e. variation <10%).

Additional information

L.A. COST provides high quality standard for processes performed and products produced as proved by a set of labels and achievements.

The UNI EN ISO 9001:2015 Quality Certification, issued by DNV GL, certifies that the management procedures followed by L.A. COST for design, production and construction comply with a standard of excellence.

The PEFC ST 2002:2013 certification, also issued by DNV GL, allows the traceability of wood, coming exclusively from forests and plants managed in a responsible and sustainable way, from an ecological, economic and social point of view.

As per the Ministerial Decree for Infrastructures of 14/01/2008, relating to the "Technical Standards on Construction", L.A. COST guarantees the quality of its structural products:

Glulam with CE Certificate of Conformity, issued by the external supervisory body CSI (part of the Italian Institute of Quality Mark), certifies the conformity of the production of glulam according to the requirements expressed in the harmonized European standard EN 14080 of 2013 (since August 2015).

For X-LAM cross-fibre panels, certificate ETA-12/0318, which certifies the conformity of production and the Certificate of Constancy of Performance 0809-CPR-1093 issued by the Finnish external supervisory body Eurofins - VTT Technical Research Centre of Finlad.

L.A. COST guarantees the accurate selection of the various classes of resistance of the wood, with the use of the Microtec Golden Eye 702 system able to perform the certified classification of the boards, according to the UNI EN 14081 standard.

L.A. COST guarantees compliance with the compulsory procedures for qualification and acceptance of the characteristics of wood products for structural uses, as per art. 11.7.10 of the Ministerial Decree 14/01/2008, through the possession of the Certificate of qualification for the processing of structural elements in wood, cutting, processing and transformation of wood products and wood-based products for structural use, issued by the "Central Technical Service of the Higher Council of Public Works".

In addition, L.A. COST is authorized to carry out public works through the possession of the SOA Certificate of qualification for the execution of public works in the category of specialized works OS32 "Structures in wood", up to the V ranking, or for amounts up to 5,165,000.00 €, OG1 "Civil and industrial buildings", up to the III-bis ranking according to Annex A of Presidential Decree 34/2000.

We have an internal technical engineering and coordination office that collaborates with a pool of architects, engineers, thermo-technicians and geometers able to design any type of structure. The lightness, workability and adaptability of wood allow us to create multiform architectural structures that can meet every need of end users.

L.A. COST holds the quality certificate for the construction of wooden houses granted by FederLegno Arredo on the adhesion to the S.A.L.E. protocol.

An agreement signed by the association for the protection of customers and credit institutions with the same institutions, which provides for the granting of credit lines and dedicated insurance for the construction of wooden houses.

Glossario

Biogenic carbon: carbon which is contained in biomass. [ISO 14067:2010]

Biogenic carbon dioxide (CO_2): CO_2 obtained by the oxidation of biogenic carbon. [ISO 14067:2010]

Carbon dioxide equivalent (CO_2 equivalent): unit for comparing the radiative forcing of a greenhouse gas to carbon dioxide. The carbon dioxide equivalent is calculated using the mass of a given greenhouse gas multiplied by its global warming potential [ISO 14064:2006]

Carbon footprint: net amount of greenhouse gas emissions and greenhouse gas removals, expressed in carbon dioxide (CO_2) equivalents. The CO_2 equivalent is calculated using the mass of a given greenhouse gas multiplied by its global warming potential. [ISO 14067:2010]

Functional unit: quantified performance of a product system for use as a reference unit. [ISO 14040:2006]

Global warming potential (GWP): factor describing the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time. [ISO 14064:2006]

Life cycle assessment (LCA): compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. [ISO 14040:2006]

Raw material: primary or secondary material that is used to produce a product. Secondary material includes recycled material. [ISO 14040:2006]

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