ENVIRONMENTAL PRODUCT DECLARATION OF MULTILAYER PANELS OF **POPLAR PLYWOOD**

PANGUANETA
Plywood For Life

Publication date	Valid until
23/05/2023	**17/01/2028**

EPD
ENVIRONMENTAL PRODUCT DECLARATION

Registration number
S-P-09388

ECO PLATFORM
EPD
VERIFIED

GENERAL INFORMATION

EPD Programme	The International EPD® System www.environdec.com
EPD Programme Operator	EPD International AB Box 210 60, SE-100 31 Stockholm, Sweden - mail: info@environdec.com.
Product Category Rules (PCR)	EPD® SYSTEM 3.01, nella PCR "CONSTRUCTION PRODUCTS PCR 2019:14 VERSION 1.11" UNI EN 15804:2019 – "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products". PCR 2019:14 Construction Products v1.11.
EPD Prepared by	Eng. Carlo Grassi, Dr. Jonatha Trabucco, Eng. Silvia Verrilli
Owner of the declaration	Panguaneta S.p.a. Via Gino Solazzi 19, 46018 Sabbioneta (MN) Italy
Website	www.panguaneta.com
Verified by	IMQ S.p.A. - Via Quintiliano 43, 20138 Milano, Italia - www.imq.it
UN CPC Code	31410 - Plywood consisting solely of sheets of wood, except of bamboo.

Geographical scope	International (except for the End of Life phase, which has Italian scope).
EPD registration number	S-P-09388
Update approval date	18/01/2023
Publication date	23/05/2023
Valid until	17/01/2028
Product description	Poplar plywood totally made of poplar veneers. Outer faces in long grain. Cross grain or unidirectional grain available on request. Suitable for those entire application fields that enhance all its main features: lightweight, stability, ease of cutting and machining.
Applications	Construction, automotive, boatbuilding, furniture and design, parquet, retailer, packaging.
Scope of application of the LCA	The Life Cycle Assessment (LCA) was carried out according to standards ISO 14025, ISO 14040, ISO 14044 and EN 15804. Both specific data from the production of the product under analysis as well as the following data bases were used: Ecoinvent 3.3. The method used for calculating the categories of impact was CML –IA version 4.1 as implemented in OpenLCA. The life cycle analysis covers the production of raw materials and energy; the transportation of raw materials; the manufacturing stage; the expedition stage; the end of life stage. The declared unit under consideration is 1 m^3 of poplar-based plywood panel for different gluing class (UNI EN 314 Standard): • **Class 1 (UNI EN 636 – 1)** • **Class 2 (UNI EN 636 – 2)** • **Class 3 (UNI EN 636 – 3)**

PROGRAM INFORMATION

EPD of construction products may not be comparable if they do not comply with **EN 15804**.
Environmental product declarations within the same product category from different programs may not be comparable.
The EPD owner has the sole ownership, liability, and responsibility for the EPD.

CEN standard EN15804 served as the core PCR

PCR:	EPD® SYSTEM 3.01, nella PCR "CONSTRUCTION PRODUCTS PCR 2019:14 VERSION 1.11"
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. - Contact via: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD Process Certification (Internal) ☒ EPD Verification (external)
Third party verifier:	IMQ
Accredited or approved by:	Accredia
Life Cycle Assessment (LCA)	Eng. Carlo Grassi, Dr. Jonatha Trabucco, Eng. Silvia Verrilli
Procedure for follow-up of data during EPD validity involves third-party verifier:	☐ Yes ☐ No

1. SOMMARIO

2. COMPANY PROFILE

Panguaneta turns a valuable raw material, poplar wood, into plywood with innovative performance features.
Playing a leading role on international markets, Panguaneta gives impetus to concrete environmental sustainability, involving all aspects of the industrial cycle in a virtuous and dynamic process. Thorough knowledge of the sector, total traceability at all stages, consistent management of complexity, coupled with the use of advanced technologies: the industrial experience of Panguaneta is a solid asset we are proud to share with our customers.

STRONG ROOTS

Originally, Panguaneta was the name of a village settlement beside the river Po. The fields, often invaded by the river waters, still give life to poplar plantations. Thanks to the tenacity of a group of young local people, led by Giuliano Azzi and Antonio Tenca, Panguaneta was reborn as a factory in Sabbioneta, in the spring of 1960. Those young people, often relatives, were to create a formidable industrial experience. In over half a century of history many events were to happen, but the success of Panguaneta will always see that same "big " family playing a leading role, now in its third generation.

REAL VALUES

The value of family, business ethics and loyalty to our origins. We at Panguaneta strongly believe in consistency and respect of our values. We prove this with commitment, planning the future in the name of sustainable development, respect and appreciation of work and with a strong propensity to product innovation. These are the core values of the Brand, the light that shines over the entire company. With loyal observance, Panguaneta also expresses deep gratitude to its roots, the territory, the founders, the women and men who have experienced all this, bringing the company to its current level of excellence.

MISSION ENVIRONMENT

Panguaneta aims to offer a product of industrial value, able to efficiently and advantageously replace other raw materials whose use has greater critical impact on the environment. The company lives its mission with passion, it often plays a leading role in international events and technical meetings, intervening on forest issues and firmly believing in good industrial practices. Panguaneta also has the ambition to grow while improving its environmental performance and impact on the Planet. The company thus contributes in a particular way to the sustainable development of the local economy, to global ecological balance, conservation of the landscape and the economic sustainability of many industrial products.

RESPONSIBLY

The continuity in the governance and ownership of the Company, the careful management of every aspect of the supply chain, the certifications acquired and complete self-sufficiency in energy testify to the strong and mature personality of the Panguaneta industrial model. In any relationship context, with the community which hosts it, customers and suppliers, workers and all stakeholders, Panguaneta acts responsibly, with awareness and a sharing approach.
This provides substantial strength, projecting the company with synergy into the future.

ESSENTIAL KNOWLEDGE

The making of Panguaneta rests on a solid link with the cultivation of poplar: this is what gives life to the raw material, the fine heritage of the landscape.
Panguaneta constantly implements field tests. Know-how gained in planting density, quality assurance represented by the Italian clone I214, the agricultural practices observed and forest management all follow the principles of biodiversity, ensuring the respect and protection of the natural environment.
Knowledge sharing and cultivation techniques take place mainly with traditional suppliers, which represent the most fruitful and accredited partnership of the company.
The direct ownership of several major estates, devoted to cultivation and experimentation confirm the "green" soul of Panguaneta.

ENERGY FOR THE FUTURE

As the poplar tree demonstrates its ecological value as it grows, improving various environmental parameters, so does Panguaneta, witnessing with the growth of the factory how it believes and also heavily invests in sustainable development. The energy system that powers the production facilities consists of a steam generator of a futuristic concept, designed specifically to exploit the best available technology (BAT) for the Panguaneta processing cycle. The biomass produced directly from in-house processing is a source of energy right on our doorstep, as well as being completely renewable. Sophisticated management of combustion processes ensures maximum energy efficiency and quality of emissions into the atmosphere. With a state-of-the-art thermal power plant reserving further, virtuous potential, plus the ability to recover other clean energy from residual steam, we have thus chosen to invest by looking ahead, to a world that is able to grow in a sustainable way.

QUALITY AND EXPERTISE

Panguaneta today looks to the future, with the certainty that it has developed strategic partnerships and equipped itself with the most advanced technologies. Continuous technical updating, global presence, deep knowledge of production processes and strong market skills are the defining elements behind a comprehensive range of products and services. Our plywood today reaches all latitudes and methods of design, construction and assembly, ensuring substantial competitive advantages, even for new applications. Our offer thus allows our customers to improve their business efficiency, timing, reliability and productivity.

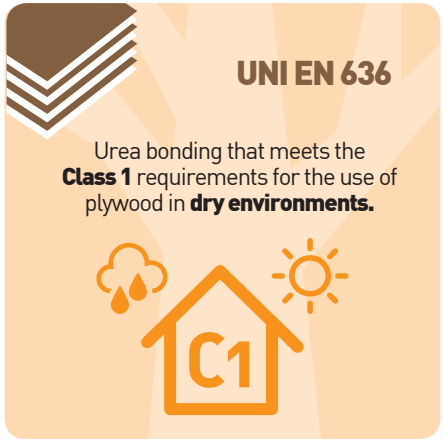
3. PRODUCTS DESCRIPTION

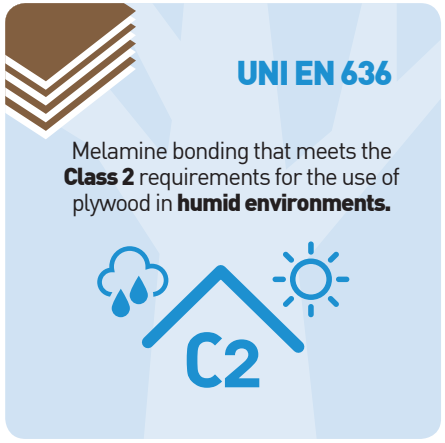
Plywood is a panel product made of thin veneers of wood peeled from poplar wood logs and bonded by resin.

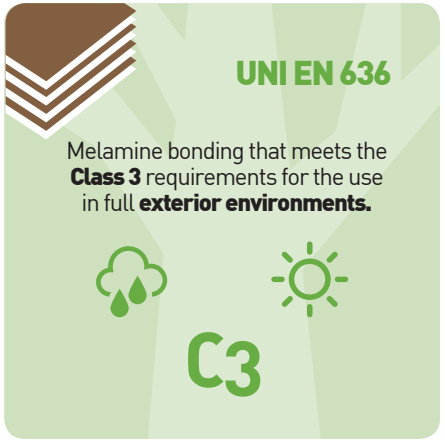
TYPES OF BONDING

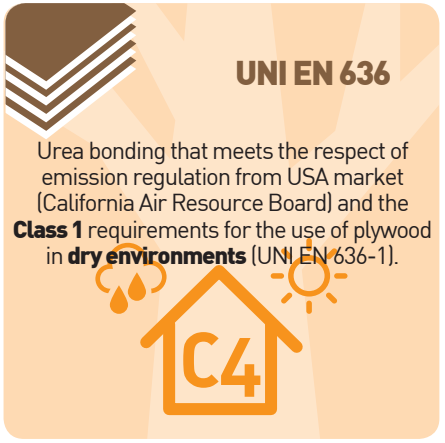
The quality of Panguaneta glues complies with the provisions of **UNI EN 314 Standard**, after suitable treatment in view of resistance to humidity.

Products are divided in **4 gluing classes.**









Plywood is used in many application areas, such as structural bracing, concrete formwork, cladding, flooring, webbed beams, boats, aircraft, door skins, furniture, wall panels and architectural joinery in exterior and interior environments. The ratio between thickness and number of layers (veneers) affect the glue quantity per m^3 necessary for bonding.

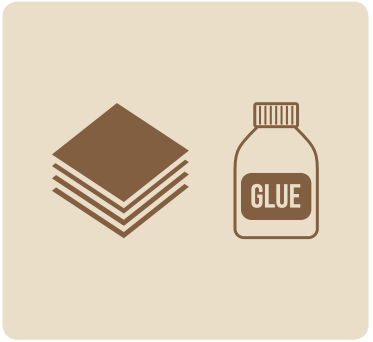
4. CONTENT DECLARATION

MAIN COMPONENTS OF THE PANGUANETA POPLAR PLYWOOD PANEL

Thickness	N. layers	C1 and C2		C3		C4	
		Glue	Poplar Wood*	Glue	Poplar Wood*	Glue	Poplar Wood*
15	7	22.9%	77.1%	27.3%	72.7%	18.5%	81.5%
8,8	5	26.6%	73.4%	28.5%	71.5%	24.9%	75.1%
15,5	9	29.1%	70.9%	31.1%	68.9%	21.6%	78.4%
6	5	35.2%	64.8%	31.1%	68.9%	29.7%	70.3%

*Poplar wood with humidity content of about 5%

The formulation contains no hazardous substances and no substances of very high concern (SVHC) on the REACH Candidate List/ published by the European Chemicals Agency in a concentration more than 0,1% (by unit weight).



In Italy it is forbidden to allow the use of panels, semi-finished or finished products with formaldehyde emissions higher than those established for Class E1. Panguaneta products are all accompanied by a conformity declaration by the producer conformity declaration. The emission class is assigned in conformity with UNI EN 636 standard.
The low emission class E1 panels do not cause a concentration of equilibrium in the air of the test chamber (defined in the UNI EN 717-1 standard) greater than 0.1 ppm, the limit established by the World Health Organisation for living and residential environments.

Standard/Certification	Conformity
Class E1	All products
EU 995/2010	All products
REACH	All products
NAF Bonding – No Added Formaldehyde	On demand
CARB2 Bonding - (California Air Resource Board, Phase 2)	On demand
FSC® (Forest Stewardship Council®)	On demand
PEFC™ (Programme for Endorsement of Forest Certification schemes)	On demand
CE2+	On demand

100% POPLAR MADE IN ITALY

CATAS QUALITY AWARD FOR 01/93

CE 2+

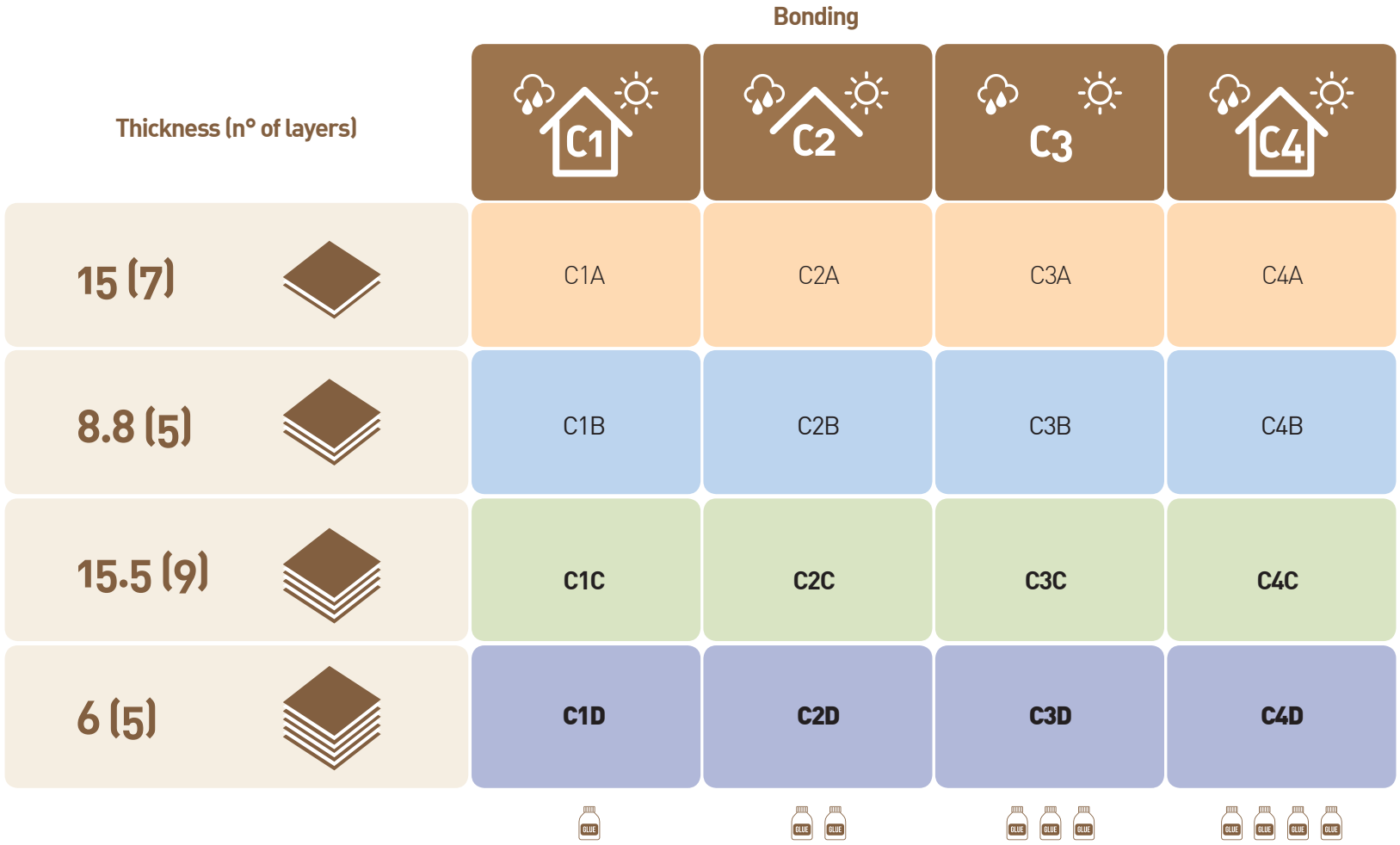
FSC www.fsc.org FSC® C019345
The mark of responsible forestry
Richiedi prodotti certificati FSC®

PEFC PEFC/18-31-30
Promoting Sustainable Forest Management
www.pefc.org

PANGUANETA SPA
ATCM 93120 Compliant for Formaldehyde Phase 2 and TSCA Title VI Certified
No. 001 - TPC 016

5. DECLARED UNIT

For this EPD, the concept of "unit declared" applies instead of "functional unit", following the guidelines established in the reference PCR. The present declaration refers to the manufacture of 1 m^3 of poplar plywood panel of different thickness, number of layers and bonding. According to PCR's guidelines results are presented using the impacts of representative products.



In the table below are shown the representative products (first column) and the related represented products ordered by glued surface per m^3:

Representative Products	Thickness (mm)	N° of layers	Glued Surface per m^3 (m^2)	Thickness (mm)	N° of layers	Glued Surface per m^3 (m^2)
 15 (7) A	5.5	3	182	14.5	7	207
	11	5	182	24	11	208
	36	15	194	28.5	13	211
	35	15	200	19	9	211
	40	17	200	38	17	211
	10	5	201	33	15	212
	15	7	201	23.5	11	213
	30	13	201	14	7	214
	20	9	202	28	13	214
	25	11	203	18.5	9	216

Representative Products	Thickness (mm)	N° of layers	Glued Surface per m³ (m²)
8.8 (5) B	27.6	13	217
	23	11	217
	27	13	218
	18	9	226
	8.8	5	227
	22	11	227
	9	5	230
	13	7	231
	17	9	235
	5	3	238
	21	11	238
	16.5	9	242

Representative Products

15.5 (9)

C

Thickness (mm)	N° of layers	Glued Surface per m³ (m²)
8	5	250
4	3	250
12	7	252
15.5	9	258
16	9	255

Representative Products

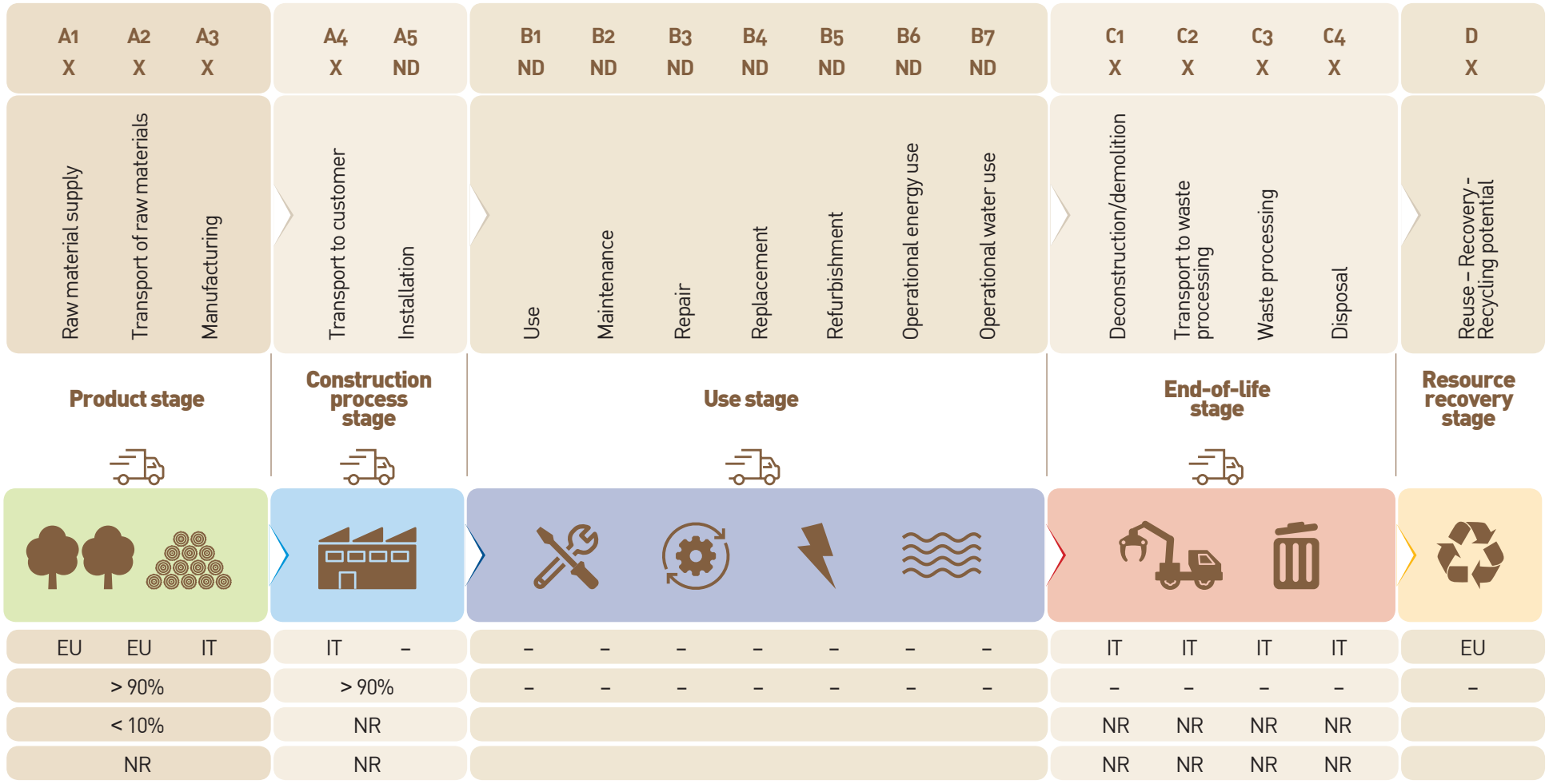
6 (5)

D

Thickness (mm)	N° of layers	Glued Surface per m³ (m²)
7	5	282
16.4	11	305
6	5	320
3	3	333

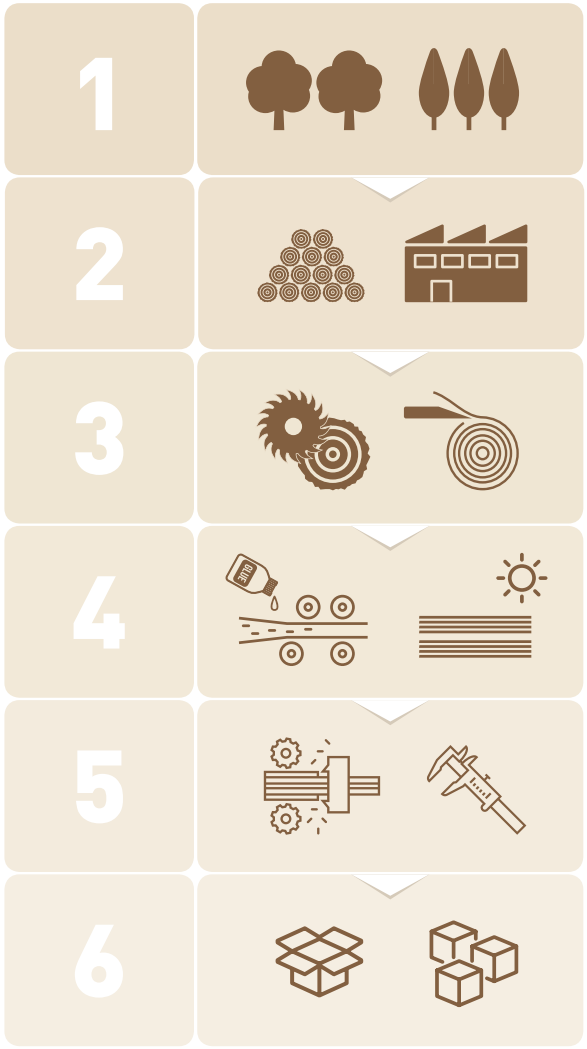
6. SYSTEM BOUNDARY

This EPD is of the "cradle to gate with options" type and includes the mandatory modules A1 (Raw materials), A2 (Transport), A3(Manufacturing) and the optional modules A4 (Transport to consumer), C2 (Transport to waste processing), C3 (Waste processing), C4 (Disposal) and D (Reuse – Recovery - Recycling potential).



NOTE – ND=module not declared; X=module included; NR = Not Relevant

7. PRODUCTION (A1-A3)



1_ Panguaneta plywood can be produced from **poplar or exotic wood**, with **poplar plywood** being the most common. This EPD represents poplar plywood panels, which includes 50% of total production by volume.

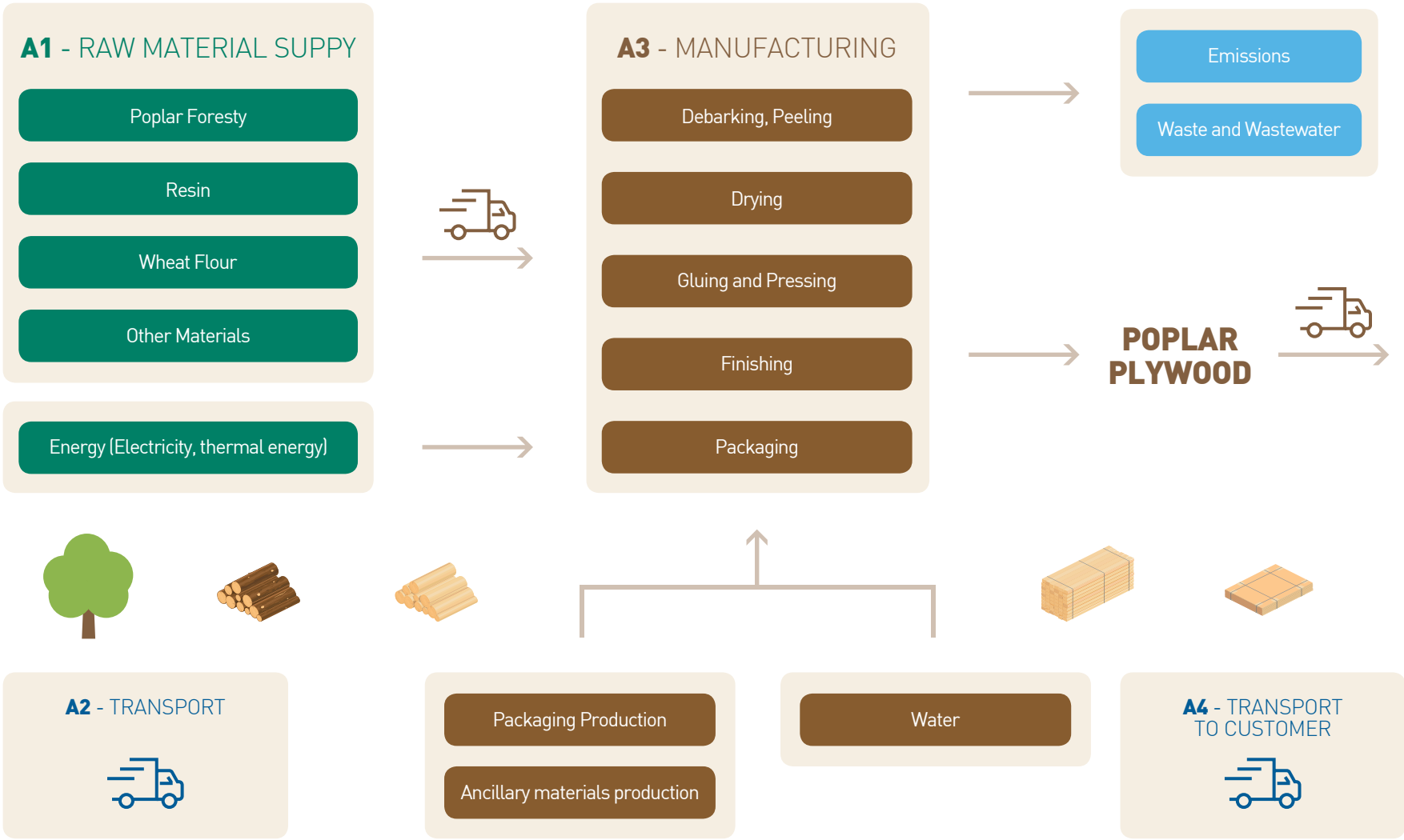
2_ The manufacturing process starts by **debarking log**, then poplar log undergoes a **peeling process** which is the first transformation cycle for plywood. This is done through the **tangential cutting** of the log which is transformed into a thin, continuous strip of wood cellulose of various thicknesses.

3_ The precision of the layers is ensured by digitally controlled, **cutting-edge** production lines that ensure uniformity and quality of the cuts. The layer obtained is then converted into veneers of the desired size before they are **dried** to achieve an optimal degree of moisture.

4_ Finished veneers are **resin-bonded** with the grain direction of each layer perpendicular to that of the previous layer and then hot **pressed into a panel**. C1-bond (urea formaldehyde) resin is most common, **while C2 and C3-bond** (melamine urea formaldehyde) resin represent a minor production.

5_ Panguaneta plywood is subjected to a **suitable finishing**, with four processing phases: squaring and trimming of the edges; balancing and smoothing to **optimize the surfaces**, and lastly, testing.

6_ The final board is **packaged and stored**.
Steel straps and cardboard are the main packaging materials used.


A1 - RAW MATERIAL SUPPY
Poplar Foresty
Resin
Wheat Flour
Other Materials
Energy (Electricity, thermal energy)
A3 - MANUFACTURING
Debarking, Peeling
Drying
Gluing and Pressing
Finishing
Packaging
Emissions
Waste and Wastewater
POPLAR PLYWOOD
A2 - TRANSPORT
Packaging Production
Ancillary materials production
Water
A4 - TRANSPORT TO CUSTOMER

8. TRANSPORT TO CUSTOMER (A4)

The transportation of the product to customer is included in this declaration.

This module is divided in 3 scenarios:

Local Transportation
Italy

Continental transportation
Europe

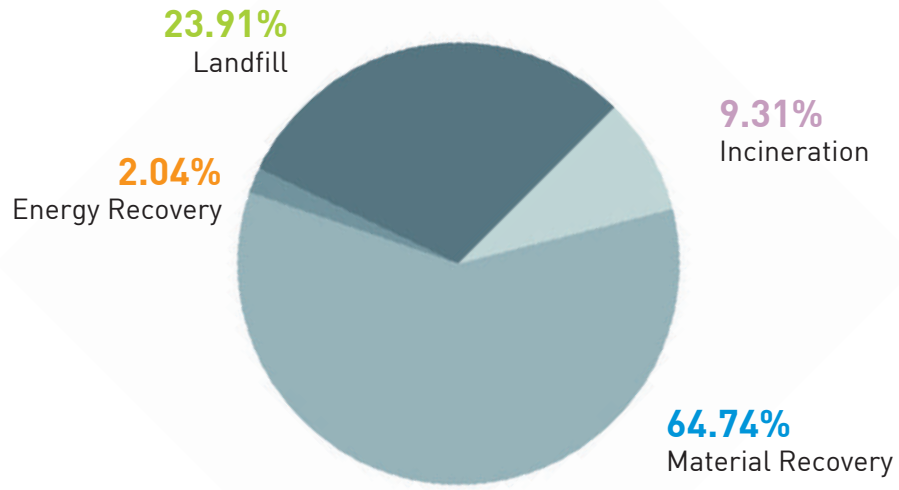
Intercontinental transportation
mainly U.S.A. and Australia

Parameter	Unit	Land Transportation	Water Transportation
Vehicle type used for transport	n.a.	Heavy-duty vehicles	Transoceanic ship
Fuel type	n.a.	Diesel	Heavy fuel oil
Fuel consumption	Kg/tkm	0.0196	0.0025
Gross vehicle weight	Ton	29.96	n.d.
Average load factor	Ton/vehicle	15.96*	50000
Bulk density of transported products	Kg/m^3	410	410
Volume capacity utilisation factor (factor: = 1 or < 1 or ≥ 1 for compressed or nested packaged products)	n.a.	<1	<1
Database process utilized (Ecoinvent)	n.a.	Transport, freight, lorry >32 metric ton, EURO3	Transport, freight, sea, transoceanic ship

* Includes empty return

9. END OF LIFE (C2-C4) AND RECOVERY (D)

When a wood product reaches the end of its useful life, it may either be reused, recycled, landfilled or combusted to produce energy.
The End-of-Life scenario is based on data from Italian national waste management reports and assumes that about 66.78% of the panels is sent to some recycling process (mainly recovery of primary material, while a smaller fraction is sent to energy recovery).
The remaining fraction (33.22%) is landfilled or incinerated.



10. CUT-OFF & ALLOCATION

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary.
All inputs and outputs to a unit process for which data are available are included in the calculation. Less than 1% of the total mass inputs / outputs of the unit process are cut off.
Allocation of co-products: As the difference in economic value of the co-products is high (>25% as per EN 15804, Section 6.4.3.2), allocation has been done by economic value.

11. ENVIRONMENTAL PERFORMANCE

Environmental Impacts: 1 m^3 poplar plywood, C1 bonding class for modules A1-A3.

Impact category	Reference unit	C1A	C1B	C1C	C1D
ADPf	MJ	6.10E+03	6.60E+03	6.97E+03	8.30E+03
ADPel	kg Sb eq	3.16E-03	3.53E-03	3.93E-03	4.95E-03
AP	kg SO_2 eq	1.94E+00	2.05E+00	2.14E+00	2.45E+00
EP freshwater	kg P eq	6.31E-02	6.76E-02	7.03E-02	8.24E-02
EP freshwater	kg P eq	6.31E-02	6.76E-02	7.03E-02	8.24E-02
GWP - GHG	kg CO_2 eq	3.43E+02	3.66E+02	3.78E+02	4.39E+02
GWP Biogenic	kg CO_2 eq	-5.48E+02	-5.51E+02	-5.55E+02	-5.63E+02
GWP Fossil	kg CO_2 eq	3.49E+02	3.73E+02	3.85E+02	4.48E+02
GWP Luluc	kg CO_2 eq	1.46E+00	1.47E+00	1.48E+00	1.50E+00
GWP Total	kg CO_2 eq	-2.07E+02	-1.87E+02	-1.78E+02	-1.26E+02
EP Marine	kg N eq	6.85E-01	7.24E-01	7.62E-01	8.74E-01
ODP	kg CFC-11 eq	6.49E-05	6.92E-05	7.20E-05	8.35E-05
POCP	kg C_2H_4 eq	1.78E+00	1.84E+00	1.88E+00	2.04E+00
WDP	m^3	4.03E+02	4.49E+02	4.99E+02	6.24E+02
PERT	MJ	1.49E+04	1.50E+04	1.50E+04	1.52E+04
PERM	MJ	7.81E+03	7.81E+03	7.81E+03	7.81E+03
PERE	MJ	7.14E+03	7.19E+03	7.23E+03	7.35E+03

Environmental Impacts: 1 m^3 poplar plywood, C1 bonding class for modules A1-A3.

Impact category	Reference unit	C1A	C1B	C1C	C1D
PENRT	MJ	6.53E+03	7.05E+03	7.42E+03	8.83E+03
PENRM	MJ	7.78E+02	8.84E+02	1.00E+03	1.30E+03
PENRE	MJ	5.75E+03	6.17E+03	6.42E+03	7.53E+03
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FWT	m^3	8.21E-02	8.27E-02	8.25E-02	8.39E-02
HWD	kg	1.22E+00	1.22E+00	1.22E+00	1.22E+00
NHWD	kg	1.72E+02	1.80E+02	1.88E+02	2.10E+02
RWD	kg	1.84E-02	1.92E-02	1.95E-02	2.15E-02
CRU	kg	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
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Disclaimer 1 is applicable for the impact category of IRP – Potential Huma exposure efficiency relative to U325. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.
Disclaimer 2 is applicable for the impact categories of Abiotic Depletion Potential - ADP mineral&metals, Abiotic Depletion Potential - ADP-fossil, Water Deprivation potential WDP, Potential Comparative Toxic Unit for ecosystems ETP-fw, Potential Comparative Toxic Unit for humans HTP-c, Potential Comparative Toxic Unit for humans HTP-nc and Potential Soil quality index SQP. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Environmental Impacts: 1 m^3 poplar plywood, C2 bonding class for modules A1-A3.

Impact category	Reference unit	C2A	C2B	C2C	C2D
ADPf	MJ	7.46E+03	8.14E+03	8.73E+03	1.06E+04
ADPel	kg Sb eq	4.52E-03	5.07E-03	5.68E-03	7.20E-03
AP	kg SO_2 eq	2.76E+00	2.98E+00	3.19E+00	3.82E+00
EP freshwater	kg PO_4^{---} eq	9.98E-02	1.09E-01	1.18E-01	1.44E-01
GWP - GHG	kg CO_2 eq	4.61E+02	5.01E+02	5.31E+02	6.37E+02
GWP Biogenic	kg CO_2 eq	-5.51E+02	-5.55E+02	-5.59E+02	-5.69E+02
GWP Fossil	kg CO_2 eq	4.71E+02	5.11E+02	5.42E+02	6.51E+02
GWP Luluc	kg CO_2 eq	1.51E+00	1.52E+00	1.54E+00	1.58E+00
GWP Total	kg CO_2 eq	-9.15E+01	-5.56E+01	-2.91E+01	6.72E+01
EP Marine	kg N eq	8.24E-01	8.82E-01	9.41E-01	1.11E+00
ODP	kg CFC-11 eq	6.89E-05	7.37E-05	7.72E-05	9.02E-05
POCP	kg C_2H_4 eq	2.16E+00	2.27E+00	2.37E+00	2.67E+00
EP Tewrrestrial	Mole N eq.	8.28E+00	8.85E+00	9.42E+00	1.10E+01
WDP	m^3	5.73E+02	6.41E+02	7.17E+02	9.07E+02
PERT	MJ	1.50E+04	1.51E+04	1.52E+04	1.53E+04
PERM	MJ	7.81E+03	7.81E+03	7.81E+03	7.81E+03
PERE	MJ	7.23E+03	7.29E+03	7.34E+03	7.50E+03

Environmental Impacts: 1 m^3 poplar plywood, C2 bonding class for modules A1-A3.

Impact category	Reference unit	C2A	C2B	C2C	C2D
PENRT	MJ	7.92E+03	8.63E+03	9.22E+03	1.11E+04
PENRM	MJ	.95E+02	1.02E+03	1.16E+03	1.49E+03
PENRE	MJ	7.02E+03	7.61E+03	8.06E+03	9.65E+03
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FWT	m^3	4.33E-02	3.86E-02	3.24E-02	1.92E-02
HWD	kg	1.22E+00	1.22E+00	1.22E+00	1.22E+00
NHWD	kg	2.68E+02	2.89E+02	3.11E+02	3.70E+02
RWD	kg	2.02E-02	2.12E-02	2.17E-02	2.44E-02
CRU	kg	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
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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Environmental Impacts: 1 m^3 poplar plywood, C3 bonding class for modules A1-A3.

Impact category	Reference unit	C3A	C3B	C3C	C3D
ADPf	MJ	8.88E+03	9.75E+03	1.06E+04	1.06E+04
ADPel	kg Sb eq	5.93E-03	6.67E-03	7.50E-03	9.55E-03
AP	kg SO_2 eq	3.49E+00	3.82E+00	4.14E+00	5.05E+00
EP freshwater	kg PO_4^{---} eq	1.41E-01	1.56E-01	1.71E-01	2.12E-01
GWP - GHG	kg CO_2 eq	5.90E+02	6.46E+02	6.97E+02	8.51E+02
GWP Biogenic	kg CO_2 eq	-5.25E+02	-5.25E+02	-5.25E+02	-5.24E+02
GWP Fossil	kg CO_2 eq	6.02E+02	6.60E+02	7.12E+02	8.70E+02
GWP Luluc	kg CO_2 eq	1.54E+00	1.56E+00	1.58E+00	1.63E+00
GWP Total	kg CO_2 eq	6.38E+01	1.21E+02	1.71E+02	3.26E+02
EP Marine	kg N eq	7.53E-01	8.02E-01	8.51E-01	9.89E-01
ODP	kg CFC-11 eq	7.13E-05	7.65E-05	8.03E-05	9.42E-05
POCP	kg C_2H_4 eq	2.57E+00	2.74E+00	2.90E+00	3.36E+00
EP Tewrrestrial	Mole N eq.	9.68E+00	1.04E+01	1.12E+01	1.34E+01
WDP	m^3	6.67E+02	7.49E+02	8.39E+02	1.06E+02
PERT	MJ	1.48E+04	1.49E+04	1.49E+04	1.50E+04
PERM	MJ	7.81E+03	7.81E+03	7.81E+03	7.81E+03
PERE	MJ	7.02E+03	7.05E+03	7.08E+03	7.16E+03

Environmental Impacts: 1 m^3 poplar plywood, C3 bonding class for modules A1-A3.

Impact category	Reference unit	C3A	C3B	C3C	C3D
PENRT	MJ	9.35E+03	1.03E+04	1.11E+04	1.35E+04
PENRM	MJ	9.94E+02	1.13E+03	1.28E+03	1.66E+03
PENRE	MJ	8.36E+03	9.13E+03	9.79E+03	1.19E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FWT	m^3	-1.47E-03	-1.23E-02	-2.54E-02	-5.54E-02
HWD	kg	1.22E+00	1.22E+00	1.22E+00	1.22E+00
NHWD	kg	3.76E+02	4.12E+02	4.51E+02	5.50E+02
RWD	kg	2.17E-02	2.30E-02	2.38E-02	2.70E-02
CRU	kg	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
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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Environmental Impacts: 1 m^3 poplar plywood, C4 bonding class for modules A1-A3.

Impact category	Reference unit	C4A	C4B	C4C	C4D
ADPf	MJ	3.00E+03	3.08E+03	2.97E+03	3.14E+03
ADPel	kg Sb eq	5.01E-04	5.04E-04	4.98E-04	5.06E-04
AP	kg SO_2 eq	1.20E+00	1.21E+00	1.18E+00	1.22E+00
EP freshwater	kg PO_4^{---} eq	3.67E-02	3.76E-02	3.63E-02	3.84E-02
GWP - GHG	kg CO_2 eq	2.13E+02	2.19E+02	2.11E+02	2.24E+02
GWP Biogenic	kg CO_2 eq	-5.25E+02	-5.25E+02	-5.25E+02	-5.25E+02
GWP Fossil	kg CO_2 eq	2.16E+02	2.21E+02	2.13E+02	2.26E+02
GWP Luluc	kg CO_2 eq	1.40E+00	1.40E+00	1.40E+00	1.40E+00
GWP Total	kg CO_2 eq	-3.14E+02	-3.09E+02	-3.16E+02	-3.04E+02
EP Marine	kg N eq	3.98E-01	3.98E-01	3.92E-01	3.97E-01
ODP	kg CFC-11 eq	3.92E-05	4.00E-05	3.88E-05	4.06E-05
POCP	kg C_2H_4 eq	1.40E+00	1.40E+00	1.38E+00	1.40E+00
EP Tewrrestrial	Mole N eq.	4.14E+00	4.14E+00	4.08E+00	4.12E+00
WDP	m^3	4.77E+01	4.83E+01	4.73E+01	4.87E+01
PERT	MJ	1.46E+04	1.46E+04	1.46E+04	1.46E+04
PERM	MJ	7.81E+03	7.81E+03	7.81E+03	7.81E+03
PERE	MJ	6.83E+03	6.83E+03	6.83E+03	6.84E+03

Environmental Impacts: 1 m^3 poplar plywood, C4 bonding class for modules A1-A3.

Impact category	Reference unit	C4A	C4B	C4C	C4D
PENRT	MJ	3.32E+03	3.40E+04	3.28E+04	3.48E+04
PENRM	MJ	1.01E+02	1.14E+03	1.30E+03	1.68E+03
PENRE	MJ	2.31E+03	2.26E+03	1.99E+03	1.80E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FWT	m^3	8.02E-02	8.05E-02	8.00E-02	8.07E-02
HWD	kg	1.21E+00	1.21E+00	1.21E+00	1.21E+00
NHWD	kg	1.18E+02	1.19E+02	1.18E+02	1.20E+02
RWD	kg	1.45E-02	1.47E-02	1.48E-02	1.49E-02
CRU	kg	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
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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ACRONYMS

ENVIRONMENTAL IMPACTS:

AP = Acidification Potential;
ADPel = Abiotic Depletion Potential (elements);
EP = Eutrophication Potential;
ODP = Ozone Depletion Potential;
GWP = Global Warming Potential;
POCP = Photochemical Ozone Creation Potential;
ADPf = Abiotic Depletion Potential (fossil).

RESOURCE CONSUMPTION:

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

WASTE PRODUCTION:

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed;
CRU = Components for reuse;
MFR = Materials for recycling;
MER = Materials for energy recovery;
EE = Exported energy.

12. DOWNSTREAM MODULES

Impacts refers to 1 m^3 of poplar plywood. Results depend on bulk density that is constant 410 kg /m^3 for different bonding classes (C1-C2-C3) and different representative products (A-B-C-D).

A4 – Transport to customer (Local Transport, Continental Transport, Intercontinental Transport)

Impact category	Reference unit	Transport to customer
ADPf	MJ	4.88E+02
ADPel	kg Sb eq	7.34E-05
AP	kg SO_2 eq	2.40E-01
EP Freshwater	kg PO_4^{---} eq	2.04E-03
EP Marine	kg N eq	9.11E-02
EP Terrestrial	Mole N eq	9.97E-01
GWP - GHG	kg CO_2 eq	3.16E+01
GWP Biogenic	kg CO_2 eq	5.31E-02
GWP Fossil	kg CO_2 eq	3.18E+01
GWP Luluc	kg CO_2 eq	9.07E-03
GWP Total	kg CO_2 eq	3.19E+01
ODP	kg CFC-11 eq	9.11E-02
POCP	kg C_2H_4 eq	7.15E-06
PERT	MJ	5.82E+00
PERM	MJ	0.00E+00

A4 – Transport to customer (Local Transport, Continental Transport, Intercontinental Transport)

Impact category	Reference unit	Transport to customer
PERE	MJ	5.82E+00
PENRT	MJ	4.97E+02
PENRM	MJ	0.00E+00
PENRE	MJ	4.97E+02
SM	kg	0.00E+00
RSF	MJ	0.00E+00
NRSF	MJ	0.00E+00
FWT	m^3	1.30E-02
HWD	kg	1.19E-03
NHWD	kg	4.48E+01
RWD	kg	3.41E-03
CRU	kg	0.00E+00
MFR	kg	0.00E+00
MER	kg	0.00E+00
EE	MJ	0.00E+00

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C2÷C4 – End of Life;
D – Resource recovery

Impact category	Reference unit	Decommissioning/ Deconstruction C1	Transport to Waste Processing C2	Waste Processing C3	Disposal C4	Resource recovery stage D
ADPf	MJ	0	5.03E+01	1.21E+02	4.11E+01	-2.22E+02
ADPel	kg Sb eq	0	1.23E-05	2.77E-05	6.67E-06	2.24E-05
AP	kg SO_2 eq	0	1.69E-02	5.71E-02	2.15E-02	-5.30E-02
EP Freshwater	kg PO_4^{---} eq	0	2.30E-03	2.26E-03	7.00E-04	-2.89E-03
EP Marine	kg N eq	0	5.90E-03	1.90E-02	5.76E-02	-1.35E-02
EP Terrestrial	Mole N eq	0	6.44E-02	2.02E-01	9.24E-02	-1.44E-01
GWP - GHG	kg CO_2 eq	0	3.35E+00	9.16E+00	1.14E+01	-1.52E+01
GWP Biologic	kg CO_2 eq	0	6.90E-03	2.74E+02	2.48E+02	-8.93E-01
GWP Fossil	kg CO_2 eq	0	3.37E+00	9.27E+00	2.33E+00	-1.54E+01
GWP Luluc	kg CO_2 eq	0	1.13E-03	7.61E-03	8.60E-04	-5.47E-03
GWP Total	kg CO_2 eq	0	3.36E+00	9.17E+00	2.32E+00	-1.51E+01
ODP	kg CFC-11 eq	0	5.90E-03	1.90E-02	5.76E-02	-1.35E-02
POCP	kg C_2H_4 eq	0	7.72E-07	1.40E-06	5.14E-07	-2.35E-06
PERT	MJ	0	6.80E-01	6.05E+00	7.74E-01	-1.91E+01
PERM	MJ	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	0	6.80E-01	6.05E+00	7.74E-01	-1.91E+01
PENRT	MJ	0	5.14E+01	1.31E+02	4.21E+01	-2.48E+02

C2÷C4 – End of Life;
D – Resource recovery

Impact category	Reference unit	Decommissioning/ Deconstruction C1	Transport to Waste Processing C2	Waste Processing C3	Disposal C4	Resource recovery stage D
PENRM	MJ	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	0	5.14E+01	1.31E+02	4.21E+01	-2.48E+02
SM	kg	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FWT	m^3	0	1.04E-03	-3.23E-02	-6.32E-02	-2.94E-02
HWD	kg	0	1.30E-04	2.50E-04	6.79E-05	-3.40E-04
NHWD	kg	0	2.82E+00	8.62E+00	1.42E+02	-5.28E+00
RWD	kg	0	3.50E-04	7.30E-04	2.20E-04	-8.30E-04
CRU	kg	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	kg	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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14. CARBON SEQUESTRATION

During growth, trees absorb carbon dioxide (CO_2) from the atmosphere through the process of photosynthesis and convert this into carbon-based compounds that constitute various components of a tree, including wood.

The CO_2 sequestered per m^3 of wood was calculated according to the formula:

$$\text{Mass of } CO_2 \text{ sequestered} = m_{dry} \text{ (timber)} \times C_f \times 44/12$$

Where:

- **Mass of CO_2 sequestered is the biogenic carbon sequestered in the wood.**
- **m_{dry} (timber) is the dry weight of the timber in the finished product.**
- **C_f is the percentage of carbon in dry matter, for Angiosperms timber = 48% ± 2 [IPCC, 2006]**

The average density of the finished product is 410 kg * m^{-3}, of which 330 kg * m^{-3} of poplar wood, with a residual moisture of 10%.

The average amount of CO_2 sequestered per m^3 of plywood is approximately 522.7 kg CO_2-Eq.

15. ELECTRICITY MIX

The electrical mix used in the model is the Italian residual mix as reported in the AIB European residual mixes 2020. A low-voltage electricity production process characterized by specific transmission losses was implemented in the model (Ecoinvent data source).
The emission factor of the energy mix used (GWP-GHG) evaluated as Low Voltage for the GWP100 indicator is equal to 0.694 Kg CO_2e/kWh.

DIFFERENCES FROM PREVIOUS VERSIONS

- The distribution of consumption within the company has been modified to comply with the 2021 Energy Analysis, drawn up for ISO 50001 certification.
- The amount of glue per m^2 used in the various gluing classes is calculated starting from the measurements of quantity of mixture consumed for every processing orders present in the company's management database.
  These data has been updated to 2021 production orders.
- The energy (thermal and electric) consumption calculation and allocation to declared unit for the different products are implemented with regression function for each products regarding the processing orders of 2021.
- Results of the environmental performance of products subject to certification have varied from the previous version by ± 10%.
  It was therefore necessary to publish the new results to replace the previous ones.

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