Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

AKRITAS Melamine Faced Chipboard

from **AKRITAS S.A.**

Publisher:	AKRITAS S.A., Tychero, Evros Prefecture, Greece (Postal Code: 68083)
Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-04769
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information:

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

EPD rules and third-party verifier information:

CEN standard EN 15804 serves as the Core Product Category Rules (PCR).

Product category rules (PCR): *Product Category Rules (PCR): 2019:14 Version 1.1, 2019-09-14, , EN 15804:2012 + A2:2019: Sustainability of Construction Works, 2012-02-29, c-PCR-006 Wood and wood-based products for use in construction (EN 16485), Version: 2019-12-2020*

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒ EPD verification

Third party verifier:

EUROCERT S.A., Chlois 89, Metamorfosi 144 52, Greece

Email: info@eurocert.gr

Website: www.eurocert.gr

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. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: AKRITAS S.A. 3, S. Economou Str., 68 100, Alexandroupolis, Greece
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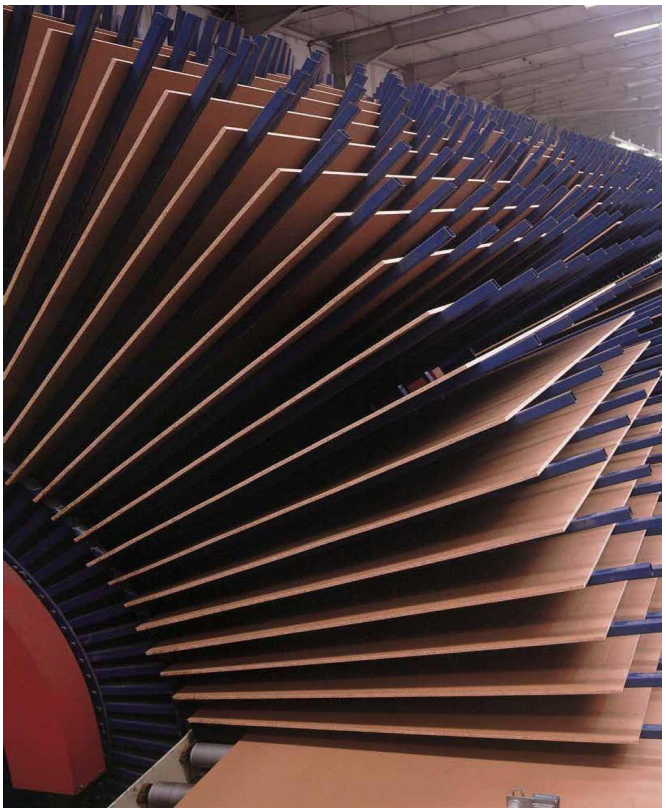
AKRITAS S.A.

AKRITAS S.A. wood processing industry was founded in 1977 in Alexandroupolis, Greece. Our sales network currently expands throughout Greece, with offices in Athens and Thessaloniki, as client service efficiency is our basic priority. Moreover, the company has developed a powerful export activity, thus establishing its presence in numerous countries abroad. Central to our wide range of products is the innovative AKRIPAN® Raw Chipboard and AKRIPAN®-coated products (melamines, worktops, kitchentops, semi-finished furniturepostforming, glossy and matt surfaces). AKRITAS' aim is to produce and distribute functional, durable and perfectly designed products, with respect for the environment and the consumer. Thus, all our products comply with international quality standards, while all departments of our industry operate under ISO 9001:2015 regulations. Since its establishment, AKRITAS has been oriented towards new technologies and low energy consumption.

Following our environmental policy program, AKRITAS S.A. is FSC® certified (FSC® C108904). Our FSC® marked products ensure that the materials we use for the production from the initial stages to the final product, are identified, separated and are sourced from suppliers that comply with the Principles of FSC® Standard.

For more than four decades AKRITAS is intent to values based on the combination of the human factor and innovative technology. These values, enforced by our commitment for consistency in sales and environmental protection, have established AKRITAS among the industry pioneers in the market.



AKRITAS S.A. Wood Processing facilities locate in Tyxero, Evros Prefecture, Eastern Macedonia and Thrace region, Greece (Postal Code:68083), 48 km northeast of the city of Alexandroupolis.

AKRITAS S.A. Environmental Policy

Wood is an excellent natural material, renewable and is found in increasing abundance in Europe. It helps mitigating climate change by absorbing and storing carbon dioxide (CO_2) from the atmosphere, as 1 m^3 of wood absorbs 1 tonne of CO_2.

AKRITAS S.A. establishes sustainable strategies at the following levels:

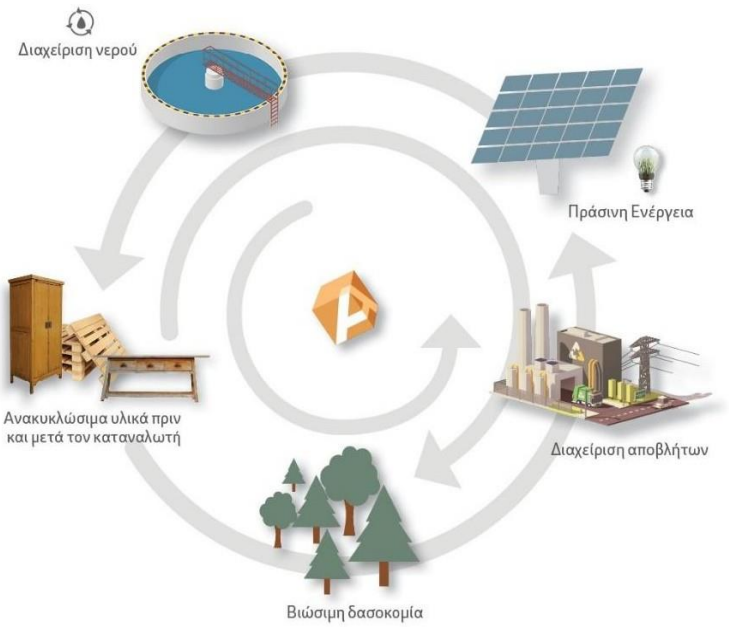
Sustainable forestry:
Emphasis is given on supporting well- managed forestry using timber which is derived from forest service studies.

Pre-consumer and post-consumer recycled content:
Contribution to the circular economy model by reusing solid industrial wood waste and municipal wood waste from commercial and domestic activities on theproduction line.

Water management:
Reduced water consumption by collecting, treating and reusing rainwater, liquid waste from car washes, production line areas and ancillary activities.

Renewable Energy:
Reduced use of fossil fuels for energy needs and CO_2 emissions through the utilization of by-products resulting from the mechanical processing of wood (biomass combustion). Green Certificate from DAPEEP for the use of electricity produced from Renewable Energy Sources (RES).

Waste management:
Non-wood waste (oils, batteries, electrical & electronic equipment, metals, paper / cardboard, glass, plastics) is collected by licensed companies and transported for recycling.



AKRITAS S.A. Certifications

✓ FSC®(C108904)

AKRITAS S.A. is FSC® certified (C108904). Our FSC® marked products ensure that the materials we use for the production from the initial stages to the final product, are identified, separated and are sourced from suppliers that comply with the Principles and Criteria of FSC® standard.

✓ E1, CARB P2, TSCA TITLE VI

The products comply with the requirements of EN 13986 for the release of formaldehyde and are classified in the European class E1. TSCA title VI and CARB Phase 2 certifications monitor the production of low-release formaldehyde boards and ensure their compliance with the US Environmental Protection Agency (EPA) regulations and are a prerequisite for the movement of products within the US.

✓ ISO 9001:2015

All parts of the production process apply the quality management system according to the international standard ISO 9001: 2015.

✓ ISO 14001:2015

ISO 14001: 2015 is an Environmental Management System which focuses on creating environmental policy and improving environmental performance.

✓ ISO 45001:2018

ISO 45001:2018 is a system for managing the health and safety of employees, but also of all persons involved in the operation of the company.

✓ Safe Loading DEKRA

Certification by the internationally recognized German body DEKRA for the safe loading of product transporting vehicles.

Additionally, on 20 July 2005, via an official letter to the UN, AKRITAS subscribed, adopted and committed to faithfully apply the UN's Global Compact on Corporate Social Responsibility. Since AKRITAS' inception, environmental protection and human rights have been a priority for the company.

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AKRITAS MF-Chipboard

- EPD Type: Average EPD for AKRIPAN® and HYDROPAN® based Melamine Faced (MF-) chipboards (UN-CPC: 3143-Particle board and similar board of wood or other ligneous materials), which are similar products differing in the type of resin used (Urea Formaldehyde Resin for AKRIPAN® Raw Chipboard-based MF-Chipboard, Melamine Urea Formaldehyde Resin for HYDROPAN® Raw Chipboard-based MF-Chipboard). Characteristics per product in regard with the Raw Chipboard used as basis:

AKRIPAN® Raw Chipboard:

- Standards: EN 312 - Type P1, P2, P4, P6
- Formaldehyde class E1 and CARB 2
- Description: Boards for interior fitments (including furniture) for use in dry conditions (EN 312:2010)
  - ✓ High stability
  - ✓ Impeccable smooth surface layer
  - ✓ Easy to process
  - ✓ Outstanding endurance in stretching, loading and assembly
  - ✓ Excellent for laminate, veneer and HPL coating
- Dimensions: Width: 1,830-2,200mm, Length: 2,200-4,200mm, Thickness: 6-38mm

-AKRIPAN® Raw Chipboard technical data sheet:

AKRITAS

AKRIPAN®
TECHINICAL DATA SHEET (Type P2 - Class E1)

			6 < T ≤ 13		13 < T ≤ 20		20 < T ≤ 25		25 < T ≤ 32		32 < T ≤ 40	
CONTROL CRITERIA	TEST METHODS	UNIT	EN 312 2010	AKRITAS VALUES	EN 312 2010	AKRITAS VALUES	EN 312 2010	AKRITAS VALUES	EN 312 2010	AKRITAS VALUES	EN 312 2010	AKRITAS VALUES
Length and width tolerance	EN 324-1	mm	± 5	**± 5**	± 5	**± 5**	± 5	**± 5**	± 5	**± 5**	± 5	**± 5**
Thickness tolerance	EN 324-1	mm	± 0,3	**± 0,3**	± 0,3	**± 0,3**	± 0,3	**± 0,3**	± 0,3	**± 0,3**	± 0,3	**± 0,3**
Raw Density	EN 323	Kg/m³	-	**690 ± 2%**	-	**630 ± 1,5%**	-	**620 ± 1,5%**	-	**612 ± 1,0%**	-	**607 ± 1,0%**
Straightness of edges tolerance	EN 324-2	mm/m	1,5	**1,5**	1,5	**1,5**	1,5	**1,5**	1,5	**1,5**	1,5	**1,5**
Squareness	EN 324-2	mm/m	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**
Board moisture	EN 322	%	5 to 13	**5 to 13**	5 to 13	**5 to 13**	5 to 13	**5 to 13**	5 to 13	**5 to 13**	5 to 13	**5 to 13**
Internal bond	EN 319	N/mm²	0,40	**≥ 0,50**	0,35	**≥ 0,40**	0,30	**≥ 0,35**	0,25	**≥ 0,32**	0,20	**> 0,30**
Bending strength	EN 310	N/mm²	11	**> 15**	11	**≥ 13,5**	10,5	**≥ 12**	9,5	**≥ 11,5**	7	**≥ 11**
Bending elasticity modulus	EN 310	N/mm²	1800	**> 2300**	1600	**> 2300**	1500	**> 2200**	1350	**> 2100**	1050	**> 2000**
Resistance to axial withdrawal of screws Vertical surface	EN 320	N	-	-	-	**> 630**	-	**> 620**	-	**> 600**	-	**> 600**
Resistance to axial withdrawal of screws Horizontal surface	EN 320	N	-	-	-	**> 950**	-	**> 1000**	-	**> 1000**	-	**> 1100**
Formaldehyde release	ISO 12460-5	mg/100gr	≤ 8	**Average 6,0**	≤ 8	**Average 6,0**	≤ 8	**Average 6,0**	≤ 8	**Average 6,0**	≤ 8	**Average 6,0**
Surface soundness	EN 311	N/mm²	0,8	**> 1,2**	0,8	**> 1,3**	0,8	**> 1,3**	0,8	**> 1,4**	0,8	**> 1,5**
AKRITAS SPECIFICATION Swelling in thickness after immersion in water 2 Hr	EN 317	%	-	**~ 8**	-	**~ 8**	-	**~ 8**	-	**~ 8**	-	**~ 8**

HYDROPAN® Raw Chipboard:

- Standards: EN 312 - Type P3, P5
- Formaldehyde class E1 and CARB 2
- Description: Boards for use in humid conditions (EN 312:2010)
  - ✓ High stability
  - ✓ Impeccable smooth surface layer
  - ✓ Easy to process
  - ✓ Outstanding endurance in stretching, loading and assembly
  - ✓ Excellent for laminate, veneer and HPL coating
  - ✓ Water Proof
- Dimensions: Width: 1,830-2,200mm, Length: 2,200-4,200mm, Thickness: 6-38mm

- HYDROPAN® Raw Chipboard technical data sheet:

AKRITAS
HYDROPAN®
TECHINICAL DATA SHEET (Type P5 - Class E1)

			13 < T ≤ 20		25 < T ≤ 32		32 < T ≤ 40	
CONTROL CRITERIA	TEST METHODS	UNIT	EN 312 2010	VALUES AKRITAS	EN 312 2010	VALUES AKRITAS	EN 312 2010	VALUES AKRITAS
Length and width tolerance	EN 324-1	mm	± 5	**± 5**	± 5	**± 5**	± 5	**± 5**
Thickness tolerance	EN 324-1	mm	± 0,3	**± 0,3**	± 0,3	**± 0,3**	± 0,3	**± 0,3**
Raw Density	EN 323	Kg/m³	-	**652 ± 1,5%**		**635 ± 1,5%**		**628 ± 1,5%**
Straightness of edges tolerance	EN 324-2	mm/m	1,5	**1,5**	1,5	**1,5**	1,5	**1,5**
Squareness	EN 324-2	mm/m	2	**2**	2	**2**	2	**2**
Board moisture	EN 322	%	5 to 13	**5 to 13**	5 to 13	**5 to 13**	5 to 13	**5 to 13**
Internal bond	EN 319	N/mm²	0,45	**> 0,58**	0,35	**> 0,54**	0,30	**> 0,50**
Bending strength	EN 310	N/mm²	16	**> 17**	12	**> 15**	10	**> 14**
Bending elasticity modulus	EN 310	N/mm²	2400	**> 2700**	1900	**> 2500**	1700	**> 2200**
Resistance to axial withdrawal of screws Vertical surface	EN 320	N	-	**> 830**	-	**> 750**	-	**> 700**
Resistance to axial withdrawal of screws Horizontal surface	EN 320	N	-	**> 1200**	-	**> 1200**	-	**> 1300**
Formaldehyde release	ISO 12460-5	mg/100gr	≤ 8	**≤ 8**	≤ 8	**≤ 8**	≤ 8	**≤ 8**
Surface soundness	EN 311	N/mm²	0,8	**> 2,0**	0,8	**> 2,0**	0,8	**> 2,2**
Swelling in thickness after immersion in water 24 Hr	EN 317	%	10	**< 8**	10	**< 8**	9	**< 8**
Internal bond after cyclic test	EN 321	N/mm²	0,22	**> 0,22**	0,17	**> 0,17**	0,15	**> 0,15**
Swelling in thickness after cyclic test	EN 321	%	12	**< 12**	10	**< 10**	9	**< 9**

Note: The AKRIPAN® and HYDROPAN®- based Chipboard products have been tested for complying with the rule: *"When the EPD is instead based on an average or representative composition of products (in a so-called average EPD) the results for A1-A3 (A1-A5 for services) (ISO 21930:2017) shall as first not differ by more than ±10% for the GWP-GHG indicator*" (PCR 2019:14, Construction Products, version 1.11). The difference of the two products for the GWP-GHG indicator in A1-A3 Modules is within the limit of ±10%, therefore the average EPD statement is valid for AKRIPAN® and HYDROPAN® based Chipboard. The average product is named as "AKRITAS MF-Chipboard" in the rest of this document.

AKRITAS MF-Chipboard

- Standards: EN 312, EN 14322: 2004, EN 14323: 2004 και EN 438-2: 2005
- Intended use in construction: Interior construction fitments, including furniture making
- Formaldehyde class E1 and CARB 2
  - ✓ Wide range of designs (wood imitation and single colour shades)
  - ✓ High stability
  - ✓ High mechanical, chemical and thermal resistance
  - ✓ Easy to clean
- Dimensions: 3,660 X 1,830mm – Also available in extra dimensions – width 2,070mm & 2,200mm. Thickness: Availability in 8, 16, 18, 25mm and available production upon request in 6, 10, 12, 22, 28, 30, 38.

AKRITAS MF-CHIPBOARD Tech data sheet:

AKRITAS

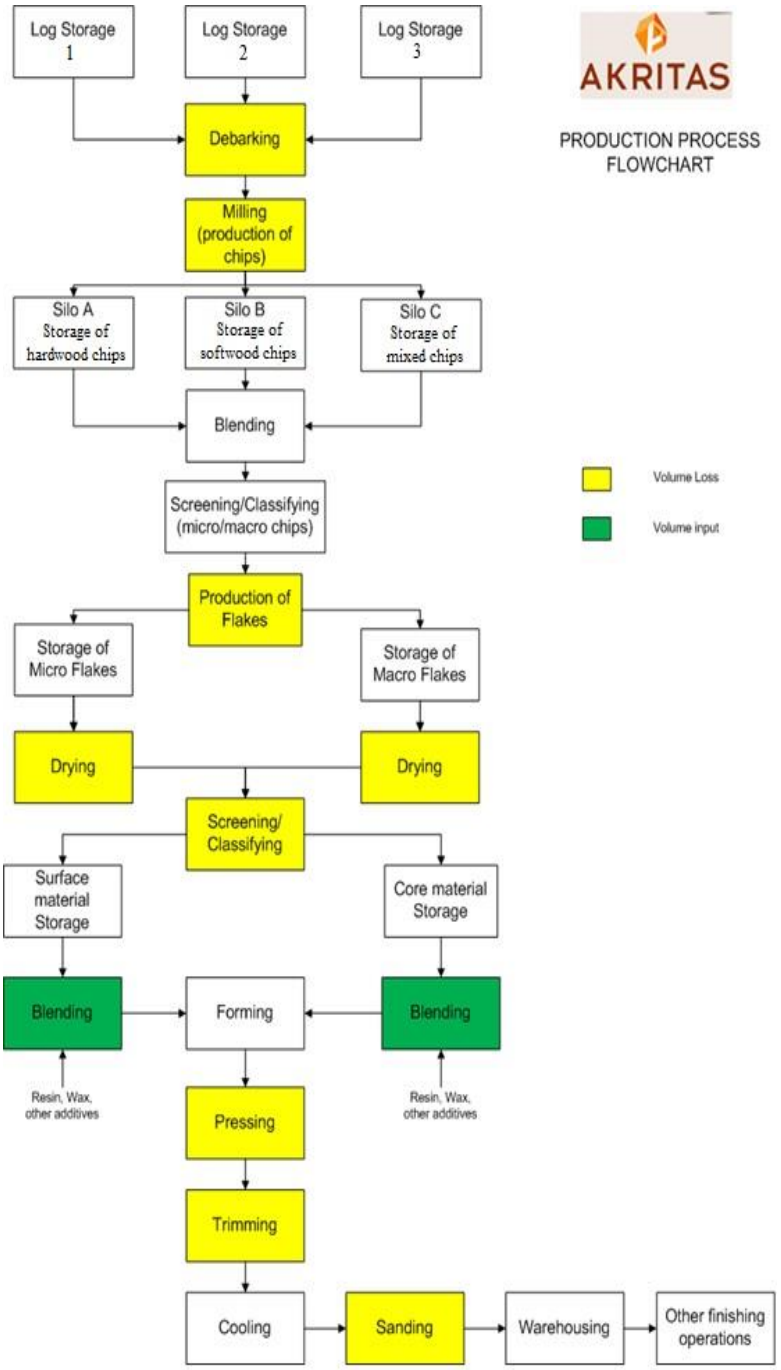
TECHNICAL DATA SHEET

MELAMINE FACED BOARD FOR INTERIOR USES

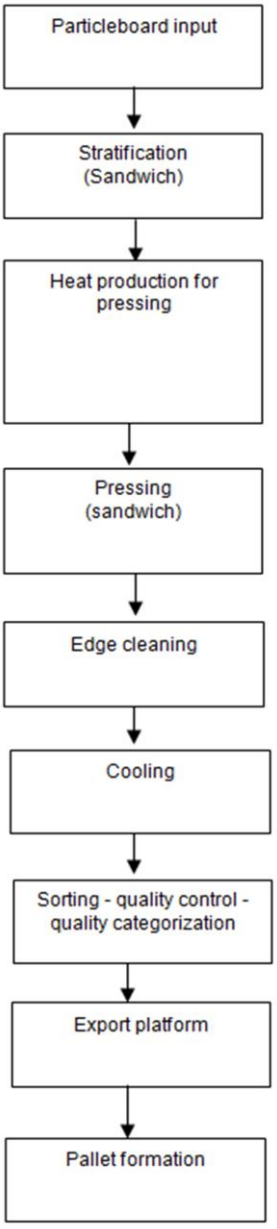
CHARACTERISTIC	TEST METHOD	UNIT	REQUIREMENT EN 14322	VALUE
Resistance to cracking *(Αντίσταση στο ράγισμα)*	EN 14323	Rating	≥ 3	**≥ 4**
Resistance to scratching *(Αντίσταση στη χάραξη)*	EN 14323	N	≥ 1,5	**≥ 1,5**
Resistance to staining *(Αντίσταση στο λέκιασμα με χημικά)*	EN 14323	Rating	≥ 3	**≥ 4**
Resistance to surface wear *(Αντίσταση στην εκδορά)*	EN 14323	Class 1 , 2 , 3A , 3B , 4		**3A**
Resistance to cigarette burn [*] *(Αντίσταση στο κάψιμο από τσιγάρο)*	EN 14323 EN 438-2	Rating		**> 3**
Resistance to steam [*] *(Αντίσταση στον ατμό)*	EN 14323 EN 438-2	Rating		**≥ 3**
Surface soundness [*] *(Αντίσταση στον επιφανειακό εφελκυσμό)*	EN 311	Nt / mm²	-	**> 1,2**
Formaldehyde release *(Εκπομπή φορμαλδεΰδης)*	ISO 12460-5	Class	-	**E1**
*[*] Supplementary properties and test methods*				

AKRITAS MF-Chipboard - Manufacturing Stage Overview

RAW CHIPBOARD PRODUCTION

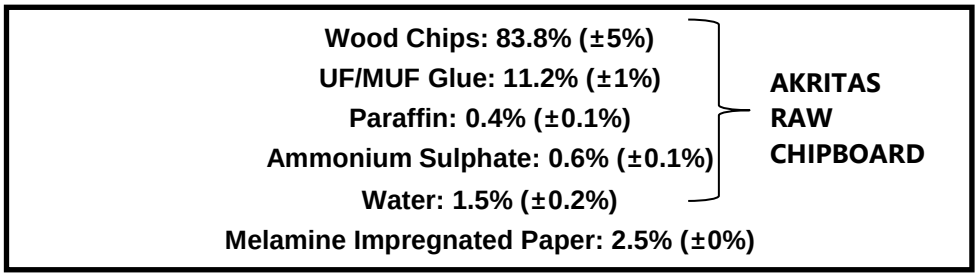


MF-CHIPBOARD PRODUCTION



LCA Background Information

-Declared unit: 1 m^2 of AKRITAS MF-Chipboard, with a density 10.51 kg/m^3, with the following material composition:



-Goal and Scope: The main goal of the LCA study of this EPD report is the development of an average EPD for the Raw Chipboards manufactured by AKRITAS S.A. It presents in detail the environmental impacts of producing 1 m^2 of AKRITAS MF-Chipboard, according to the core mandatory and voluntary environmental indicators that are prescribed for the Life Cycle Impact Assessment (LCIA) for such studies in relevant standards. Simultaneously, this LCA report describes in detail important information about the AKRITAS MF-Chipboard product, such as its material composition, the boundaries of its production system with nature, the main life cycle stages that were considered in the study etc. As a result, the intended audience of this LCA report is considered to be all individuals involved in the validation of the EPD, the EPD certification body and all interested stakeholders that prefer EPD certified products both as raw materials (companies) and final products (customers). Therefore, this LCA study could be considered as a communication tool for AKRITAS S.A. practices of producing AKRITAS MF-Chipboard both for third-party businesses that are interested in being supplied with the AKRITAS MF-Chipboard [Business-To-Business (B2B)], and for customers that take into account the environmental practices of the respective producers in their buying choices [Business-To-Customer (B2C)].

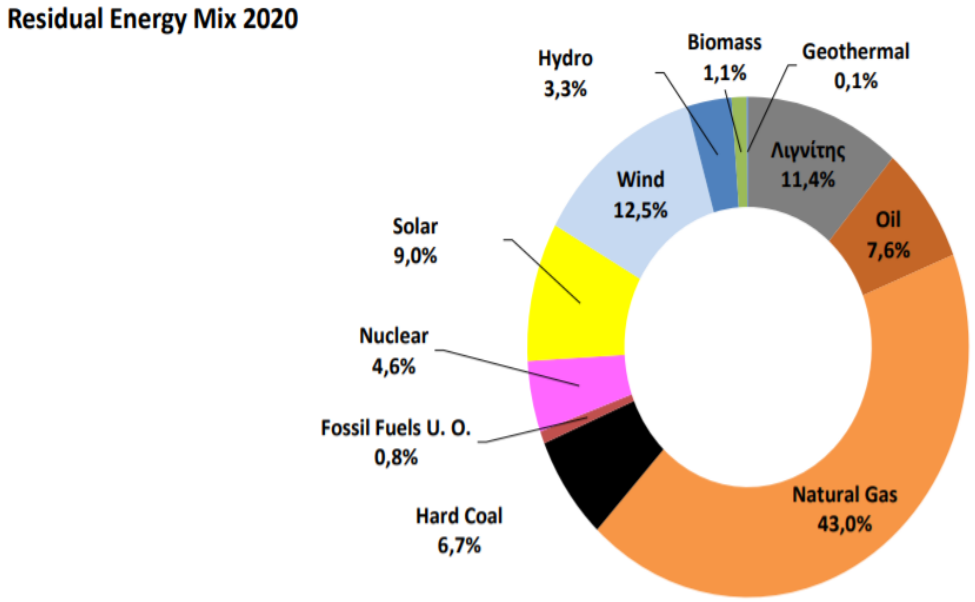
-Time representativeness: The data used for the LCA study for this EPD are specific data from the main production site of AKRITAS S.A. from the year 2019 (COVID-19 pandemic operational complications led to omitting year 2020).

-Databases, LCA software and LCIA methods used: OpenLCA 1.10.3- Ecoinvent 3.7.1. EF 3,0 (adapted) method, CML-IA Method (for "Eutrophication-fw (kg PO_4^{3-})" Indicator), IPCC 2013 (for "GWP-GHG" Indicator), Cumulative Energy Demand-LHV Method (for "Use of Resources")

-Background data collection: Site specific data have been collected for the total year of 2019, including the total production of AKRITAS MF-Chipboard in this year through questionnaire surveys. Additionally, generic data use, employment of assumptions and end-of-life scenarios were applied only for instances for which specific data were not available, as explained in the relevant sections. The questionnaire surveys that were prepared and distributed from the EPD developer to the AKRITAS S.A. representatives, mined specific data regarding inputs in the following three areas:

i. Natural resources, Energy, raw materials and machinery use
ii. Transportation of raw materials from suppliers to the production site
iii. Wastes and byproducts of manufacturing processes

Regarding the electrical energy used, the DAPEEP S.A. Residual Mix of 2020 was assumed to be the representative electricity mix in the context of AKRITAS MF-Chipboard production:



Source: DAPEEP, Residual Energy Mix 2020 (https://www.dapeep.gr/wp-content/uploads/2021/07/20210614_Residual%20Energy%20Mix_20201.pdf?_t=1627024624)

In cases of lack of specific data, generic data found in Ecoinvent database and similar with the temporal, geographical and technological context of the AKRITAS MF-Chipboard were used. All assumptions replacing specific data are based on literature sources, as described in the relevant section (See "Assumptions"). Finally, the employed assumptions are representing possible real-life outcomes and based on European Institution publications.

-Geographical scope: The product is produced in Greece and it can be applied in interior constructions (including furniture making) at dry (AKRIPAN-based MF-Chipboard) and wet conditions (HYDROPAN-based MF-Chipboard). The end-of-life of the product is assumed to take place in Greece.

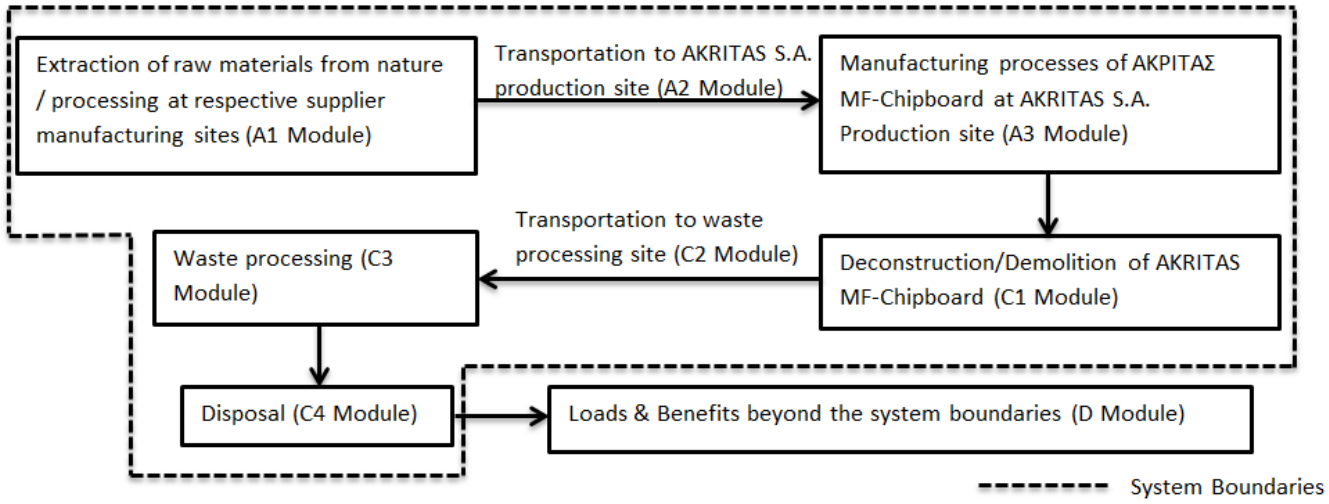
-Comparability: The results of this EPD can be compared with the respective EPDs of similar products, only when they fully comply with EN 15804 standard.

System Boundary:

Cradle to gate with modules C1–C4 and module D (A1–A3 + C + D):

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

System boundary visual representation:



It must be noted that the Life Cycle Assessment Study for this EPD does not include the following:

- Equipment Maintenance
- Human labor and employee transport

Additional information

1. LCA practitioner: Georgios Lanaras-Mamounis, MEng Environmental Engineering, BETECO lab, Department of Environmental Engineering, Democritus University of Thrace, Greece. Contact Info: +302461304515, +306986573767 (tel.),glanaras@env.duth.gr (e-mail)
2. Cut-off rules: No cut-off rules were applied.
3. Allocation rules: In general, allocations have been avoided as much as possible, as instructed by EN 15804: 2012 + A2:2019 standard. Raw materials, energy and all necessary inputs and known outputs (I/O) from the manufacture of AKRITAS MF-Chipboard have been allocated by the respective S.I. unit of each I/O per declared unit (1 m^3) of product, respectively, based on 2019 specific site data. This has been realized by dividing the total amount of every I/O used/released during the production of AKRITAS MF-Chipboard in year 2019 with the total volume of production for the same year.

   Infrastructure flows (buildings, machinery) have been allocated by unit (buildings) and mass (machinery) per declared unit (1 m^2), by taking into account the expected lifetime of these flows declared by the respective providers of these inputs, as described above. The use of energy consuming machines have been allocated to the declared unit by employing either the total consumption of fuels/electricity or time of use in 2019 and dividing with the total production volume for 2019 in order to calculate the consumption per declared unit (KWh, MJ/m^2 AKRITAS MF-Chipboard). Regarding co-product allocations in this LCA study, the co-production of wood and wood processing waste was handled with the latter being used on-site for energy recovery and being accounted as energy input from wood burning in furnaces. Analytically, the main I/O of the respective modules have been allocated to the declared unit as follows:

   Electricity: AKRITAS S.A. allocates the total electricity consumption (as shown in the electricity bills it receives) to the final price of its respective products according to the installed electricity power of the production lines of each respective product. That being said, the average power of the machinery used in the respective production line adds up to the installed power of this line. In total, AKRITAS MF-Chipboard production line is responsible for 10% of the total electricity consumption of AKRITAS S.A. in 2019.

   Water: AKRITAS S.A. installed separate hydrometers to their production lines in 2020. Therefore, the allocation of water consumption is realized by utilizing the consumptions as measured by the separate hydrometers of 2020 for 2019, leading to an allocation of almost 17% of the total water consumption to the production of AKRITAS MF-Chipboard.

   Heat: For the production of AKRITAS MF-Chipboard, one furnace with known heat production efficiency is in use out of a total of three furnaces. The fuel used in this furnace is wood particles and propane. Wood particles come from the residual wood dust and wood barks of the production of AKRITAS Raw Chipboard and AKRITAS MF-Chipboard, while at the same time AKRITAS S.A. has two

separate propane tanks for its two main products (Raw Chipboard,

MF-Chipboard). The total wood dust/wood bark production (which is measured by AKRITAS S.A.) and their use as fuel have been allocated to the Raw Chipboard by utilizing the heat production efficiency of the one used furnace in the production of AKRITAS MF-Chipboard divided by the total heat production efficiency of all three furnaces. It was found that almost 8.97% of these wood particles are employed for heat needed for the production of AKRITAS MF-Chipboard. No allocation strategy was employed for the propane use, since there are separate tanks. The final heat production was calculated by taking into account the allocation of wood particles to the Raw Chipboard and the assumed net calorific value of it, as well as the assumed net calorific value of propane according to the indications of the MF-Chipboard propane tank (See Assumptions and Limitations for assumed net calorific values). It should be noted that AKRITAS S.A. facilities are heated with electricity means.

Diesel use in machinery and lubricant consumption: The total use of diesel fuel is consistently measured by AKRITAS S.A. separately for different types of production operations. Raw Chipboard and MFC only operations aside, the rest of the diesel use was allocated to the AKRITAS MF-Chipboard by subtracting the irrelevant diesel uses (other products, outside of C2G operations) and multiplying with 0.025 (2,5%), which is the amount of the total mass production of AKRITAS MF-Chipboard to the total production mass of all AKRITAS S.A. products. By adding MF-Chipboard-only uses and allocated use as described above, results to the total diesel use in the production of AKRITAS MF-Chipboard. Afterwards, this diesel use (in litres) is transformed to kg by assuming diesel density and multiplying with assumed net calorific value of diesel fuel (See "Assumptions" section) results to the diesel energy consumed.

Lubricant use has been allocated to the AKRITAS MF-Chipboard consumption accordingly.

Raw materials: For the main raw materials of AKRITAS MF-Chipboard, no allocations were applied, since the exact quantities of each raw material were known through the software of materials logistics that AKRITAS S.A. uses to record its material imports and stocks.

Known waste: For all known waste of the production processes of AKRITAS MF-Chipboard, allocations were applied to the quantities of 2019 according to the distribution of the same waste in 2020. The reason behind this strategy lies in the absence of data regarding the distribution of waste per product for 2019, while this information was available for year 2020, excluding the distribution of wood particle waste which were used as fuel in furnaces and allocated as described above (See "Heat").

4. Data quality: A data quality assessment was conducted according to the Ecoinvent data quality system, which assesses the quality of the input data in 5 areas:
    i. Reliability
    ii. Completeness
    iii. Temporal Correlation
    iv. Geographical Correlation

v. Further Technological Correlation

The results of the data quality assessment are accessible through the LCA Report that has been provided to the EPD verifiers.

5. Assumptions:

A1-A3 Modules:

I. For certain infrastructure flows that were allocated by unit (buildings) or mass (machinery), no specific data were available. For the instance of buildings, generic representative inputs sourced in the Ecoinvent database were used, and their providers were selected to realistically represent the infrastructure flows necessary for the production of AKRITAS MF-Chipboard, temporally, geographically and technologically. Temporally, generic flows representative of years as close as possible to the year of 2019 were applied. Geographically, providers of European representativeness were chosen, while technologically, the generic data represent wood board factories of similar capacity with the production capacity of AKRITAS S.A.. For the instance of machinery that were allocated by mass to the declared unit, when no mass data were available for the particular model of each machine, generic mass data of similar machines (geographically produced in a similar geographical context, models of same/similar years) of different manufacturers were used. Finally and in more detail for A2 Module (Transportation), specific data were available only for the distances and loads of raw materials per route, as well as the number of routes per raw material for the year 2019. Despite of that, the exact type of trucks/lorries for the transportation of raw materials to the AKRITAS S.A. production site was unknown. Therefore, these inputs were represented with lorries of European origin with an unknown exact EURO class and capacity.

II. AKRITAS imports three different wood species as raw material for the production of AKRITAS Raw Chipboard, which serves as the basic material input for the production of AKRITAS MF-Chipboard. Despite the fact that their density and volume is unknown, AKRITAS S.A. measures the weight of each wood species and the total moisture content of the logs used in the production of AKRITAS Raw Chipboard (regarding the moisture content, it was measured to be equal to 70.89% before drying). In order to calculate the volume (m^3) of the wood species used in the production of the D.U. of AKRITAS Raw Chipboard the following calculations and assumptions are employed:

✓ The density of every wood species (3 different species) used in the production of 1 m^3 of AKRITAS Raw Chipboard equals to the sum of the moisture amount multiplied with the assumed moisture density and the dry wood fraction multiplied with the assumed dry wood density, divided by the total yearly production for 2019:

$$Dx=(Dm\times MC)+(Dx\times WCx)$$

Where:

i. Dx is the density of the wood species (kg/m^3)

ii. Dm is the density of the moisture (1000 kg/m^3)

iii. MC is moisture content for each wood species (measured to be 0.7089)

iv. Dx is the density (kg/m^3) of dry wood of each wood species [x: 1,2,3 for the three different wood species and dry wood density for each wood species found in " Science and Technology of Wood, first edition" (Tsoumis, 1991)]

v. WCx is the dry wood content for each species (x: 1,2,3 for the three different wood species and dry wood content for all species assumed to be equal to 29,11%).

Since weight and density of each wood species are known, the volume used for each one of the three wood species is calculated as follows:

$$Vx=Wx/Dx$$

Where

i. Vx is the used volume of the wood species (m^3)

ii. Wx is the weight of the used wood species (kg)

✓ The assumed density of dry logs (Dx), found in the work of G. Tsoumis titled "Science and Technology of wood" (1991), for each one of the imported wood species in order to produce the declared unit of AKRITAS Raw Chipboard are the following:

✓ Pine (Softwood): 410 kg/m^3

✓ Beech (Hardwood): 700 kg/m^3

✓ Poplar (Hardwood): 460 kg/m

III. A density of 0.85 kg/L was assumed for diesel fuel, in order to transform the known used volume from litres to kg. Also, a net calorific value of 42.80 MJ/kg (Greek Ministry of Environment and Energy, 2021) was assumed for this input, for calculating the energy consumption of diesel fuel in diesel-operating machines.

IV. A density of 0.825 kg/L was assumed for all lubricants, in order to transform the known used volume from litres to kg.

V. The heat production in the one AKRITAS MF-Chipboard furnace is measured as the quantity of the fuel used (wood particles, propane) multiplied by their assumed net calorific value. The net calorific value of wood particles is assumed to be 15.6 MJ/kg (EC, 2018), while the net calorific value of propane was assumed to be 46.33 MJ/kg. (OECD/International Energy Agency/Eurostat, 2004).

VI. All of the assumptions made in the A1-A3 Modules of AKRITAS Raw Chipboard are valid for this

EPD, since the AKRITAS Raw Chipboard serves as the basic material input of AKRITAS MF-Chipboard.

- ✓ Scenario for end-of-life stages of AKRITAS MF-Chipboard: The scenario involves the demolition of end-of-life AKRITAS MF-Chipboard (C1 Module), the transportation of the resulting material to a waste sorting facility (C2 Module), the waste sorting to two fractions i. fraction intended for incineration, 70% of the initial mass of the demolished AKRITAS MF-Chipboard and ii. Fraction intended for landfill, 30% of the initial mass of the demolished AKRITAS MF-Chipboard (C3 Module), the landfill of the landfill intended fraction (C4 Module), and the production of electricity and heat from the incineration intended fraction (D Module), with the avoided grid electricity and natural gas based heat production as well as the environmental impacts of both landfilled fraction and incinerated fraction in the last two modules also accounted for. The scenario of 70% incineration and 30% landfill is inspired by EUROSTAT sources, which state that in 2018, of all the wood waste generated in EU-28, almost 50% was used for energy recovery (https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do). The 1-year progression since the reference year of this statistic table, the probable advance in relevant technologies, in conjunction with the high calorific value of Raw Chipboard products, justifies an optimistic improvement scenario of the 70-30 energy recovery/disposal hypothesis as a reasonable assumption.

C1 Module:

I. The distance between the use site of AKRITAS MF-Chipboard and the site of demolition/deconstruction (C1 Module) was assumed to be equal to 100 km.

II. An energy demand of 0.323 MJ/kg of AKRITAS MF-Chipboard was assumed for the demolition/deconstruction phase of the product (Gervasio et al., 2018).

C2 Module:

I. The distance between the demolition/deconstruction site of AKRITAS MF-Chipboard (C2 Module) and the site of waste sorting (C3 Module) was assumed to be equal to 100 km.

C3 Module:

I. An energy demand of 0.5 MJ/kg for the waste sorting was assumed.

C4 Module:

I. The distance between the waste sorting site of AKRITAS MF-Chipboard (C3 Module) and the site of inert material landfill (C4 Module) was assumed to be equal to 100 km.

D Module:

I. The distance between the waste sorting site of AKRITAS MF-Chipboard (C3 Module) and the site incineration (D Module) was assumed to be equal to 100 km.

II. An efficiency of energy recovery from the incineration process in the form of electricity and heat equal to 60% was assumed. The electricity (20%) and heat (40%) result in avoiding production of

grid electricity and natural gas heat purposes (on-site) in a ratio equal to the net calorific value of wood waste (15.6 MJ/kg, 2018/2066/EC).

6. Emissions of substances of very high concern (SVHC): Raw Chipboard and MFC products are known for containing formaldehyde, a basic substance of the glue/resin (UF, MUF) that is used in the manufacturing of these products. Formaldehyde is listed as a candidate substance for the SVHC and REACH lists. Its use in adhesives such as UF resin and other manufacturing purposes is strictly regulated, since formaldehyde, in concentrations over certain limits, causes severe irritation of various forms in humans while it is also considered as a carcinogen. As mentioned earlier in Section "About AKRITAS MF-Chipboard", this average product belongs is the E1 and CARB 2 formaldehyde class, which means that this product does not emit more than 0.1 ppm of formaldehyde into ambient area, and that the formaldehyde emissions of this quantity are well below the tolerance limits set by the SVHC list.

LCA Results for AKRITAS MF-Chipboard

Mandatory indicators

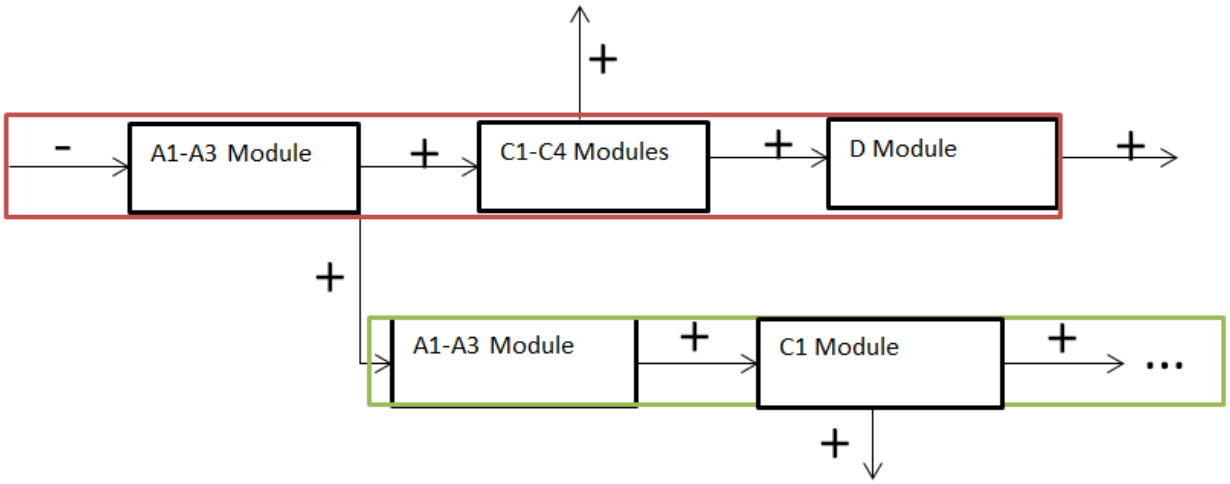
Results per 1 m^2 of AKRITAS MF-Chipboard

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D	TOTAL
GWP-fossil	kg CO_2 eq.	9,85E+00	2,64E-01	1,36E-01	1,90E-01	4,96E-02	-6,89E+00	3,60E+00
GWP-biogenic	kg CO_2 eq.	4,71E-03	8,48E-05	1,37E-05	5,07E-05	1,15E-05	-1,00E-04	4,77E-03
GWP-luluc	kg CO_2 eq.	5,26E-03	1,90E-04	5,63E-05	1,80E-04	1,88E-05	-2,90E-04	5,41E-03
GWP-total	kg CO_2 eq.	9,86E+00	2,64E-01	1,36E-01	1,90E-01	4,96E-02	-6,89E+00	3,61E+00
ODP	kg CFC 11 eq.	1,87E-06	6,29E-08	3,05E-08	4,96E-08	1,15E-08	-1,08E-06	9,46E-07
AP	mol H^+ eq.	4,44E-02	7,90E-04	5,10E-04	3,80E-04	2,40E-04	-1,97E-02	2,67E-02
EP-freshwater	kg P eq.	2,92E-03	3,39E-05	1,43E-05	2,52E-05	4,94E-06	-3,68E-03	-6,80E-04
EP-freshwater	kg PO_4^{3-} eq.	1,43E-02	2,10E-04	1,10E-04	1,30E-04	4,86E-05	-1,21E-02	2,62E-03
EP-marine	kg N eq.	1,10E-02	2,50E-04	1,60E-04	1,20E-04	8,70E-05	-2,47E-03	9,19E-03
EP-terrestrial	mol N eq.	1,32E-01	2,84E-03	1,77E-03	1,49E-03	9,50E-04	-1,82E-02	1,21E-01
POCP	kg NMVOC eq.	3,97E-02	8,90E-04	5,60E-04	4,60E-04	2,90E-04	-6,91E-03	3,49E-02
ADP-minerals&metals*	kg Sb eq.	1,90E-04	1,28E-05	4,70E-07	1,59E-05	1,29E-07	-1,74E-05	2,00E-04
ADP-fossil*	MJ	1,83E+02	3,83E+00	2,04E+00	2,67E+00	7,64E-01	-1,06E+02	8,59E+01
WDP	m^3	7,46E+00	2,35E-02	7,32E-03	2,10E-02	4,87E-03	-2,97E-01	7,22E+00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption							

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Overview of the biogenic carbon flows (GWP-biogenic Indicator)

AKRITAS selects wood of sustainable origin for its products. Additionally, all wood imports come from countries that have opted for the Kyoto Protocol regarding the subject of carbon neutrality of wood. Therefore, the assumption of biogenic carbon neutrality is valid for AKRITAS Raw Chipboard, which enters the product system of AKRITAS MF-Chipboard as a basic material input. An overview of the biogenic carbon flows in the different modules considered in this LCA study is presented below:



As seen above, the sustainable planted trees which provide wood for the AKRITAS Raw Chipboard absorb biogenic carbon from the environment for the formation of its vital parts. Its deduction from the environment and entry in the product system of AKRITAS Raw Chipboard (red box) is considered as a negative biogenic carbon flow (carbon sequestration). The biogenic carbon moves along the various life cycle stages (Modules) as a positive carbon flow stored in the product, both when entering these lifecycle stages and as emissions to the environment. At the same time, AKRITAS Raw Chipboard enters the product system of AKRITAS MF-Chipboard (green box) and contains stored carbon which is also considered a positive carbon flow in this respective product system. AKRITAS MF-Chipboard moves along its respective life cycle stages (and beyond) while transferring this stored carbon, until its final release to the environment both in the form of emissions during the life cycle stages and at the final modules of its life cycle. In conclusion, carbon sequestration (negative flow) takes place only at the deduction of wood from its natural environment (input of A1-A3 module of AKRITAS Raw Chipboard), while the transferring of the stored carbon through the life cycle stages of both AKRITAS Raw Chipboard and AKRITAS MF-Chipboard is represented as positive carbon flows.

Additional mandatory and voluntary indicators

Results per 1 m^2 AKRITAS MF-Chipboard

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D	TOTAL
GWP-GHG	kg CO_2 eq	9,71E+00	2,60E-01	1,35E-01	1,85E-01	4,96E-02	-6,79E+00	3,56E+00
PM	Disease incidence	4,45E-07	1,32E-08	1,00E-08	4,08E-09	5,33E-09	-5,07E-08	4,27E-07
IRP*	KBq U235 eq.	2,49E-01	9,68E-03	8,72E-03	1,32E-03	3,24E-03	-2,88E-01	-1,63E-02
ETP-fw**	CTUe	1,36E+02	4,13E+00	1,56E+00	3,33E+00	5,57E-01	-1,60E+01	1,30E+02
HTP-c**	CTUh	4,52E-08	1,86E-10	6,07E-11	1,62E-10	2,21E-11	1,18E-09	4,68E-08
HTP-nc**	CTUh	1,11E-07	3,85E-09	1,76E-09	2,71E-09	5,97E-10	-1,93E-08	1,01E-07
SQP**	dimensionless	1,53E+03	4,64E+00	1,82E+00	3,34E+00	5,10E-01	-4,66E+00	1,53E+03
Acronyms	GWP-GHG = Global Warming Potential-Greenhouse Gases; IRP = Ionizing Radiation, human health; ETP-fw = Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Land use related impacts/Soil quality							

* Disclaimer: 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 with this indicator

* *Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Use of Resources

Results per 1 m^2 of AKRITAS MF-Chipboard

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D	TOTAL
PERE	MJ	260	3,4841	0,03581	5,32086	0,016	-5,64717	263,20966
PERM	MJ	159,705	0	0	0	0	0	159,705
PERT	MJ	419,705	3,4841	0,03581	5,32086	0,016	-5,64717	422,915
PENRE	MJ	182,55754	3,82778	2,0448	2,6715	0,7644	-105,93	85,936
PENRM	MJ.	25,623	0	0	0	0	0	25,623
PENRT	MJ	208,18054	3,82778	2,0448	2,6715	0,7644	-105,93	111,559
SM	kg	0	0	0	0	0	0	0
RSF	MJ	1,34488	0	0	0	0	0	1,34488
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	0,162257	0,014	0,007	0,009	0,049	-0,00457	0,236687
Acronyms	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							

Waste/output flows, biogenic carbon content

Results per 1 m² of AKRITAS MF-Chipboard

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D	TOTAL
Waste production								
Hazardous waste disposed	kg	0,005899	0	0	0	0	0	0,005899
Non-hazardous waste disposed	kg	0	0	0	0	3,15	0	3,15
Radioactive waste disposed	kg	0	0	0	0	0	0	0
Output Flows								
Components for re-use	kg	0	0	0	0	0	0	0
Material for recycling	Kg	0,002191	0	0	0	0	0	0,002191
Materials for energy recovery	kg	0,08621	0	0	0	7,36	7,44621	7,44621
Exported energy, electricity	MJ	0	0	0	0	9,83	9,83	9,83
Exported energy, thermal	MJ	1,3449	0	0	0	45,93	47,2749	47,2749
Biogenic carbon content (product)	Kg C	5,255*						
Biogenic carbon content (packaging)	Kg C	2,1125						

*Disclaimer: The biogenic carbon content is assumed to be 50% of the product

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