Environmental Product Declaration

In accordance with ISO 14025:2006 and EN15804:2012+A2:2019/AC:2021 for:

MDF (Medium Density Fibreboard)

by

Dřevozpracující družstvo

Programme:	Czech Environmental Information Agency (CENIA) www.cenia.cz, "National programme of environmental labeling "- CZ
Programme operator:	CENIA, Czech Environmental Information Agency, Executive Body of NPEZ Agency
EPD owner:	DDL Dřevozpracující družstvo
Author:	Envitrail s.r.o.
Publication date:	2024-10-10
Valid until:	2029-10-10

EnviTrail s.r.o.
Bucharova 2657/12
158 00 Praha 5
IČO: 109 21 443

www.envitrail.com

Eva-Žofie Bergmannová
LCA Team lead
+420 604 237 592
bergmannova@envitrail.com

General information

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *EN 15804:2012+A2:2019+AC:2021*
Life Cycle Assessment (LCA)
LCA accountability: *Ing. Eva-Žofie Bergmannová, Envitrail s.r.o., bergmannova@envitrail.com, https://envitrail.com/*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Doc. Ing. Jan Weinzettel, Ph.D., Individual EPD verifier for the NPEZ*
The procedure for follow-up of data during EPD validity involves a third-party verifier: ☐ Yes ☒ No
Industry operator: CENIA, Czech Environmental Information Agency, Executive body of the NPEZ Agency, Moskevská 1523/63, Praha 10, 101 00, www.cenia.cz

The EPD owner has the sole ownership, liability, and responsibility for the EPD. Explanatory and supportive documentation can be obtained from the EPD owner. EPD of construction products may not be comparable if they do not comply with EN 15804+A2.

Company information

Owner of the EPD: Dřevozpracující družstvo, Lukavec čp. 9, 394 26 Lukavec, Czech Republic, IČ: 00028631 *(hereinafter referred to as DDL)*
Contact: David Roll, Head of Quality Management, ddl@ddl.cz
Name and location of production site(s): Lukavec čp. 9, 394 26 Lukavec, Czech Republic

DDL is a manufacturer of sawn timber and wood-based board materials with more than 70-year history. DDL specializes in the production of a wide range of products from wood and wood-based panels, namely from MDF and particle boards.

DDL is not a mere materials supplier, but a journey for customers from materials to semi-products to final products, which we complement with consultancy services.

Fast and reliable deliveries, verified quality, high flexibility, individual customer approach, capability to produce small batches, and a wide range of exclusive decorations. These are the main advantages that our customers have appreciated for dozens of years.

More at: https://www.ddl.cz/en/

DŘEVO ✓ DOVEDNOST ✓ LIDÉ ✓

Product information

Product name: MDF – Medium Density Fibreboard (raw)

Product identification and description: MDF is made from wood fibers (mainly spruce) bonded with synthetic glue under temperature and pressure. The boards are intended for non-bearing purposes in cabinet-making, joinery, mill workshops and other interior uses. Board structure enables good quality surface treatment using milling and painting. Excellent product properties include smooth surface (ground), strong edges, homogeneity, and excellent workability. They conform to the EN 622-1 and EN 622-5 standards in all parameters. Intended use differs and is based on the consumer.

UN CPC code: 314

Geographical scope: Europe – Czech Republic

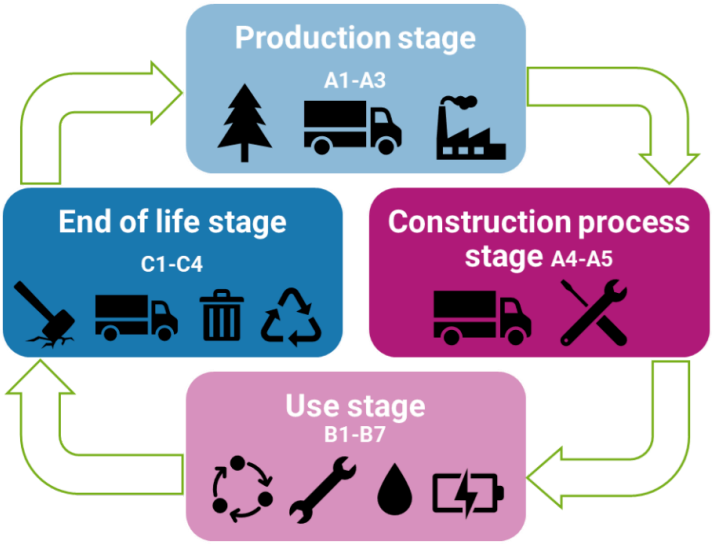
Technical parameters of an average product:

Parameter	Value					Unit	Source
Density	751					kg/m^3	DDL 2023
Moisture	5,51					%	DDL 2023
Release of dangerous substances to air during the use stage – formaldehyde emissions	class E1 perforated value ≤ 8					mg/100 g a.s. board	
Thickness class	>8-9	>9-12	>12-19	>19-30	>30-40		EN 13 986:2004
Bending strength	23	22	20	18	17		
Bending stiffness/elastic modulus	2700	2500	2200	2100	1900		
Friability (tensile strength)	0,65	0,6	0,55	0,55	0,5		
Durability (swelling)	17	15	12	10	8		

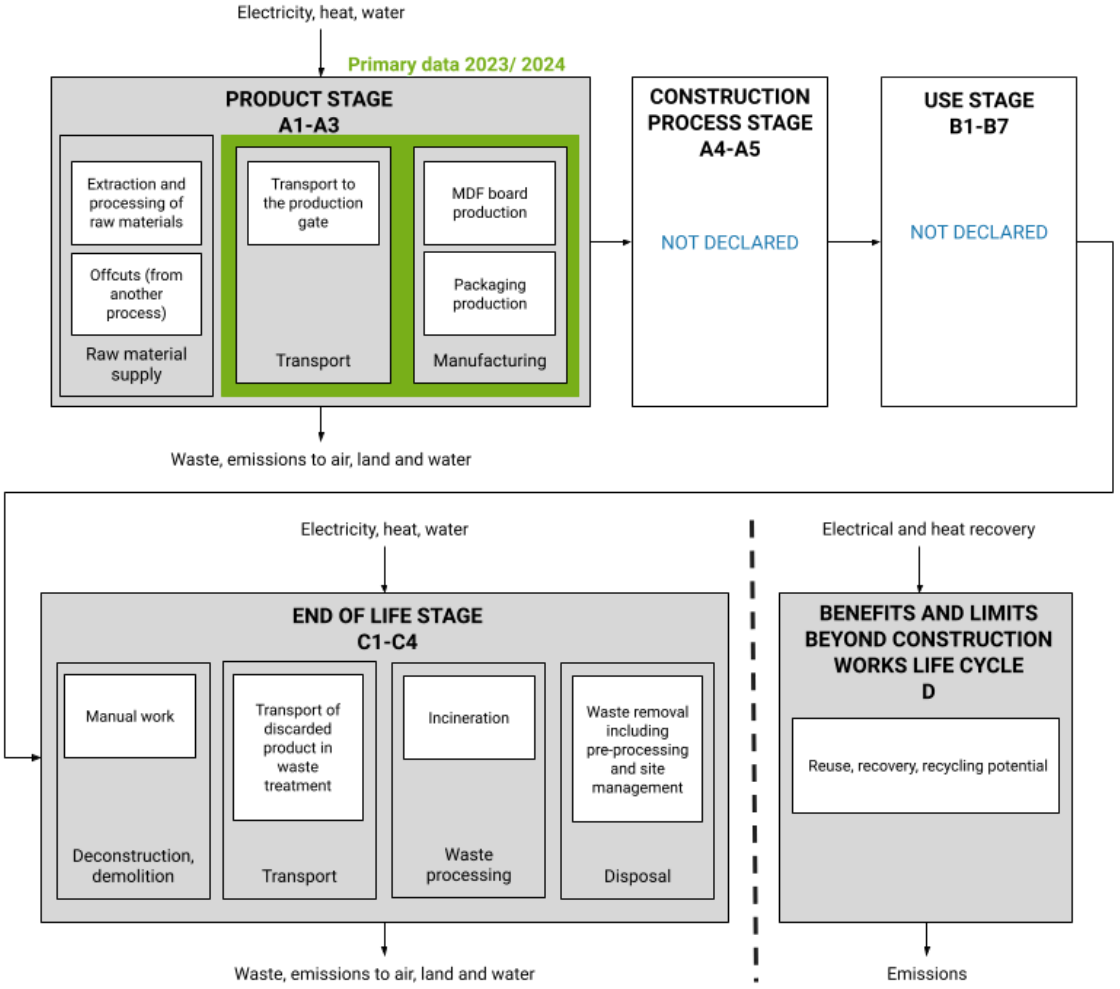
LCA information

Declared unit	1 m^3 of raw medium-density fibreboard (MDF)
Reference flow	1 m^3 of MDF
Reference service life	Not applicable
Time representativeness	01/2023 – 12/2023 *The data set will be considered valid until there are significant changes to data in the production, technology, supply chain or operational and end-of-life scenarios.*
Database and LCA software used	OpenLCA ver. 2.1.1., ecoinvent 3.10, cut-off
Methodology	Environmental Footprint 3.1 and its EN 15804 reference package
Description of system boundaries	Cradle-to-gate with modules C1–C4 and module D (A1–A3 + C + D). *Modules C1 and C4 have zero environmental impacts, as C1 is represented by manual labor and C4 is not applicable as the product is completely burned with energy recovery in phase C3.*
Cut-off rules	Ecoinvent cut-off system model is based on the recycled content, or cut-off, approach. In this system model, wastes are the producer's responsibility (PPP), and recycled or secondary products are available burden-free (cut-off). Processes and flows with a predicted resulting impact of less than 1 % have been excluded from the system.
Allocations	Waste allocation uses the selected Polluter Pays Principle (PPP). The allocation of input materials, consumption of energy and output flows was done through a volume allocation based on a reference flow of declared unit. For residual wood, an economic allocation method was used.
Conversion factor	The conversion factor is 0.0013 and 1 kg of material has a volume of 0.0013 m^3.

Life cycle phases



System diagram



Description of the manufacturing processes

The production of MDF boards takes several steps. First, the logs are debarked and cut into chips, which are sorted, cleaned, and stripped of impurities. The chips are then steam pulped and crushed in a defibrator. An adhesive (urea-formaldehyde resins) and a hydrophobing agent (paraffin and its emulsion) are applied to the fibers. The mixture is then dried and the layered carpet of fibers is pre-moulded. Finally, the boards are hot-pressed, cooled, formatted,and graded to make them ready for further use.

Modules declared

	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**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**X**	**X**	**X**	**X**	**X**

ND = Not Declared, used for voluntary parameters that are not quantified because no data is available.

The production stage includes the following modules:

- A1 – Module A1 includes raw material supply, such as forestry operations, residual wood, packaging, urea, paraffin and its emulsion, hardener, antifoaming agent, and glue production.
- A2 – Stage A2 covers the transportation of the materials to the mill and the fuels necessary for that. The logs and wood are transported by trucks >32 tonnes.
- A3 – This stage covers the manufacture of products including impacts connected to the generation of electricity (specific production mix by contractual instrument with GWP-GHG indicator of 0,642 kg CO_2 eq./kWh was calculated) and heat (from residual wood and oil), water and diesel (manipulation on the site) consumption. The processing of any waste arising from this stage is also included. For process description please see Description of the manufacturing processes above.

The end-of-life stage includes modules:

- C1 – De-construction by manual labor (zero environmental impacts).
- C2 – Transport to the incineration site.
- C3 – Waste processing. MDF may be disposed of with various disposal scenarios after construction and demolition as their final fate is related to consumer behavior. For this EPD it is assumed that 100 % of the waste is used as a material for incineration plants with energy recovery due to their high calorific value.
- C4 – Disposal (zero environmental impacts).

The benefits and costs beyond the product system in Module D:

- D – Module D contains credits for the substitution of thermal energy (heat from treatment of coal gas, in power plant - default provider) and electricity (production mix, high voltage, Czech Republic) by energy generation from thermal treatment of product (Module C3).

Excluded stages (not declared):

- *A4-A5 Construction process stage*
- *B1-B7 Use stage*

Content information

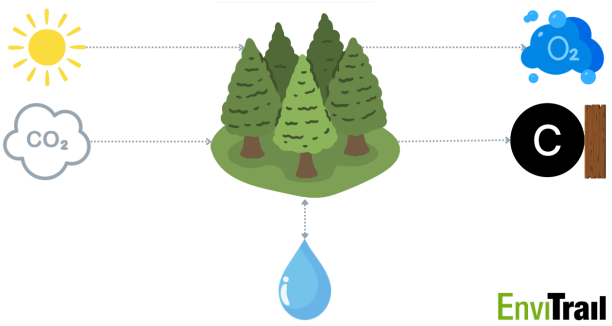
Material distribution

Production and acquisition of raw materials	kg per 1 m³	Percentage material distribution [%]	Data source
Primary wood	637,50	55,88%	DDL
Secondary recycled residual wood	369,18	32,36%	DDL
Other material	130,50	11,44%	DDL
Packaging material	3,69	0,32%	DDL
Total	**1 140,87**	**100,00%**	

Biogenic carbon content

The calculation of the biogenic carbon content of wood and the conversion to carbon dioxide was carried out according to the rules of EN 16449 [2] and is based on the distribution of the wood content and other materials per declared unit of the final product – 1m³ of MDF. The resulting biogenic carbon content for 1m³ of MDF is **319,84 kg C** and 1,74 kg C for accompanying packaging.

Biogenic carbon content	kg C/m³
Biogenic carbon content in product	**319,84**
Biogenic carbon content in accompanying packaging	**1,74**



The carbon sequestration and storage process involves capturing carbon dioxide (CO_2) from the atmosphere, particularly through renewable materials such as trees. During photosynthesis, trees and other plants absorb CO_2 and convert it into sugars, releasing oxygen. This natural mechanism reduces the amount of CO_2 in the atmosphere. Over time, the carbon is stored in the form of biomass, such as wood. The longer carbon remains locked in these materials instead of re-entering the atmosphere, the greater the environmental benefit. The diagram illustrates this cycle, showing how sunlight powers photosynthesis, which leads to the growth of trees that absorb CO_2 and produce oxygen, ultimately storing carbon in wood products. This entire cycle is sustained by the circulation of water and nutrients. At the end of the product's life cycle, the carbon returns to the atmosphere, most likely in the form of CO_2.

Results of the Environmental Performance Indicators

Mandatory impact category indicators according to EN 15804.

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	6,22E+02	0	5,84E+00	1,17E+01	0	-6,22E+02
GWP-biogenic	kg CO_2 eq.	-1,08E+03	0	3,44E-03	1,10E+03	0	2,38E-01
GWP- luluc	kg CO_2 eq.	1,30E+00	0	1,98E-03	2,85E-03	0	-6,21E-01
GWP- total	kg CO_2 eq.	-4,57E+02	0	5,84E+00	1,11E+03	0	-6,23E+02
ODP	kg CFC 11 eq.	7,31E-06	0	1,17E-07	1,31E-07	0	-2,35E-06
AP	mol H^+ eq.	2,92E+00	0	2,62E-02	1,21E-01	0	-2,46E+00
EP-freshwater	kg P eq.	4,10E-01	0	4,01E-04	5,06E-03	0	-6,16E-01
EP-marine	kg N eq.	5,76E-01	0	1,03E-02	6,43E-02	0	-5,49E-01
EP-terrestrial	mol N eq.	6,38E+00	0	1,12E-01	6,18E-01	0	-4,62E+00
POCP	kg NMVOC eq.	2,19E+00	0	4,03E-02	1,55E-01	0	-1,30E+00
ADP-minerals&metals*	kg Sb eq.	1,15E-03	0	8,01E-06	1,28E-05	0	-1,23E-04
ADP-fossil*	MJ	9,76E+03	0	8,35E+01	1,04E+02	0	-8,62E+03
WDP*	m^3	5,65E+02	0	4,16E-01	2,45E+01	0	-1,33E+02

***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.*

***General disclaimer:** The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.*

***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*

Additional mandatory and voluntary impact category indicators

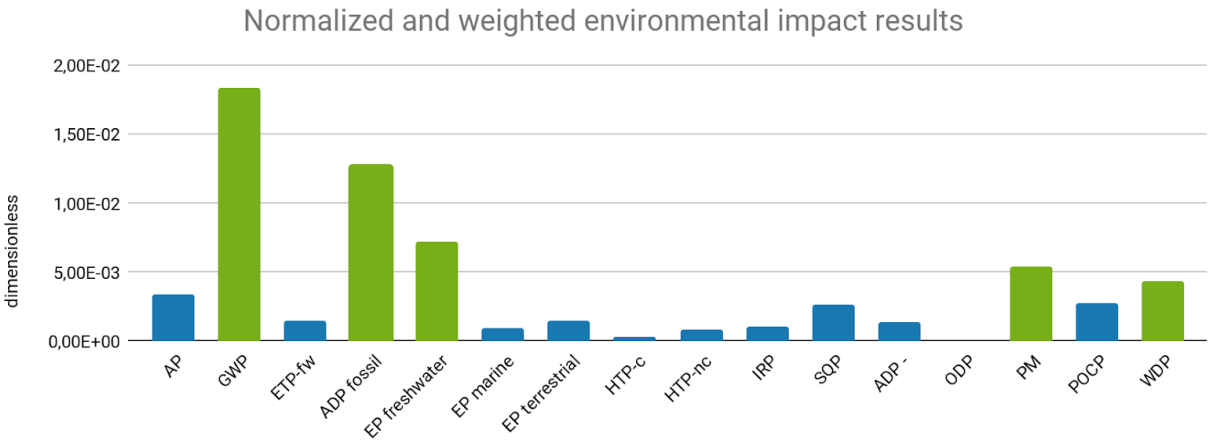
Indicator	Unit/DU	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	-4,57E+02	0	5,84E+00	1,11E+03	0	-6,23E+02
PM	disease incidence	3,43E-05	0	4,66E-07	1,34E-06	0	-1,78E-05
IRP**	kBq 235U eq.	8,52E+01	0	1,11E-01	1,20E-01	0	-1,87E+02
ETP-fw	CTUe	4,11E+03	0	1,27E+01	9,27E+01	0	-5,07E+03
HTP-c	CTUh	2,59E-07	0	1,37E-09	2,13E-08	0	-3,31E-07
HTP-nc	CTUh	4,11E-06	0	5,14E-08	1,46E-06	0	-3,00E-06
SQP	dimensionless	2,73E+04	0	6,25E+01	2,97E+01	0	-1,03E+03

***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 by this indicator.*

***Acronyms:** GWP-total = Global Warming Potential total; PM = Potential incidence of disease due to PM emissions ; IRP = Potential Human exposure efficiency relative to U235 ; ETP-fw = Potential Comparative Toxic Unit for ecosystems ; HTP-c = Potential Comparative Toxic Unit for humans; HTP-nc = Potential Comparative Toxic Unit for humans ; SQP = Potential soil quality index .*

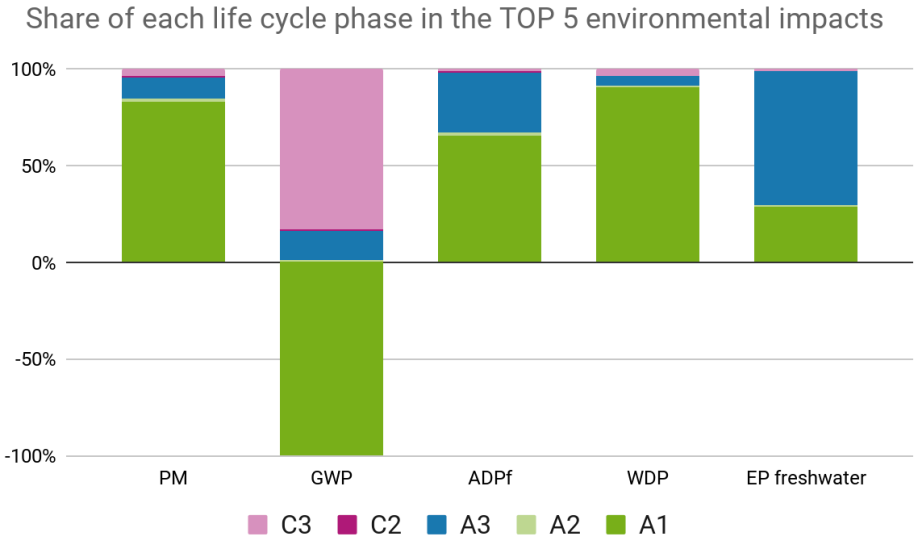
LCA Interpretation

Normalized and weighted selected environmental impact results



Based on the results, the three most relevant impact categories (hotspots) after normalization and weighting through EF ver. 3.1 factors are **Climate Change, Resource Depletion – Fossil Fuels, and Eutrophication – freshwater** [5]**.**

The Raw material supply phase (module A1) and the MDF production phase (module A3) have the highest environmental impacts in all impact categories. The cumulative distribution of contributions for the five most important impact categories is shown in the graph.



Phase C3 (end-of-life processing of MDF by incineration with a predicted wood energy recovery efficiency greater than 60 %) in the climate change impact category compensates for the negative values from module A1 (caused by the sequestration), as incineration (i.e. release of sequestered carbon back into the environment) occurs under module C.

A1 – Raw material supply

The most significant contributor to eutrophication potential-freshwater (EPf) emissions, depletion of raw material resources – fossil fuels (ADP-fossil), and climate change (GWP) in the analyzed system is **melamine urea formaldehyde adhesive production**, which dominates in all three categories with a share of 77,9 % (EPf), 96 % (GWP) and 86,2 % (ADP-fossil).

A3 – Production phase

The main contributors for all three of the most significant impact categories are the **electricity consumption process for the production of MDF board** (Electricity DDL), and the **production of heat from biomass** (Tepelná energie DDL).

Within the climate change impact category, the impacts from electricity consumption (75,6 %) and heat produced from fuel oil (11.5 %) dominate. Thermal energy from biomass is in third position with a share of 5.5 %. The processes that have the greatest impact on the category of impact of resource depletion (fossil fuels) have the same ranking as in the case of climate change, with the representation of electricity consumption (84.0 %) and heat (9.0 %).

Eutrophication-freshwater, on the other hand, is most affected by electricity **consumption**, with a majority share of 85.0 % and is followed by thermal energy from biomass with a representation of 13.3%.

Resource use indicators

Results per declared unit.

		Total A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
PERE	MJ	7,46E+01	0	0	0	1,44E+00	1,25E+04	0	-2,48E+02
PERM	MJ	1,25E+04	0	0	0	0	-1,25E+04	0	0
PERT	MJ	1,25E+04	0	0	0	1,44E+00	2,58E+00	0	-2,48E+02
PENRE	MJ	3,16E+03	0	0	0	8,35E+01	6,70E+03	0	-8,62E+03
PENRM	MJ	6,60E+03	0	0	0	0	-6,60E+03	0	0
PENRT	MJ	9,76E+03	0	0	0	8,35E+01	1,04E+02	0	-8,62E+03
SM	kg	3,69E+02	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m^3	1,50E+01	0	0	0	1,17E-02	1,50E-01	0	-4,51E+00

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 re-sources; 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 indicators

Results per declared unit.

Environmental information describing waste categories (MANDATORY)		A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	9,09E+01	ND	ND	0	8,16E-02	4,17E+00	0	-5,79E+00
Non-harzardous waste disposed (NHWD)	kg	1,63E+02	ND	ND	0	8,88E-01	7,64E+02	0	-1,30E+02
Radioactive waste disposed (RWD)	kg	1,07E-02	ND	ND	0	1,43E-05	1,51E-05	0	-2,36E-02

Output flow indicators

Results per declared unit.

Environmental information describing output flows (MANDATORY)		Total A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
Components for re-use (CRU)	kg	0	ND	ND	0	0	0	0	0
Materials for recycling (MFR)	kg	9,93E-01	ND	ND	0	0	0	0	0
Materials for energy recovery (MER)	kg	3,68E+01	ND	ND	0	0	0	0	0
Exported electrical energy (EEE)	MJ	0	ND	ND	0	0	2,10E+03	0	0
Exported thermal energy (EET)	MJ	0	ND	ND	0	0	6,29E+03	0	0

References and standards followed

[1] ČSN EN ISO 16485: Round and sawn timber – Environmental Product Declarations – Product category rules for wood and wood-based products for use in construction, 2014

[2] ČSN EN ISO 16449: Wood and wood-based products – Calculation of the biogenic carbon content of wood and conversion to carbon dioxide, 2014

[3] ČSN ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures, 2006

[4] ČSN EN 15804+A2: Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, 2019

[5] Andreasi Bassi, S., Biganzoli, F., Ferrara, N., Amadei, A., Valente, A., Sala, S. and Ardente, F., Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/798894, JRC130796. Available at: https://publications.jrc.ec.europa.eu/repository/handle/JRC130796