



Environmental Product Declaration

of EXTRUDED POLYSTYRENE products by FIBRAN

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

EPD of multiple products, based on the average results of the product group.

The products included are MAESTRO, ETICS GF, SEISMIC GF, ETICS BT, FABRIC, 300, 400, 500, 700.



FIBRANxps

EPD Owner	FIBRAN S.A.
EPD Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0002372:002 (S-P-02372)
CPC Code	369
Version date:	2026-02-04
Validity date:	2031-02-03
Geographical scope:	Global

An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com



www.fibran.gr



General Information

Programme Information

Program: The International EPD® System

Address: EPD International AB Box 210 60 SE-100 31 Stockholm, Sweden

Website: www.environdec.com

E-mail: support@environdec.com

Product Category Rules (PCR)

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

Product category rules (PCR): Construction products, PCR 2019:14, v. 2.0.1

Complementary Product Category Rules (c-PCR): C-PCR-005 (TO PCR 2019:14)
"Thermal Insulation Products (EN 16783:2024)", v 1.0.0 (2025-04-08)

PCR review was conducted by: The Technical Committee of the International EPD System.
A full list of members is available at www.environdec.com

Verification

Third-party Verification

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

Individual EPD verification without a pre-verified LCA/EPD tool

Third-party verifier: Business Quality Verification P.C.

Address: 5, Konitsis Street, GR 15125, Marousi, Attica / Greece

www.bqv.gr - info@bqv.gr

Accredited by: Hellenic Accreditation System (ESYD) with accreditation number 1218

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 of the EPD.

EPDs within the same product category but from different programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

Information about EPD owner

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FIBRAN S.A., founded in 1974 by Dimitrios Anastasiadis in Terpni, Greece, has grown into a leading multinational insulation group. Today, FIBRAN operates factories in seven European countries with 13 production lines and maintains commercial presence in over 60 markets worldwide, ranking among Europe's top insulation manufacturers.

The company specializes in high-performance insulation solutions, producing extruded polystyrene (XPS), stonewool, and expanded polystyrene (EPS) for thermal, acoustic, and fire protection across civil, industrial, agricultural, and marine applications. Additionally, FIBRAN manufactures gypsum-based products for dry construction and distributes a wide range of complementary building materials.

Its product portfolio includes:

- FIBRAN*geo* - stonewool insulation
- FIBRAN*xps* - extruded polystyrene insulation
- FIBRAN*gyps* and FIBRAN*profiles* - dry construction systems
- FIBRAN*neps* - expanded polystyrene insulation

Driven by innovation, FIBRAN's R&D department continuously develops certified insulation and construction systems that meet the evolving needs of architects, engineers, contractors, and property owners. This commitment reflects the founder's vision: improving everyday living and enhancing comfort and sustainability for consumers worldwide.

Information on LCA Practitioner commissioned

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Product Information

FIBRANxps are high performance extruded polystyrene (XPS) insulation boards manufactured by FIBRAN S.A. at five production sites located in Rouse (Bulgaria), Most (Czech Republic), Terpni (Greece), Ovar (Portugal) and Sodražica (Slovenia). It is engineered with specialized surface and edge profiles to meet diverse building and infrastructure requirements. They deliver excellent thermal insulation, superior mechanical strength, and extremely low water absorption, making them ideal for insulating basements, walls, floors, roofs, and ceilings, as well as for demanding applications such as cold storage rooms, heated pools, industrial panels, and major infrastructure projects including roads, bridges, railways, and airports.

The manufacturing process begins with feeding polystyrene and additives into the extrusion system, where blowing agents are introduced and the polymer is melted, mixed, and expanded. A second extrusion stage cools and foams the melt, forming the characteristic closed cell structure of XPS. The boards are then shaped, cut, and finished to the required dimensions before being packaged and stored for distribution.

FIBRANxps boards' declared thermal conductivity is determined after an ageing procedure representing a time average value of about 25 years of use:

- At production: 0.025–0.031 W/m·K
- After 25 years: 0.032–0.040 W/m·K

Their closed-cell structure ensures water absorption below 1.5% by volume and vapor diffusion resistance between $\mu \geq 50$, depending on surface finish. Compressive strength ranges from 200 to 700 kPa, providing exceptional durability for heavy-load applications.

All FIBRANxps products comply with EU Regulation 305/2011 (CPR), carry CE marking according to EN 13164, and are assessed under systems 3. Declarations of Performance (DoP) for all types and thicknesses are available at <https://fibranpedia.com>. Quality is certified under EN 13164 and EN 13172, and management systems exist according to ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, and ISO 50001:2018.

FIBRANxps contributes to LEED certification, meets stringent VOC emission standards (Belgian, French A+, German AgBB/ABG, Finnish M1), and is supported by verified EPDs and Health Product Declarations (HPDs).



This EPD is based on average product of a product group, produced on multiple sites. The study analyses **MAESTRO**, **ETICS GF**, **SEISMIC GF**, **ETICS BT**, **FABRIC**, **300**, **400**, **500** and **700**, all being under FIBRANxps produced by FIBRAN S.A.

Content Declaration

Functional unit

The studied products are grouped into one category, and the results of the average product are presented. The functional unit of this study is 1 m² of FIBRANxps with $\lambda=0.032-0.040$ W/mK. Data for the inventory and impact assessment are expressed based on the functional unit. Also, the density is 31.85 kg/m³ and the thickness 33 mm. Thus, the quantity for 1 m² of product is 1.05 kg.

Product content

In the tables below, the product content of the average product and the range of the content of the included products are declared. For the average product, the declared content is calculated by taking into consideration the production volumes per site for the year 2024, resulting in the weighted average.

Product content (average product)	Mass, kg	Post-consumer recycled material, mass-% of product
Polystyrene	0.91	0.07%
Blowing Agents	0.12	0%
Additives	0.01	0%
Total	1.05	

Packaging Materials	Mass, kg	Mass-% (versus the product)
LDPE Film	0.02	1.59
Paper (labels)	0.01	1.07
EPS Pallet legs	0.00	0.07

Product content (range)	Mass, kg	Post-consumer recycled material, mass-% of product
Polystyrene	0.92-1.03	0-0.2%
Blowing Agents	0.12-0.14	0%
Additives	0.01-0.03	0%
Total	1.07-1.20	

Packaging Materials	Mass, kg	Mass-% (versus the product)
LDPE Film	0.01 - 0.02	1.56% - 2.11%
Paper (labels)	0.00 – 0.07	0.02% - 6.68%
EPS Pallet legs	0.00 – 0.01	0.00% - 0.27%

According to the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Regulation, the product does not contain any substance included in the Candidate List of Substances of Very High Concern (SVHCs) for authorization with concentrations higher than 0.1% weight by weight (w/w).

LCA Information

Functional unit

The studied products are grouped into one category, and the results of the average product are presented. The functional unit of this study is 1 m² of FIBRANxps with $\lambda=0.032-0.040$ W/mK. Also, the density is 31.85 kg/m³ and the thickness 33 mm. Thus, the quantity for 1 m² of product is 1.05 kg.

Reference service life

The reference service life of FIBRANxps equals the building frame being at least 50 years.

Time representativeness

The reporting year of this study is the calendar year 2024.

Geographical scope

The geographical scope is global.

Database and Software used

Ecoinvent database 3.11+EN 15804 add-on in OpenLCA v.2.4.1

Description of system boundaries

The EPD system boundary is cradle-to-grave and module D and a description of modules is as follows:

A1 This stage covers the extraction and processing of raw materials and primary fuels required for the product’s manufacturing. It includes the production of upstream components such as polystyrene, blowing agents, and additives. Additionally, the module accounts for the extraction of primary fuels used in these processes. Electricity generation for the production of the insulation board is also included within the A1 module.

A2 This stage includes all transportation activities up to the factory gate, as well as internal transport within the facility. Additionally, it encompasses the transportation of raw materials sourced from various locations across the globe. These materials are delivered to the plant via a combination of trucks and ships.

A3 The manufacturing process encompasses all production activities within the plant, along with their associated environmental impacts. It begins with feeding raw materials—polystyrene and additives—into the system, followed by the introduction of blowing agents. In the first extrusion stage, the material undergoes heating, dispersion, and gas diffusion, powered by electrical energy. The second extrusion stage focuses on cooling, expansion, and foaming to achieve the desired cellular structure. After extrusion, the material is cut, shaped, and finished to form precise edges and surfaces. Packaging is then carried out using polyethylene paper to protect the product, which is subsequently stored until distribution. This module also includes waste processing up to the end-of-waste state and the disposal of final residues generated during the product stage.

A4 This module includes the transport of products from the manufacturing facility to the point of use.

Scenario information	Unit (expressed per functional unit)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long-distance truck, boat etc.	EURO 5 truck, diesel
Distance	500 km
Capacity utilisation (including empty returns)	100%
Bulk density of transported products	Not applicable
Volume capacity utilisation factor (factor: =1 or <1 or ~1 for compressed or nested packaged products)	Not applicable

A5 This module covers the environmental impacts associated with installing FIBRANxps at the customer’s premises. Installation is performed manually, without the use of electricity or water, resulting in zero consumption of these resources during the process. The environmental impact of minor components, such as screws, is considered negligible and has been excluded from the scope of this study.

In accordance with EN 16783, this module accounts for installation waste of insulation products, assumed to be 2% of the total product mass. Additionally, the treatment of packaging waste generated during installation is included in this module.

Scenario information	Unit (expressed per functional unit)
Ancillary materials for installation (specified by material);	Not applicable
Water use	Not applicable
Quantitative description of energy type and consumption during the installation process	Considered negligible
Waste materials on the building site before waste processing, generated by the product’s installation (specified by type)	Not applicable
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Waste packaging materials (LDPE films and paper) Recycling rate 67.5%, disposal rate 32.5%. FIBRANxps 2% to 100% landfilling
Direct emissions to ambient air, soil and water	Not applicable

B1-B7 The use stage begins when the end user starts utilizing the product—typically after construction or installation—and continues until the product is removed and enters the next life cycle process. FIBRANxps, as a thermal insulation material, does not consume energy during use, requires no maintenance, and is not subject to repair under standard conditions when correctly installed. It is also assumed that the product is neither replaced nor refurbished during its service life. Furthermore, thermal insulation products do not require energy or water during the operational phase of the building. Consequently, the environmental impacts associated with Use Stage Modules B1–B7 are considered negligible and are assumed to be zero in accordance with EN 16783.

C1 In this module, the impacts arising from the de-construction/ demolition of the insulation board in the installation site. Assuming that the process of demolition is performed without using any form of electricity or thermal energy, but only hand tools, the environmental impacts of C1 module are considered zero.

C2 In this stage the emissions from the transportation of the discarded product from the demolition site to the relevant waste treatment facilities are calculated. Conservatively, 50 km by EURO5 trucks are considered.

Scenario information	Unit (expressed per functional unit)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat etc.	EURO 5 truck, diesel
Distance	50 km
Capacity utilisation (including empty returns)	100%
Bulk density of transported products	Not applicable
Volume capacity utilisation factor (factor: =1 or <1 or ~1 for compressed or nested packaged products)	Not applicable

C3 This module generally includes the impacts arising from potential recycling/reuse of final products after their life cycle. FIBRANxps is considered 100% landfilled, therefore the impacts of this module are considered zero.

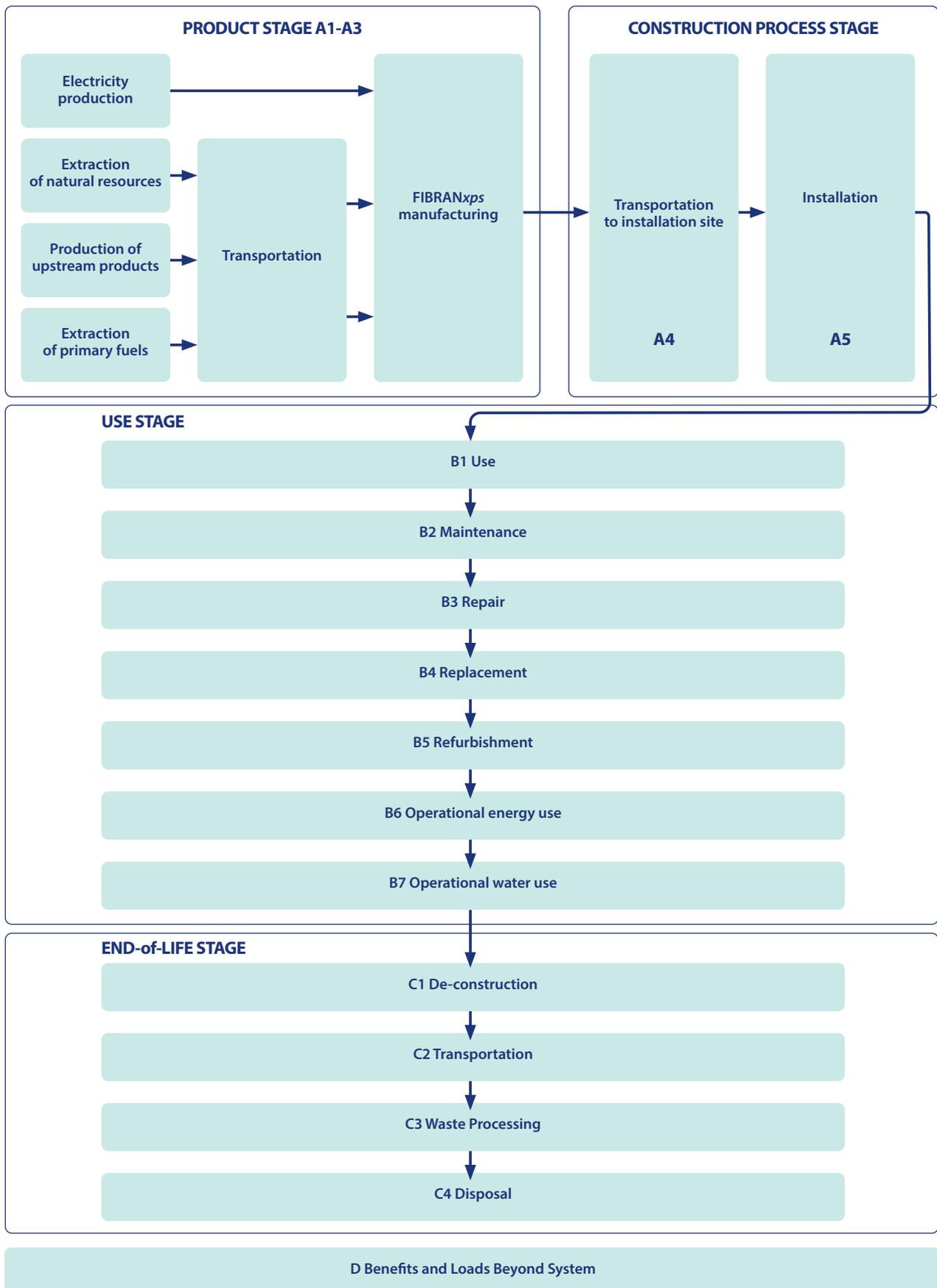
C4 This module generally accounts for the environmental impacts associated with the potential landfilling of products at the end of their life cycle. As previously noted, 100% of FIBRANxps waste is disposed of in landfills, making this a significant consideration in the overall waste management scenario.

D Module D generally includes potential avoided burdens related to the potential reuse and/or recycling of the product and its packaging after its end-of-life stage. In this case, since all polystyrene is assumed to be landfilled, the environmental benefits from the reuse of this 67.5% of LDPE packaging film and labels are considered.

¹ *Packaging waste statistics - Statistics Explained - Eurostat*

² *Packaging waste statistics - Statistics Explained - Eurostat*

Process flow diagram



Modules declared, Geographical scope, share of primary data (in GWP-GHG results) and data variation (in GWP-GHG results)

	Product stage		Construction stage			Use stage							End-of-life stage			Resource recovery stage	
	Raw Materials Supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and demolition	Transport	Waste processing for reuse, recovery and/or recycling	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Module Declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	Global	Multi-site EU (BG, CZ, GR, PT, SL)		EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	Global
Share of primary data	18.37%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-products	-58% to +199% ²			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - Sites	-6.0% to +10.6%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

Allocations

Allocation rules have been performed in accordance with the requirements of ISO 14044:2006. No allocation of co-products has been carried out, since there are no co-products during the process.

During the manufacturing process, offcuts and production residues are generated. These materials are managed through internal recycling practices. In accordance with PCR 2019:14 Construction Products, version 2.0.1, internally recycled FIBRANxps residues are considered part of a closed-loop recycling system. A portion of these residues is reintroduced into the manufacturing process, while another portion is utilized in packaging. Consequently, they are not accounted for as inputs of secondary material in the life cycle inventory.

In the plants located in Greece and the Czech Republic, post-consumer polystyrene is used as an input material. This material is externally sourced and originates from modules B or C of another product system. In accordance with PCR 2.0.1, it is assumed that the end-of-waste state is reached at the point of its generation, meaning that any environmental burdens prior to this point are allocated to the previous product life cycle. Consequently, when entering the product system under analysis, the material carries only the environmental burden associated with its transportation to the respective plants for use.

³ This variation represents the difference between the declared average GWP-GHG result for Modules A1-A3 and the product with GWP-GHG results furthest from the declared results

Cut-off rules

The cut-off criteria adopted are as stated in PCR 2019:14, v.2.0.1 and EN 15804:2012+A2:2019. Where there is insufficient data or data gaps for a unit process, the cut-off criteria are 1% of the total mass of input of that process. The total of neglected input flows per module is a maximum of 5% of energy usage and mass. In this study, cut-off rule has been applied to certain additives and packaging materials of FIBRANxps reaching 0.59%.

Electricity Modelling

Electricity consumed for FIBRANxps manufacturing is either sourced solely from the grid (Bulgaria, Czech Republic and Greece) or there is also sourced from Photovoltaic Panels (Portugal and Slovenia). In accordance with the requirements set out in PCR 2019:14 v2.0.1, a market-based approach has been applied for electricity modelling. As no contractual instruments (e.g., Guarantees of Origin or Power Purchase Agreements) were in place during the reporting year, the residual mix for each country has been used, particularly as calculated by the Association of Issuing Bodies (AIB) and presented by the dataset electricity, medium voltage, residual mix | electricity, medium voltage | EN15804GD, S". The composition of the residual mixes is valid for the year 2023 and sourced by AIB (2024) using grexel methodology resulting in the factors presented in the table below. These datasets include both direct and indirect emissions of electricity generation taking into consideration all different production sources, accounting also for upstream emissions and transmission losses. Regarding electricity generated by Photovoltaic Panels, the dataset electricity production, photovoltaic, 570kWp open ground installation, multi-Si | electricity, low voltage | EN15804GD, S – RoW has been used.

Country	Factor (kg CO ₂ eq/kWh) – residual mix	Factor (kg CO ₂ eq/kWh) – PV
Bulgaria	0.61	-
Czech Republic	0.71	-
Greece	0.82	-
Portugal	0.62	0.08
Slovenia	0.68	0.08

Data quality and declaration

ISO 14044 was applied in terms of data collection and EN 15941 in data quality requirements. The data collection period of primary data is the full calendar year 2024, the technical representativeness has been concluded as Very Good, and the geographical representativeness has been characterized as Very Good since the data is collected within the organization boundaries, having been representative of the manufacturing plants. Regarding the electricity mix, AIB's datasets for 2024 and for the residual energy mixes of each country have been used. For the secondary data, database Ecoinvent database v.3.11+EN 15804 add-on has been used, presenting a Very Good time representativeness, but demonstrating a Fair score on average in geographical and technical representativeness. Data quality declaration, as well as the share of primary data in GWP-GHG results are presented below as obliged by PCR 2019:14 for processes that contribute more than 10% to the GWP-GHG results:

Process	Source Type	Source	Reference year	Data category	Share of primary data, of GWP-GHG results for A1-A3
Product Manufacturing	Collected data	EPD Owner	2024	Primary	0.02%
Generation of Electricity used in manufacturing process	Database	AIB (2024). 2023 European Residual	2023	Primary, Secondary	14.90%
Transportation of Raw Materials	Collected data, Database	Ecoinvent 3.11 EN15804GD	2024	Primary	3.46%
Production of Polystyrene	Collected data, database	EPD Owner, Ecoinvent 3.11 EN15804GD	2024	Secondary	0%
Production of other Raw and Auxiliary Materials	Collected data, database	EPD Owner, Ecoinvent 3.11 EN15804GD	2024	Secondary	0%
Others	Collected data, database	EPD Owner, Ecoinvent 3.11 EN15804GD	2024	Secondary	0%
Total share of primary data of GWP, GHG results for A1-A3					18.37%

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. It should be noted that this indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

Characterization factors (JRC)

Based on Reference package EF 3.1 in Ecoinvent database 3.11+EN 15804 add-on

Environmental Performance

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. The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3). The impact results below refer to 1 square meter (m²) of FIBRAN_{geo} with $\lambda=0.033-0.039$ W/mK, density 75 kg/m³ and thickness 33 mm.

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global Warming Potential (GWP)-GHG ¹	kg CO ₂ eq	4.67E+00	1.00E-01	1.04E-01	0.00E+00	0.00E+00	9.80E-03	0.00E+00	1.26E-01	-4.59E-02
Global Warming Potential (GWP) -total	kg CO ₂ eq	4.67E+00	1.00E-01	1.05E-01	0.00E+00	0.00E+00	9.80E-03	0.00E+00	1.26E-01	-4.26E-02
Global Warming Potential (GWP) -fossil	kg CO ₂ eq	4.66E+00	1.00E-01	9.84E-02	0.00E+00	0.00E+00	9.80E-03	0.00E+00	1.26E-01	-4.67E-02
Global Warming Potential (GWP) -biogenic	kg CO ₂ eq	8.63E-03	1.80E-05	6.61E-03	0.00E+00	0.00E+00	1.77E-06	0.00E+00	3.19E-05	4.14E-03
Global Warming Potential (GWP) -luluc	kg CO ₂ eq	4.22E-04	3.31E-05	1.12E-05	0.00E+00	0.00E+00	3.24E-06	0.00E+00	6.81E-06	-6.73E-05
Ozone Depletion Potential (ODP)	kg CFC-11 eq	3.09E-08	2.18E-09	6.57E-10	0.00E+00	0.00E+00	2.14E-10	0.00E+00	2.84E-10	-1.25E-09
Acidification Potential (AP)	mol H+ eq	1.84E-02	3.21E-04	3.80E-04	0.00E+00	0.00E+00	3.15E-05	0.00E+00	7.93E-05	-1.87E-04
Eutrophication potential (EP) - freshwater	kg P eq	5.09E-04	6.83E-06	1.08E-05	0.00E+00	0.00E+00	6.69E-07	0.00E+00	1.17E-06	-1.73E-05
Eutrophication potential (EP) - marine	kg N eq	3.23E-03	1.08E-04	8.70E-05	0.00E+00	0.00E+00	1.06E-05	0.00E+00	6.92E-04	-3.60E-05
Eutrophication potential (EP) - terrestrial	mol N eq	3.38E-02	1.18E-03	7.21E-04	0.00E+00	0.00E+00	1.15E-04	0.00E+00	3.28E-04	-3.64E-04
Photochemical ozone creation potential (POCP)	kg NMVOC eq	1.35E-02	4.87E-04	2.90E-04	0.00E+00	0.00E+00	4.77E-05	0.00E+00	1.45E-04	-2.25E-04
Abiotic depletion potential (ADP) – minerals and metals ²	kg Sb eq	2.96E-06	3.45E-07	7.49E-08	0.00E+00	0.00E+00	3.38E-08	0.00E+00	2.15E-08	-1.99E-07
Abiotic depletion potential (ADP) – fossils fuels ²	MJ	1.02E+02	1.42E+00	2.07E+00	0.00E+00	0.00E+00	1.39E-01	0.00E+00	2.51E-01	-1.22E+00
Water deprivation potential (WDP) ²	m ³ eq	2.45E+00	7.43E-03	4.95E-02	0.00E+00	0.00E+00	7.28E-04	0.00E+00	1.10E-02	-3.43E-02

¹ GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product, with characterization factors (CFs) based on IPCC (2013).

² The results of this environmental impact indicators of ADPf, ADPe and WDP shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

RESOURCE USE	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Use of renewable primary energy excluding resources used as raw materials (PERE)	MJ	1.45E+00	2.31E-02	3.08E-02	0.00E+00	0.00E+00	2.26E-03	0.00E+00	3.39E-03	-2.95E-01
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT)	MJ	1.45E+00	2.31E-02	3.08E-02	0.00E+00	0.00E+00	2.26E-03	0.00E+00	3.39E-03	-2.95E-01
Use of non-renewable primary energy excluding resources used as raw materials (PENRE)	MJ	1.02E+02	1.42E+00	2.08E+00	0.00E+00	0.00E+00	1.39E-01	0.00E+00	2.51E-01	-1.22E+00
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT)	MJ	1.02E+02	1.42E+00	2.08E+00	0.00E+00	0.00E+00	1.39E-01	0.00E+00	2.51E-01	-1.22E+00
Use of secondary material (SM)	kg	-3.49E-02	-1.37E-03	-1.40E-02	0.00E+00	0.00E+00	-1.34E-04	0.00E+00	-1.74E-04	-1.68E-02
Use of renewable secondary fuels (RSF)	MJ	1.79E-02	3.21E-04	3.69E-04	0.00E+00	0.00E+00	3.15E-05	0.00E+00	2.70E-05	-2.21E-03
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water (FW)	m ³	5.68E-02	1.71E-04	1.03E-03	0.00E+00	0.00E+00	1.68E-05	0.00E+00	-3.81E-03	-8.05E-04

OUTPUT FLOWS	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	5.62E-02	1.44E-03	1.31E-03	0.00E+00	0.00E+00	1.41E-04	0.00E+00	3.08E-04	-1.45E-03
Non-hazardous waste disposed (NHWD)	kg	5.50E-01	1.54E-02	9.61E-02	0.00E+00	0.00E+00	1.51E-03	0.00E+00	2.72E+00	-2.13E-01
Radioactive waste disposed (RWD)	kg	4.87E-05	4.17E-07	9.94E-07	0.00E+00	0.00E+00	4.09E-08	0.00E+00	5.05E-08	-2.15E-06
Components for re-use (CRU)	kg	-2.79E-21	0.00E+00	-9.74E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.32E-22
Materials for recycling (MFR)	kg	3.34E-02	1.23E-03	7.57E-04	0.00E+00	0.00E+00	1.21E-04	0.00E+00	1.21E-04	-3.73E-03
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (EE), electricity	MJ	7.07E-02	2.73E-04	1.42E-03	0.00E+00	0.00E+00	2.67E-05	0.00E+00	2.24E-05	-1.37E-03
Exported energy (EE), thermal	MJ	4.14E-03	3.30E-04	8.96E-05	0.00E+00	0.00E+00	3.24E-05	0.00E+00	2.65E-05	-4.08E-04

ADDITIONAL IMPACTS	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate Matter (PM)	Disease incidence	1.70E-07	3.84E-09	5.97E-10	0.00E+00	0.00E+00	7.83E-10	0.00E+00	1.82E-09	-1.19E-09
Ionizing radiation, human health (IRP) ³	kBq U235 eq	2.02E-01	3.99E-03	9.64E-05	0.00E+00	0.00E+00	1.66E-04	0.00E+00	2.06E-04	-8.46E-03
Eco-toxicity, freshwater (ETP-FW)	CTUe	2.91E+00	2.48E-01	1.93E-01	0.00E+00	0.00E+00	1.84E-02	0.00E+00	3.26E-01	-2.25E-01
Human toxicity, cancer effects (HTP-c)	CTUh	3.93E-10	1.16E-11	4.13E-12	0.00E+00	0.00E+00	1.67E-12	0.00E+00	4.28E-12	-9.77E-12
Human toxicity, non-cancer effects (HTP-nc)	CTUh	9.82E-09	2.64E-10	7.73E-11	0.00E+00	0.00E+00	8.70E-11	0.00E+00	5.85E-10	-3.09E-10
Soil Quality (SQP)	dimensionless	5.11E+00	1.40E-01	4.48E-02	0.00E+00	0.00E+00	8.21E-02	0.00E+00	5.93E-01	-1.32E+00

³This 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 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.

Environmental Performance

Impacts of products with different thickness and density

This LCA covers FIBRANxps products with densities ranging from 27 to 40 kg/m³ and thicknesses between 20 mm and 240 mm. While the results are presented for the functional unit of 1 m² of FIBRANxps with thermal conductivity $\lambda = 0.032\text{--}0.040$ W/m·K, density 31.85 kg/m³, and thickness 33 mm (corresponding to a mass of 1.05 kg), the conversion factor (A) below should be used to determine the impacts of products with different density and thickness by multiplying with each impact category:

$$A = \frac{\rho * S}{1.05}$$

Where:

- A is the conversion factor
- ρ is the density of the product in kg/m³ and,
- S is the thickness of the product in m

Environmental Performance

Variations

The variations between individual sites and the average product are presented in the tables below. A positive deviation indicates that a product has a higher environmental impact than the calculated average. These deviations provide insight into the relative performance of each product and help identify which life cycle stages contribute most significantly to its overall environmental footprint. The observed differences are primarily driven by variations in product mass per functional unit, along with minor differences in the packaging materials used across sites.

Variation of Environmental impacts between 1 m² of average product and Bulgaria site product

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4
GWP-GHG	kg CO ₂ eq	-6.0%	-4.9%	-10.5%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
GWP-total	kg CO ₂ eq	-6.0%	-4.9%	-10.9%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
GWP-fossil	kg CO ₂ eq	-6.0%	-4.9%	-6.0%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
GWP-biogenic	kg CO ₂ eq	-7.6%	-4.9%	-83.9%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
GWP-luluc	kg CO ₂ eq	-40.8%	-4.9%	-34.8%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
ODP	kg CFC-11 eq	-39.9%	-4.9%	-38.7%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
AP	mol H+ eq	5.8%	-4.9%	5.1%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
EP-freshwater	kg P eq	-31.2%	-4.9%	-30.3%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
EP-marine	kg N eq	5.6%	-4.9%	-0.8%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
EP-terrestrial	mol N eq	6.9%	-4.9%	5.0%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
POCP	kg NMVOC eq	1.8%	-4.9%	-0.3%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
ADPe	kg Sb eq	-20.4%	-4.9%	-20.6%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
ADPf	MJ	-3.1%	-4.9%	-2.8%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%
WDP	m ³ eq	-2.6%	-4.9%	-2.3%	0.00E+00	0.00E+00	-4.9%	0.00E+00	-4.9%

Environmental Performance

Variation of Environmental impacts between 1 m² of average product and Czech Republic site product

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4
GWP-GHG	kg CO ₂ eq	2.2%	0.8%	-6.8%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
GWP-total	kg CO ₂ eq	2.2%	0.8%	-7.2%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
GWP-fossil	kg CO ₂ eq	2.2%	0.8%	-2.5%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
GWP-biogenic	kg CO ₂ eq	4.7%	0.8%	-77.5%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
GWP-luluc	kg CO ₂ eq	-17.3%	0.8%	-12.1%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
ODP	kg CFC-11 eq	-32.7%	0.8%	-33.7%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
AP	mol H+ eq	-9.4%	0.8%	-13.5%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
EP-freshwater	kg P eq	-29.2%	0.8%	-30.0%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
EP-marine	kg N eq	-6.2%	0.8%	-10.2%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
EP-terrestrial	mol N eq	-5.8%	0.8%	-10.0%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
POCP	kg NMVOC eq	-5.7%	0.8%	-10.5%	0.00E+00	0.00E+00	0.8%	0.00E+00	0.8%
ADPe	kg Sb eq	-14.3%	0.8%	-12.7%	0.00E+00	0.00E+00	-0.8%	0.00E+00	-0.8%
ADPf	MJ	5.1%	0.8%	0.0%	0.00E+00	0.00E+00	-0.8%	0.00E+00	-0.8%
WDP	m ³ eq	3.1%	0.8%	-1.9%	0.00E+00	0.00E+00	-0.8%	0.00E+00	-0.8%

Variation of Environmental impacts between 1 m² of average product and Greece site product

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4
GWP-GHG	kg CO ₂ eq	1.5%	-2.1%	-3.6%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
GWP-total	kg CO ₂ eq	1.5%	-2.1%	-4.0%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
GWP-fossil	kg CO ₂ eq	1.5%	-2.1%	1.3%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
GWP-biogenic	kg CO ₂ eq	-9.6%	-2.1%	-82.9%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
GWP-luluc	kg CO ₂ eq	-5.0%	-2.1%	-6.6%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
ODP	kg CFC-11 eq	71.4%	-2.1%	66.3%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
AP	mol H+ eq	6.1%	-2.1%	5.5%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
EP-freshwater	kg P eq	100.2%	-2.1%	93.8%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
EP-marine	kg N eq	2.3%	-2.1%	-2.5%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
EP-terrestrial	mol N eq	-0.8%	-2.1%	-2.0%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
POCP	kg NMVOC eq	1.6%	-2.1%	-0.2%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
ADPe	kg Sb eq	-6.9%	-2.1%	-9.1%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
ADPf	MJ	-1.9%	-2.1%	-1.6%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%
WDP	m ³ eq	-2.4%	-2.1%	-2.0%	0.00E+00	0.00E+00	-2.1%	0.00E+00	-2.1%

Environmental Performance

Variation of Environmental impacts between 1 m² of average product and Portugal site product

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4
GWP-GHG	kg CO ₂ eq	10.6%	6.6%	39.3%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
GWP-total	kg CO ₂ eq	10.6%	6.6%	41.8%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
GWP-fossil	kg CO ₂ eq	10.6%	6.6%	14.3%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
GWP-biogenic	kg CO ₂ eq	24.5%	6.6%	451.5%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
GWP-luluc	kg CO ₂ eq	157.3%	6.6%	132.5%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
ODP	kg CFC-11 eq	25.0%	6.6%	30.1%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
AP	mol H+ eq	0.2%	6.6%	5.4%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
EP-freshwater	kg P eq	-29.5%	6.6%	-23.0%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
EP-marine	kg N eq	4.8%	6.6%	27.6%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
EP-terrestrial	mol N eq	5.8%	6.6%	14.8%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
POCP	kg NMVOC eq	10.8%	6.6%	22.2%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
ADPe	kg Sb eq	55.6%	6.6%	63.0%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
ADPf	MJ	7.9%	6.6%	10.3%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%
WDP	m ³ eq	11.0%	6.6%	12.8%	0.00E+00	0.00E+00	6.6%	0.00E+00	6.6%

Variation of Environmental impacts between 1 m² of average product and Slovenia site product

IMPACT CATEGORY	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4
GWP-GHG	kg CO ₂ eq	-1.7%	3.3%	-6.0%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
GWP-total	kg CO ₂ eq	-1.6%	3.3%	-6.5%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
GWP-fossil	kg CO ₂ eq	-1.6%	3.3%	-1.5%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
GWP-biogenic	kg CO ₂ eq	-0.7%	3.3%	-80.8%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
GWP-luluc	kg CO ₂ eq	-38.3%	3.3%	-31.0%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
ODP	kg CFC-11 eq	-9.3%	3.3%	-9.4%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
AP	mol H+ eq	-7.9%	3.3%	-7.9%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
EP-freshwater	kg P eq	-10.4%	3.3%	-10.2%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
EP-marine	kg N eq	-9.2%	3.3%	-9.9%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
EP-terrestrial	mol N eq	-9.0%	3.3%	-9.4%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
POCP	kg NMVOC eq	-7.8%	3.3%	-8.8%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
ADPe	kg Sb eq	2.5%	3.3%	-1.0%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
ADPf	MJ	-2.2%	3.3%	-1.8%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%
WDP	m ³ eq	-3.4%	3.3%	-2.9%	0.00E+00	0.00E+00	3.3%	0.00E+00	3.3%

Variation of Environmental impacts among 1 m² of average product and rest of products

This study evaluates 1 m² of FIBRANxps insulation products with thermal conductivity values ranging from 0.032 to 0.040 W/m-K and density ranging from 27 to 40 kg/m³. To ensure comparability, all products were normalized to the declared unit defined by EN 16783: 1 m² providing a thermal resistance of R = 1 m²·K/W. For each product, the required thickness was calculated using the relation

$$R = \text{thickness} / \lambda$$

and the corresponding mass was derived from the nominal density and calculated thickness.

Products were grouped by thermal conductivity classes and density bands to assess variability in GWP-GHG results. This grouping approach captures the primary drivers of environmental impact—material mass and thermal performance—while ensuring compliance with PCR 2019:14 requirements for representativeness and variability reporting.

The observed differences in GWP-GHG are mainly attributable to variations in product weight, which result from the combined effect of density and thermal conductivity adjustments to achieve R = 1. The following table summarizes the variation in key environmental impact categories for the analyzed products, expressed relative to the average result within modules A1–A3, in accordance with the reference standard.

IMPACT CATEGORY	Maestro	ETICS GF	SEISMIC GF	ETICS BT	FABRIC	300	400	500	700
GWP-GHG	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
GWP-total	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
GWP-fossil	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
GWP-biogenic	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
GWP-luluc	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
ODP	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
AP	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
EP-freshwater	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
EP-marine	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
EP-terrestrial	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
POCP	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
ADPe	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
ADPf	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%
WDP	-1.53%	-1.53%	0.61%	-1.53%	-2.14%	-1.53%	10.68%	10.68%	26.73%

Abbreviations

Abbreviation	Description
LCA	Life Cycle assessment
EPD	Environmental Product Declaration
PCR	Product category rules
GLO	Global
RER	Europe
RoW	Rest of the world
GWP	Global Warming Potential
ODP	Ozone Depletion Potential
AP	Acidification Potential
EP	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADPe	Abiotic depletion potential for non-fossil resources
ADPf	Abiotic depletion potential for fossil resources
WDP	Water use
PERE	Use of renewable primary energy excluding 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 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
HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EE	Exported Energy
PM	Particulate Matter
IRP	Ionizing radiation, human health
ETP-FW	Eco-toxicity (freshwater)
HTP-c	Human toxicity, cancer effects
HTP-nc	Human toxicity, non-cancer effects
SQP	Soil quality

References

- **ISO 14040:2006** “Environmental management — Life cycle assessment — Principles and framework”;
- **ISO 14044:2006** “Environmental management — Life cycle assessment — Requirements and guidelines”;
- **General Programme Instructions (GPI) of The International EPD® System** (v.5.0.1, 2024-06-19).
- **EN 15804:2012+A2:2019** “Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products”;
- **EN 16783:2024** “Thermal insulation products - Environmental Product Declarations (EPD) - Product Category Rules (PCR) complementary to EN 15804 for factory made and in-situ formed products”;
- **PCR 2019:14** “Construction products”, v 2.0.1 (2025-06-05)
- **C-PCR-005 (TO PCR 2019:14)** “THERMAL INSULATION PRODUCTS (EN 17328:2024)”, v 1.0.0 (2025-04-08)
- **Ecoinvent / Ecoinvent Centre**, www.ecoinvent.org

Version History

Original Version of the EPD, 2020-12-14

Version 002, Editorial correction (spelling/typographical error), 2021-06-22