ENVIRONMENTAL PRODUCT DECLARATION

In Accordance with ISO14025 and 15804:2012+A2:2019 for

fibranXPS

Programme	The International EPD® System, www.environdec.com
Programme operator	EPD International AB
EPD registration number	S-P-02372
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fibran

EPD®

THE INTERNATIONAL EPD® SYSTEM

PROGRAMME RELATED 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 Based on Product Category Rules (PCR)	The CEN standard EN 15804 serves as the core Product Category Rules (PCR) PCR 2019:14 Construction products (EN 15804:A2); Version 1.1; 2020-09-14 C-PCR-005 "Thermal insulation products (EN 16783:2017)
PCR review was conducted by	The Technical Committee of the International EPD® System.
Independent third-party verification of the declaration and data, according to ISO 14025:2006	☐ EPD process certification ☒ EPD verification
Third party verifier:	Vladimir Koci Approved by: The International EPD® System
EPD Prepared by	ENVIROMETRICS Ltd Envirometrics.gr
Procedure for follow-up 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

FIBRAN S.A. was founded in Greece, Thessaloniki, in 1974. Ever since, FIBRAN S.A. has been designing and manufacturing products and solutions for the thermal insulation, acoustic insulation and fire protection in building, industrial and marine applications. Since 1995, it plays a leading role as a producer of insulation materials both in Greece and in Europe.

Today, FIBRAN has 6 production units, utilizing the latest technology for the manufacture of insulation products (Extruded Polysterene, Stone wool and Expanded Polysterene), as well as Gypsum Boards.

In Greece, in the industrial plant located in Terpni, Serres, FIBRAN produces stonewool insulation products with the brand name FIBRANgeo and extruded polysterene products with the brand name FIBRANxps. Other extruded polysterene production units are located in Ovar, Aveiro, Portugal, in Rousse, Bulgaria and in Sodrazica, Slovenia. In Italy, FIBRAN has invested in the production of gypsum products (gypsum boards and bagged products), as well as in the distribution of insulation, waterproofing and dry construction materials. Finally, in North Macedonia, FIBRAN produces expanded polysterene.

Purpose of FIBRANproducts and solutions is to bring energy efficiency in building, industrial and marine applications.

PRODUCT DESCRIPTION

FIBRANxps is the commercial name of extruded polystyrene as produced and supplied by FIBRAN. It is a thermal insulating material made of polystyrene and blowing agents. Most of the FIBRANxps mass consists of transparent, general purpose and high heat-resistant polystyrene, and for the achievement of foaming, inflating gases are added at 5-8% of the total mass. The product is used in building applications, such as roofs, floors and walls, as well as in industrial applications and underground applications like: perimeter basement walls, swimming pools, foundation slabs, bridges, roads and railways.

A typical material composition along with technical specification of the product are presented below:

Material	Composition (%)
Polystyrene	>86
Blowing agents	<10
Additives	<4

Technical Specifications	
Density (kg/m^3)	29-37
Thermal conductivity, W/mK	0.032-0.040
Reaction to fire (BS EN 13501-1:2002)	E

No substances included in the Candidate List of Substances of Very High Concern for authorization under the REACH Regulations are present in the FIBRANs products, either above the threshold for registration with the European Chemicals Agency or above 0.1% (wt/wt).

This EPD covers the products listed in the table below:

Products	
Maestro	300
FABRIC	400
ETICS GF	500
ETICS BT	700

The total recycling content is between 20 to 30% for all 4 factories in Greece, Bulgaria, Slovenia and Portugal.

MULTIPLE MANUFACTURING SITES

To develop this EPD, the data from 4 manufacturing plants of FIBRAN in different countries in Europe have been taken into account.

Country	Carbon Footprint of Electricity Residual mix (g CO2eq/kwh)
Greece	601,4
Bulgaria	437,4
Slovenia	364,1
Portugal	256,0

The variation of each manufacturing site from the average EPD result is lower than ±10 % for stages A1-A3 in regard to the GWP-GHG indicator. Consequently, the results presented in this EPD concern the average production.

ENVIRONMENTAL PERFORMANCE RELATED INFORMATION

Declared unit	The declared unit is 1 m^2 of FIBRANxps with λ=0.032-0.040 W/mK. The density is 30 kg/m^3 and the thickness 30 mm.
Reference service life (RSL)	At least 50 years (as long as the lifetime of the building in which it is installed)
Product group classification	UN CPC 369 ''Other plastics products''
Goal and Scope	This EPD evaluates the environmental impacts of the production of 1 m^2 of FIBRANxps with λ=0.032-0.04 W/mK from Cradle to grave and module D.
System Boundary	Cradle to grave and module D (A + B + C+ D)
Cut-Off Rules	For this LCA study, 1% cut off rule applies.
Background Data	The most recent version of Ecoinvent database (V3.7) was used as a source of background data.
Data Quality	Data on raw materials, transportation, energy, waste and water is collected by FIBRAN S.A.
Time representiveness	All primary data used in this study is for the entire year 2019.
Geographical Scope	Worldwide
Allocations	There are no co-products in the production of FIBRANxps manufactured by FIBRAN. Hence, there was no need for co-product allocation.
LCA software	openLCA v. 1.10.3

SYSTEM BOUNDARIES

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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Description of the system boundary (X = Included in the study, MNA = Module Not Assessed)

PRODUCT STAGE

Product stage include raw material supply, transportation and manufacturing.

A1: Raw Material Supply

Production starts with raw materials supply. This stage includes raw material extraction and processing along with processing of secondary materials. The raw materials are mainly polystyrene, blowing agents and additives. Also, in this stage included the production of the packaging materials (polyethylene film and paper).

A2: Transportation

Some of the raw materials are locally sourced while others are transported from different countries all over the world with lorry 16-32 tonnes and containers for sea transportation.

A3: Manufacturing

Manufacturing processes include all the production activities within the plant with all the associated impacts. These include:

1. Extrusion
2. Cutting, edge & facing addition
3. Packaging
4. Storing

CONSTRUCTION STAGE

Construction stage includes transportation from the factory to the final user and installation in the building.

A4: Transportation

The transportation concerns either to reseller close to the final user either the final user. For this stage an average distance of 500 km delivered by lorry 16-32 tonnes was assumed.

A5: Installation

FIBRANxps is installed in the building manually. No ancillary material, water or other resource used in this stage. However, Waste materials on the building site before waste processing, generated by the product's installation, should be included. It is assumed that 5% waste of the material generated from the product installation which is transported to landfill by lorry 16-32 tonnes over a distance of 50 km.

USE-STAGE

The use stage is divided into the following modules:

- **B1: Use**
- **B2: Maintenance**
- **B3: Repair**
- **B4: Replacement**
- **B5: Refurbishment**
- **B6: Operational energy use**
- **B7: Operational water use**

FIBRANxps does not require maintenance, repair, replacement or refurbishment during use in standard conditions and if correctly applied. Also, after installation

FIBRANxps does not use energy or water during use of the building. As a result, the environmental impacts for use stage is zero.

Note that in this stage, potential energy savings are excluded

END OF LIFE STAGE

The end-of-life stages begins with the deconstruction and demolition of entire building in which FIBRANxps is installed and then they are transferred for recycling and disposal. Though it is possible the 100% recycling of polystyrene, this does not happen because of not developing the appropriate separation process of the different materials yet.

C1: De-construction, demolition

The environmental impact is assumed to be very small and can be neglected since the de-construction and/or dismantling of insulation products take part of the demolition of the entire building.

C2: Transport to waste processing

The product is assumed to be 100% landfilled as it is. Hence, a distance of 50 km by lorry 16-32 tonnes from construction/demolition sites to disposal sites has been chosen as a conservative assumption.

C3: Waste processing for reuse, recovery and/or recycling

The environmental impacts are zero since the product is considered to be landfill without reuse, recovery or recycling.

C4: Disposal

The product is assumed to be 100% landfilled.

BENEFITS AND LOADS BEYOND THE PRODUCT SYSTEM BOUNDARY IN INFORMATION MODULE D

Module D consists of avoided burdens related to the potential reuse and/or recycling of the product after its end-of-life stage. Since the product is only disposed, there are no benefits deriving from the reuse or recycling of the product after its end-of-life stage, and neither any energy recovery from incinerating the packaging materials.

ENVIRONMENTAL PERFORMANCE INDICATORS

The environmental performance indicators are shown in the following tables for the declared unit of 1m^2 at 30 mm thickness (0.030 m^3). For stages A1-A3 the results are aggregated.

ENVIRONMENTAL IMPACTS PER 1 m^2 of FIBRANxps

ENVIRONMENTAL IMPACTS	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	3,86E+00	7,61E-02	3,48E-02	0,00E+00	0,00E+00	7,41E-03	0,00E+00	4,95E-01	0,00E+00
GWP-fossil	kg CO2 eq	3,85E+00	7,61E-02	3,48E-02	0,00E+00	0,00E+00	7,40E-03	0,00E+00	4,95E-01	0,00E+00
GWP-biogenic	kg CO2 eq	1,29E-02	2,57E-05	6,78E-06	0,00E+00	0,00E+00	2,50E-06	0,00E+00	4,19E-06	0,00E+00
GWP-luluc	kg CO2 eq	8,79E-04	2,58E-05	4,69E-06	0,00E+00	0,00E+00	2,51E-06	0,00E+00	3,12E-06	0,00E+00
GWP-GHG[1]	kg CO2 eq	3,85E+00	7,61E-02	3,48E-02	0,00E+00	0,00E+00	7,40E-03	0,00E+00	4,95E-01	0,00E+00
ODP	kg CFC-11 eq	7,15E-08	1,74E-08	1,63E-09	0,00E+00	0,00E+00	1,69E-09	0,00E+00	2,57E-09	0,00E+00
AP	mol H+ eq	1,54E-02	3,81E-04	5,06E-05	0,00E+00	0,00E+00	3,71E-05	0,00E+00	2,36E-04	0,00E+00
EP-freshwater	kg $PO4^{-3}$ eq	1,48E-03	1,58E-05	3,16E-06	0,00E+00	0,00E+00	1,54E-06	0,00E+00	2,38E-06	0,00E+00
EP-freshwater[2]	kg P eq	4,84E-04	5,15E-06	1,03E-06	0,00E+00	0,00E+00	5,02E-07	0,00E+00	7,77E-07	0,00E+00
EP-marine	kg N eq	2,63E-03	1,33E-04	4,57E-05	0,00E+00	0,00E+00	1,30E-05	0,00E+00	6,28E-04	0,00E+00
EP-terrestrial	mol N eq	2,74E-02	1,45E-03	1,95E-04	0,00E+00	0,00E+00	1,41E-04	0,00E+00	1,12E-03	0,00E+00
POCP	kg NMVOC eq	1,05E-02	4,14E-04	6,81E-05	0,00E+00	0,00E+00	4,03E-05	0,00E+00	5,40E-04	0,00E+00
ADPe	kg Sb eq	1,00E-05	2,12E-06	2,33E-07	0,00E+00	0,00E+00	2,06E-07	0,00E+00	2,33E-07	0,00E+00
ADPf	MJ	8,39E+01	1,16E+00	1,37E-01	0,00E+00	0,00E+00	1,13E-01	0,00E+00	1,75E-01	0,00E+00
WDP	m^3 eq	2,18E+00	5,16E-03	1,65E-03	0,00E+00	0,00E+00	1,78E+00	0,00E+00	3,89E-01	0,00E+00

[1] This 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]Eutrophication aquatic freshwater shall be given in both kg PO4 eq and kg P eq.

RESOURCE USE PER 1 m^2 of FIBRANxps

RESOURCE USE	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
PERE	MJ	1,14E+00	1,34E-02	3,45E-03	0,00E+00	0,00E+00	6,71E-01	0,00E+00	2,81E-01	0,00E+00
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
PERT	MJ	1,14E+00	1,34E-02	3,45E-03	0,00E+00	0,00E+00	6,71E-01	0,00E+00	2,81E-01	0,00E+00
PENRE	MJ	7,02E+01	1,03E+00	1,43E-01	0,00E+00	0,00E+00	4,14E+01	0,00E+00	1,68E+01	0,00E+00
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
PENRT	MJ	7,02E+01	1,03E+00	1,43E-01	0,00E+00	0,00E+00	4,14E+01	0,00E+00	1,68E+01	0,00E+00
SM	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
RSF	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
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
FW	m^3	2,18E+00	5,16E-03	1,65E-03	0,00E+00	0,00E+00	1,78E+00	0,00E+00	3,89E-01	0,00E+00

OUTPUT FLOWS AND WASTE CATEGORIES PER 1 m^2 of FIBRANxps

OUTPUT FLOWS AND WASTE CATEGORIES	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
HWD	kg	1,13E-05	3,02E-06	2,93E-07	0,00E+00	0,00E+00	9,78E-06	0,00E+00	4,81E-06	0,00E+00
NHWD	kg	1,17E-01	5,56E-02	6,60E-03	0,00E+00	0,00E+00	9,13E-02	0,00E+00	7,04E-02	0,00E+00
RWD	kg	7,06E-05	7,94E-06	7,74E-07	0,00E+00	0,00E+00	6,29E-05	0,00E+00	1,61E-05	0,00E+00
CRU	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
MFR	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
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
EE	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

ADDITIONAL ENVIRONMENTAL IMPACTS PER 1 m^2 of FIBRANxps

ADDITIONAL	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
PM	Disease incidence	1,19E-07	5,44E-09	1,22E-09	0,00E+00	0,00E+00	9,69E-08	0,00E+00	2,62E-08	0,00E+00
IR	kBq U235 eq	2,34E-01	6,06E-03	7,19E-04	0,00E+00	0,00E+00	2,17E-01	0,00E+00	3,08E-02	0,00E+00
EF	CTUe	1,57E+00	2,04E-01	1,49E-01	0,00E+00	0,00E+00	1,24E+00	0,00E+00	4,82E-01	0,00E+00
HT-c	CTUh	3,08E-08	1,55E-09	9,57E-10	0,00E+00	0,00E+00	2,44E-08	0,00E+00	7,50E-09	0,00E+00
HT-nc	CTUh	8,00E-08	1,11E-08	4,57E-09	0,00E+00	0,00E+00	6,44E-08	0,00E+00	2,74E-08	0,00E+00
LU	Dimensionless	7,50E+00	1,17E+00	1,61E-01	0,00E+00	0,00E+00	8,95E+00	0,00E+00	1,74E+00	0,00E+00

RESULTS INTERPRETATION

Concerning the contribution of the different stages, as can be seen in *Σφάλμα! Το αρχείο προέλευσης της αναφοράς δεν βρέθηκε.*, the life cycle environmental impacts of FIBRANxps are mainly dominated by **Product Stage** (A1-A3) following by **transportation of product** (A4) and **disposal** (C4). Installation stage (A5) and transportation to waste processing site (C2) are negligible.

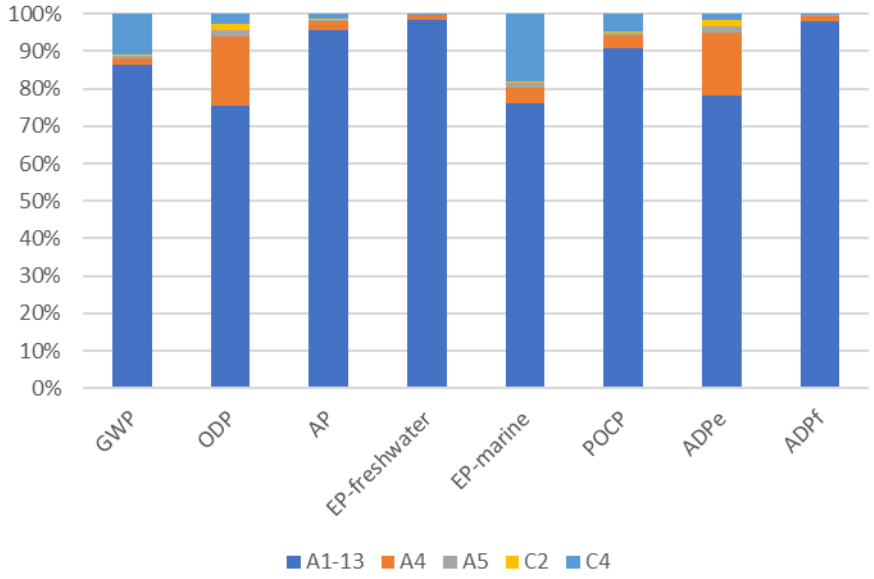

Figure 1 Contribution of each stage in various environmental impacts

Regarding to the Global warming potential (GWP-GHG) of the **production phase (A1-A3)**, each plant has various contributions for the different stages. However, it is common for all plants that the most important contribution comes from the polystyrene production, 80-85%, followed by electricity production, 5-14%. The transportation of raw materials is up to 3,5% while the rest is mainly due to the production of the blowing agents and production of packaging materials.

IMPACTS FOR DIFFERENT THICKNESS AND DENSITY

This EPD covers FIBRANxps products in the range of density between 29 and 37 kg/m^3 and the range of thicknesses between 20 mm and 200 mm. The impacts listed in the tables above concern the product with λ in the range of 0,032-0,040 W/mK, thickness 30 mm and density 30 kg/m^3. To determine the impacts for products with different density and thickness, a conversion factor (A) shall be multiplied with each impact category value. The conversion factor (A) is calculated by:

$$A = \frac{\rho \cdot S}{0.9}$$

Where:

- **ρ** = density of the product [kg/m^3]
- **S** = product thickness [m]

REFERENCES

General Programme Instructions of the International EPD® System. *Version 3.01, 2019-09-18*

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ISO 14025:2006 *Environmental labels and declarations - Type III environmental declarations — Principles and procedures*

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ISO 14040:2006 *Environmental management - Life cycle assessment- Principles and framework*

ISO 14044:2006 *Environmental management - Life cycle assessment - Requirements and guidelines*

Ecoinvent, *www.Eco-invent.org*

Residual Energy Mix 2019 *from Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)*

European Residual Mixes 2019 *from Association of Issuing Bodies*

LIST OF ABBREVIATIONS

GWP-total	Global Warming Potential total
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Ozone Depletion Potential
AP	Acidification Potential
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 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