



# ENVIRONMENTAL PRODUCT DECLARATION OF DANOPREN® EXTRUDED POLYSTYRENE (XPS) INSULATION BOARD



**EPD® Registration number:** S-P-00501

**Ecoplatform Registration number:** 00000467

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**Version:** 2

**Scope of the EPD®:** International

**UN CPC code** 369

**In accordance with EN ISO 14025:2010 and EN 15084**

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# ENVIRONMENTAL PRODUCT DECLARATION OF DANOPREN<sup>®</sup> XPS INSULATION BOARD

## 1. PROGRAMME RELATED INFORMATION

Name of the programme and programme operator	The international EPD <sup>®</sup> System, operated by EPD <sup>®</sup> International AB
Reference PCR	PCR based on ISO 14025:2010 2012:01 Construction products and construction services v 2.3 Sub-PCR-I-Thermal insulation products
EPD <sup>®</sup> registration number	S-P-00501
Ecoplatform registration number	00000467
Date of publication	The 15 <sup>th</sup> of November, 2016
Revision date	The 21 <sup>th</sup> of May, 2019
EPD <sup>®</sup> version	2
Validity	5 years (the 20 <sup>th</sup> of May, 2024)
Geographical scope of the EPD <sup>®</sup>	International
Further information on the next reference website	<a href="http://www.environdec.com">www.environdec.com</a>

## 2. PRODUCT RELATED INFORMATION

### 2.1. INFORMATION ABOUT MANUFACTURING COMPANY

- **Company related information**

Company responsible of the EPD <sup>®</sup> publication	DANOSA ESPAÑA Polígono Industrial Sector 9 19290 FONTANAR (Guadalajara) SPAIN
Contact	Carlos Castro 34 949 888 210 <a href="mailto:info@danosa.com">info@danosa.com</a> , <a href="http://www.danosa.com">www.danosa.com</a>
Company responsible of the technical support for the generation of the LCA calculations	Marcel Gómez Consultoría Ambiental <a href="http://www.marcelgomez.com">www.marcelgomez.com</a> Email: <a href="mailto:info@marcelgomez.com">info@marcelgomez.com</a>

- **Information about Environmental Management Systems**

As part of our commitment to manufacturing products to the highest quality standards, DANOSA has implemented and certificated ISO 9.001 Quality Management Systems since 2012 (registration number: ES044036-1) and ISO 14.001 Environmental Management Systems certification (registration number: ES069274-1).

- **Environmental commitment of the company**

DANOSA considers that personal and business honesty is a core value of its internal relations with its suppliers, its customers and the environment. DANOSA is committed to complying with the laws, rules and regulations that concern both the quality and the environment and other internal commitments made by the company itself.

DANOSA manufactures its products always respecting the declared specifications and minimizing the environmental impacts associated with their activities. Where possible, this includes reducing the amount of waste sent to sewage.

DANOSA especially considers suppliers and subcontractors in order to achieve its objectives of Quality and Environment, encouraging them to develop the best environmental practices creating a relationship of mutual collaboration.

- **Company logotype**



## 2.2. PRODUCT SPECIFICATIONS

### • Product specifications

Rigid boards of extruded polystyrene (XPS), in accordance with UNE EN 13164 standard, with different treatments for perimeter joints (shiplap, tongue & groove, butt edge). The product is manufactured in a wide range of sizes and thickness, being used mainly for thermal insulation in building. DANOPREN® is manufactured at Danosa's manufacturing plants in Fontanar (Spain) and Leiria (Portugal).

This EPD® is representative for all DANOPREN® product ranges, including:

- Inverted roof: Danopren® TR 30 mm-100 mm
- Pitched roof: Danopren® TL 30 mm-100 mm y Danopren® CH 30-100 mm
- Cavity walls: Danopren® PR 30 mm-100 mm
- Exterior facade (ETICS systems): Danopren® FS 30 mm-100 mm

DANOPREN® product ranges present the following technical specifications:

PARAMETER	VALUE
Composition	Polystyrene: 70%-99% (48,7% recycled) Nucleating: 1%-20% Pigments: 1%-20% Flame retardant: 1%-20% CO <sub>2</sub> : 1%-20%
Thickness	30-100 mm
Width	600 mm
Length	1.250 mm
Density	32,41 Kg/m <sup>3</sup>
Thermal Resistance (R) according to the chosen Functional Unit	1,00 K.m <sup>2</sup> .W <sup>-1</sup> (UNE-EN 12667)

<b>Thermal conductivity</b>	0,034 W/(m·K) (UNE-EN 12667)
<b>Compressive strength</b>	≥300 Kpa (UNE-EN 826)
<b>Fire resistance</b>	Euroclass E (UNE-EN 13501-1)
<b>Acoustic properties</b>	Not recognised
<b>Water vapour transmission</b>	μ=200 (UNE-EN 12086)
<b>Packaging</b>	PE film (1,86 E-02 Kg/m <sup>2</sup> ) and Extruded polystyrene (1,90 E-03 Kg/m <sup>2</sup> )
<b>Products used during installation phase</b>	None
<b>Reference Service Life of the product</b>	50 years

**Table 1** DANOPREN® technical specifications

During the life cycle of the product, no hazardous substance listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization<sup>1</sup>” is present in a percentage greater than 0.1% of the weight of the product.

The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

- **Data quality and allocation**

It has been taken specific data regarding the quantities of materials and energy used during the DANOPREN® product life cycle. These data have been supplied by DANOSA, referring to year 2017, and come from production data.

In order to achieve a proper transportation modelling, it have been used weighted averages according to sales percentage of trading destinations.

The results presented in this EPD® are valid until there are differences that affect the environmental impact of the product. An augmentation of more than 10% of the environmental impact of the life cycle of the product is considered a significant difference. Generic data on the impact per unit of matter or energy is considered. This data was obtained from the internationally

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<sup>1</sup> [http://echa.europa.eu/chem\\_data/authorisation\\_process/candidate\\_list\\_table\\_en.asp](http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp)

recognized database of Life Cycle Assessment Ecoinvent, in its version 3.2. This database has been selected as the reference database because it fulfills the following aspects:

- Geographical representativeness: data comes from areas with the same legislative frame and electricity mix.
- Technological equivalence: data comes from the same physical and chemical processes, or at least the same technological coverage.
- Environmental boundaries: data includes all the quantitative information needed for the EPD®.
- Technological system boundaries: the same life cycle stages are taken into account.

With reference to the electricity mix used for electricity consumption in the manufacturing plants, the electricity mix production in Spain in 2016 and Portugal in 2012 have been introduced (explained in more depth at point 2.5).

### **2.3. FUNCTIONAL UNIT**

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Raw materials extraction, transport, manufacturing, transport to the customer, installation, use and end of life of one m<sup>2</sup> of extruded polystyrene (XPS) insulation board DANOPREN®, with a thermal resistance of 1.00 K.m<sup>2</sup>.W<sup>-1</sup>. Panel thickness: 3,4 cm.

### **2.4. METHODOLOGY AND HYPOTHESIS**

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A Life Cycle Assessment of DANOPREN® extruded polystyrene (XPS) insulation panel has been done, including all life cycle stages (from cradle to grave). This EPD® has been performed following the guidelines of PCR 2012:01 Construction products and construction services v. 2.3 and the Sub-PCR-I Thermal insulation products. It has been used the CML IA 3.05 impact method, as well as EDIP 2003 for the calculation of waste production. The pollutant payer principle has been used. Where necessary, an allocation based in mass has been done.

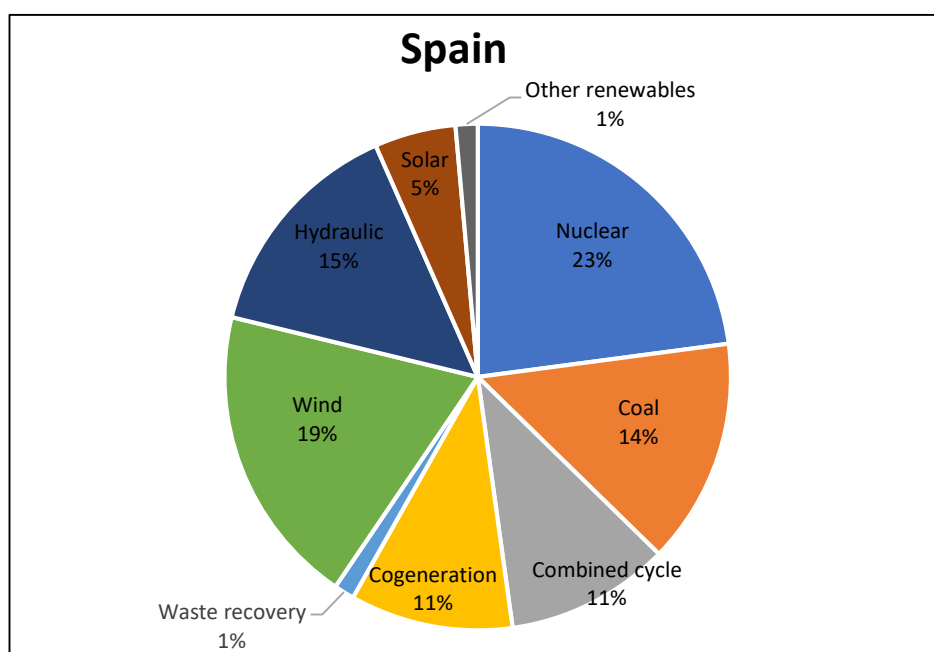
Primary data has been used to determine the quantity of raw materials, energy and transport consumption, as well as waste production and emissions to air, water and soil (any emissions). These data correspond to year 2017.

With reference to the electricity mix, electricity production mix of Spain in 2016 (source Red Eléctrica de España<sup>2</sup>, see figure 6) and Portugal in 2012 (source: Ecoinvent 3.2 database) have been considered in this LCA study.

In order to assess the emissions by Kg of material, KWH of energy or Tnkm transported, the internationally recognized Ecoinvent v. 3.2 database has been used.

Transport distance of waste between the factory and the waste manager, and from the building site to the waste manager: 50 km.

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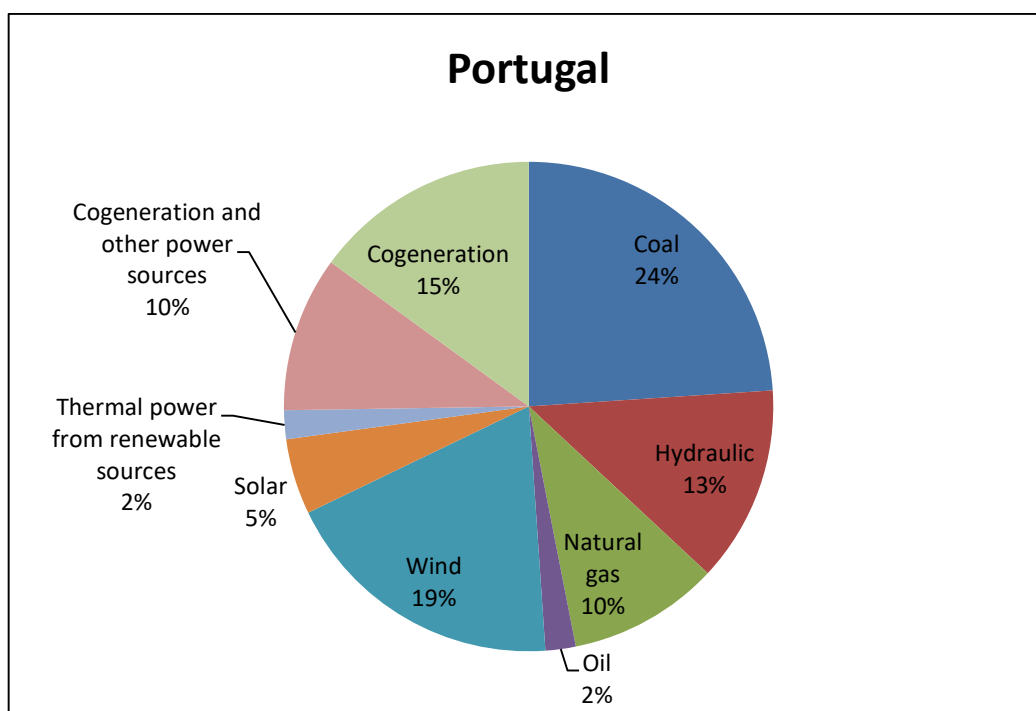


**Figure 1** Electricity mix production of Spain (2016)

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<sup>2</sup> El Sistema Eléctrico español 2016





**Figure 2** Electricity mix production of Portugal (2012)

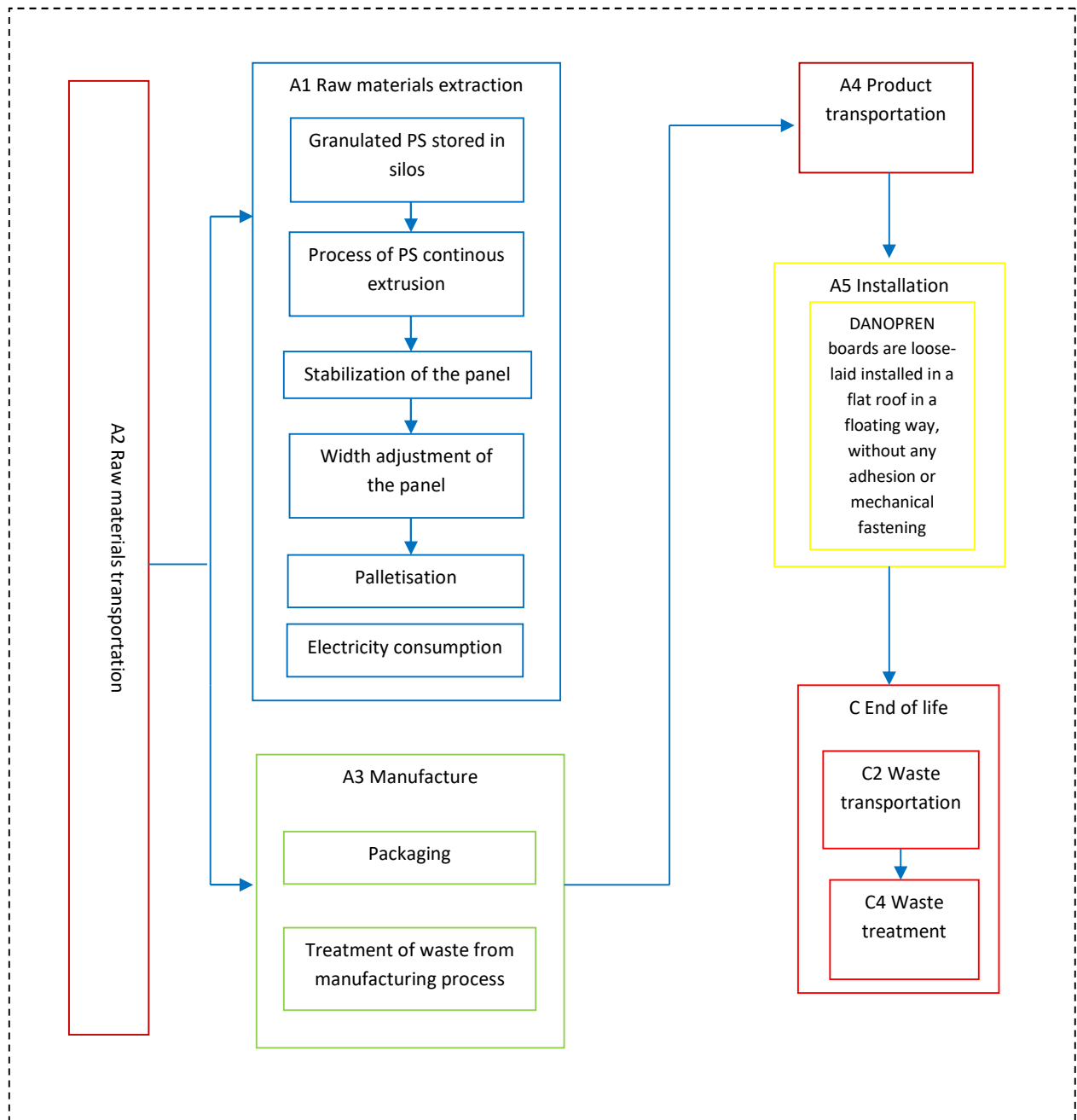
## 2.5. DESCRIPTION OF THE PROCESSES AND SYSTEM BOUNDARIES

Product stage			Construction stage		Use stage							End of life stage				Benefits and loads beyond system boundaries
A1 Raw materials	A2 Transport	A3 Production	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replace	B5 Refurbishment	B6 Energy use	B7 Water use	C1 Demolition	C2 Transport	C3 Waste treatment	C4 Disposal	D Reuse, recycling and recovery
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

**Table 2** Description of the product stages on LCA study (X=included, MND=Module Not Declared)

This EPD® has its life cycle stages structured following the established guidelines of reference standards PCR: 2012:01 Construction products and construction services v. 2.3 and the Sub-PCR-I Thermal insulation products, both based on UNE-EN 15804 regulation.

## SYSTEM BOUNDARIES



**Figure 3** System boundaries and description of the significant processes

### 2.5.1. Product stage A1-A3

Product stage is structured by the following modules: Raw material extraction and processing (A1), Raw materials transportation to manufacturing plant (A2) and Manufacturing (A3). As allowed by UNE-EN 15804 regulation, the results of A1-A3 modules have been grouped in a single product stage (A1-A3).

#### A1-RAW MATERIALS EXTRACTION AND PROCESSING

This module takes into account the extraction and processing of raw materials, as well as the required energy consumption for these processes before product manufacturing.

#### A2-RAW MATERIALS TRANSPORTATION

This module includes the transport of raw materials from the manufacturer to DANOSA's manufacturing plant. The real distance and type of truck for every raw material has been introduced.

#### A3-MANUFACTURE

In this module is included the energy consumption, additives and packaging used during the manufacturing process. At the same time, emissions in the facility which have not originated during the fuels combustion are assessed (no emissions from fuels occur), as well as the transport and management of waste produced in the factory.

Extruded polystyrene (XPS) is produced through a continuous extrusion processing with electricity as the energy source. In this process, first raw polystyrene is melted in an extruder machine, together with additives (flame retardant, pigments, etc.), and subsequently other additives as expansion or foaming agents. The fall of the pressure in the entry of the extruder makes the gel expands, producing a foam or homogenous cellular structure base in polystyrene. This results in a continuous panel, with homogeneous closed-cellular structure. Then in the manufacturing plant the panel is divided in measured dimensions, with the necessary lengths depending of the type of product and intended use. The sides of the panels are profiled to half wood or dovetail. Then, the foaming skin from the extrusion process can be maintained, resulting in a smooth surface, or can be mechanically brushed, resulting in a rough surface and suitable to adhere the panel with common products as, for example, cement glues, ETICS mortars, gypsum plaster, etc.

Finally, XPS panels which are not in agreement with the specifications, together with the materials rejected from cutting and mechanical treatments are recycled, being reincorporated to the manufacturing process (10%-12% of the polystyrene used in the product).

### 2.5.2. Construction stage A4-A5

Construction stage is structured by the modules A4 Transportation of the product and A5 Installation.

#### A4-TRANSPORTATION OF THE PRODUCT

Module A4 Transportation of the product includes the transport of the finished product from DANOSA's manufacturing plant to customer site. Then, are described the main parameters of the module.

TYPE	PARAMETER	VALUE/DESCRIPTION
Truck	Type and fuel consumption of the vehicle, types of vehicles used during the transport	Lorry > 32 tn. Diesel consumption of 31,1 L/100 Km
	Distance	250 Km
	Capacity use (including empty returns)	% assumed in Ecoinvent
	Density of the transported products	32,41 Kg/m <sup>3</sup> (packaging not included)

**Table 3** Transport specifications for DANOPREN® product.

#### A5-INSTALLATION

Module A5 Installation includes all materials and energy consumption needed for installation process. Furthermore, it takes into account the transportation and further treatment of the waste arise from this phase.

In this case, no matter and energy consumption are required in the most common installation scenario (flat roof). Nevertheless, it must be noted that for the installation on other wall types is necessary the use of ancillary materials.

PARAMETER	VALUE/DESCRIPTION
Ancillary materials for installation	None
Water consumption	None
Use of other resources	None
Quantitative description of the regional mix and energy consumption during installation	None
Material waste in the construction site, before the waste processing, generated during the installation of the product (specified by type)	Product losses: 5% Polyethylene film: 18,6 g/m <sup>2</sup> EPS: 1,9 g/m <sup>2</sup>
Materials outflow (specified by type) resultant from the waste processing in the construction site, for example, during the recycling, energy recovering (valorization) or spill (specifying the route)	Packaging and losses waste are 100% collected and recycled.  Following the pollutant payer principle, it has only been taken into account the waste transportation and not its further treatment, since these materials can be potentially recycled.

**Table 4** Specifications for module A5 Installation

### 2.5.3. Use stage B1-B7

#### B1-USE

It includes aspects and environmental impacts during the product use, with the exception of water and energy consumption. In this case, the impact of the product is 0 since any material is consumed, as well as neither emission to the environment occurs during its use phase.

#### B2-MAINTENANCE

The product does not require any type of maintenance during the 50 years of reference service life of the building.

#### B3-REPAIR

The product does not require any type of repair during the 50 years of reference service life of the building.

#### B4-REPLACEMENT

The product does not require any type of replacement during the 50 years of reference service life of the building.

#### B5-REFURBISHMENT

The product does not require any type of refurbishment during the 50 years of reference service life of the building.

#### B6-OPERATIONAL ENERGY USE

The product does not consume any type of energy during the 50 years of reference service life of the building.

#### B7-OPERATIONAL WATER USE

The product does not consume water during the 50 years of reference service life of the building.

#### 2.5.4. End of life stage C1-C4

This stage includes the transport and management of waste produced once the RSL is finished. The end of life stage is composed by the modules C1 Deconstruction, C2 Transport to the waste manager, C3 Waste treatment and C4 Waste disposal.

Following the most common scenario in Spain with regard to treatment of construction waste, it has been established that the entire waste arise from building demolition are conveyed to an authorized landfill. On the other hand, it has been considered that the environmental impacts related to building demolition are negligible in comparison with other impacts occurred during its life cycle.

PARAMETER	VALUE/DESCRIPTION
PRODUCT RANGE	DANOPREN®
COLLECTION PROCESS SPECIFIED BY TYPE	1,10 Kg (mixed with the other waste of construction)
RECOVERY SYSTEM SPECIFIED BY TYPE	No reuse, recycling or energy recovery
DISPOSAL SPECIFIED BY TYPE	1,10 Kg disposed on authorized landfill
ASSUMPTIONS FOR SCENARIO DEVELOPMENT (I. E. TRANSPORT)	16-32 Tn truck with a fuel consumption of 25 l per 100 km. 50 Km of distance to landfill

Table 5 Specifications for End of life stage

#### *2.5.5. Additional information beyond the building life cycle*

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##### **BENEFITS AND LOADS BEYOND SYSTEM BOUNDARIES**

It has not been taken into account the possible benefits due to the manufacturing plant waste recycling, neither the product packaging recycling.

Based on the limits of the system stated in the reference PCR 2012:01 Construction products and construction services v. 2.3 and the Sub-PCR-I Thermal insulation products

it has not been taken into account the next processes:

- The manufacturing of equipment goods with RSL bigger than 3 years, buildings and other capital goods.
- Maintenance activities in the manufacturing plant
- Transport of workers from home to the factory

#### *2.6. EPDs COMPARISON OF THE SAME PRODUCT CATEGORY*

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In case you want to compare different EPDs® within this product category, these must be based on PCR: 2012:01 Construction products and construction services v. 2.3 and the Sub-PCR-I Thermal insulation products

“Environmental Product Declarations within the same product category from different programs may not be comparable”

“Omissions of life cycle mandatory stages according to this PCR are not allowed”

“EPDs of construction products may be not comparable if they do not comply with EN 15804 or ISO 21930”

#### *2.7. EPD® VALIDITY*

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The present EPD® has a validity of five years since its revision date. In the case of observing changes that represent a worsening in any of the environmental impact indicators of the product life cycle bigger than 10%, this EPD® should be updated.

### 3. ENVIRONMENTAL PERFORMANCE RELATED INFORMATION

#### 3.1. *POTENTIAL ENVIRONMENTAL IMPACTS*

The environmental impacts indicated at this point corresponds to the life cycle of 1m<sup>2</sup> DANOPREN® insulation board with a thickness of 3,4 cm ( $R=1 \text{ K.m}^2.\text{W}^{-1}$ ). In the next table are presented the conversion factors needed to obtain the environmental impacts for each one of the commercialized thicknesses:

THICKNESS (CM)	FACTOR
3	0,88
4	1,18
5	1,47
6	1,76
8	2,35
10	2,94

**Table 6** Conversion factors from a product thickness of 3,4 cm (Functional Unit) to each one of the commercialized thicknesses.



Indicator	Product stage  A1/A2/A3	Construction stage		Use stage							End of life stage				Module D Reuse, recovery and recycling potential	TOTAL
		A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction/Demolition	C2 Transport	C3 Waste treatment	C4 Disposal		
Global Warming (Kg CO <sub>2</sub> -eq /m <sup>2</sup> )	2,57E+00	2,59E-02	1,30E-01	0	0	0	0	0	0	0	Not relevant	9,20E-03	0	1,28E-01	MND	2,86E+00
Ozone layer depletion (Kg CFC 11-eq/m <sup>2</sup> )	8,52E-08	4,96E-09	4,56E-09	0	0	0	0	0	0	0	Not relevant	1,69E-09	0	3,02E-09	MND	9,94E-08
Acidification of soil and water (Kg SO <sub>2</sub> -eq/m <sup>2</sup> )	1,04E-02	1,04E-04	5,28E-04	0	0	0	0	0	0	0	Not relevant	3,68E-05	0	8,12E-05	MND	1,12E-02
Eutrophication (Kg PO <sub>4</sub> <sup>3</sup> -eq/m <sup>2</sup> )	1,35E-03	2,34E-05	6,90E-05	0	0	0	0	0	0	0	Not relevant	8,33E-06	0	6,18E-03	MND	7,63E-03
Photochemical oxidation (Kg ethylene-eq/m <sup>2</sup> )	6,30E-04	4,35E-06	3,17E-05	0	0	0	0	0	0	0	Not relevant	1,57E-06	0	2,59E-05	MND	6,93E-04
Abiotic depletion of resources- Elements (Kg Sb-eq)	1,28E-06	4,36E-08	6,72E-08	0	0	0	0	0	0	0	Not relevant	2,71E-08	0	1,57E-08	MND	1,44E-06
Abiotic depletion of resources- Fossil fuels (MJ)	5,59E+01	4,27E-01	2,82E+00	0	0	0	0	0	0	0	Not relevant	1,47E-01	0	2,92E-01	MND	5,96E+01

**Table 7** Potential environmental impacts of 1 m<sup>2</sup> DANOPREN® insulation board

Indicator	Product stage	Construction stage		Use stage							End of life stage				Module D Reuse, recovery and recycling potential	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction/Demolition	C2 Transport	C3 Waste treatment	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (MJ)	2,34E+00	6,15E-03	1,17E-01	0	0	0	0	0	0	0	Not relevant	1,78E-03	0	9,08E-03	MND	2,47E+00
Use of renewable primary energy resources used as raw materials (MJ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0
Total use of renewable primary energy resources (MJ)	2,34E+00	6,15E-03	1,17E-01	0	0	0	0	0	0	0	Not relevant	1,78E-03	0	9,08E-03	MND	2,47E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (MJ)	5,59E+01	4,27E-01	2,82E+00	0	0	0	0	0	0	0	Not relevant	1,47E-01	0	2,92E-01	MND	5,96E+01
Use of non-renewable primary energy resources used as raw materials (MJ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0
Total use of non-renewable primary energy resources (MJ)	5,59E+01	4,27E-01	2,82E+00	0	0	0	0	0	0	0	Not relevant	1,47E-01	0	2,92E-01	MND	5,96E+01
Use of secondary materials (Kg)	4,79E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	4,79E-01
Use of secondary renewable fuels (MJ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0
Use of secondary non-renewable fuels (MJ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0
Use of net fresh water[1] (m3)	8,21E-03	9,92E-05	4,16E-04	0	0	0	0	0	0	0	Not relevant	2,70E-05	0	3,07E-04	MND	9,06E-03

**Table 8** Use of renewable and non-renewable resources of 1 m<sup>2</sup> DANOPREN® insulation board

Indicator	Product stage	Construction stage		Use stage							End of life stage				Module D Reuse, recovery and recycling potential	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction/Demolition	C2 Transport	C3 Waste treatment	C4 Disposal		
Hazardous waste (Kg)	9,19E-06	2,25E-07	4,74E-07	0	0	0	0	0	0	0	Not relevant	8,55E-08	0	2,22E-07	MND	1,02E-05
Non-hazardous waste (Kg)	2,25E-01	3,47E-02	1,32E-02	0	0	0	0	0	0	0	Not relevant	6,54E-03	0	1,10E+00	MND	1,38E+00
Radioactive waste (Kg)	5,90E-05	2,81E-06	3,12E-06	0	0	0	0	0	0	0	Not relevant	9,58E-07	0	1,78E-06	MND	6,76E-05
Materials for reuse (Kg)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0
Materials for recycling (Kg)	0	0	7,55E-02	0	0	0	0	0	0	0	0	0	0	0	MND	7,55E-02
Materials for energy valorization (Kg)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MND	0

**Table 9** Waste production of 1 m<sup>2</sup> DANOPREN® insulation board.

#### 4. INTERPRETATION OF RESULTS

As can be seen in figure 4 and table 10, the life cycle environmental impacts of 1 m<sup>2</sup> DANOPREN® insulation board are mainly dominated by Product Stage (A1-A3), since it registers the maximum contribution at six of the seven assessed environmental indicators. Hence, this stage represents between 94% (Abiotic depletion of resources-Elements) and 18% (Eutrophication) of the total life cycle impacts.

Installation module (A5), presents a slight environmental contribution on the product life cycle with registered values around 5% over all impact categories, except for Eutrophication indicator. Disposal module (C4), presents a very high impact on Eutrophication (81%), and a slight or negligible contribution for the rest of indicators. With regard to Transport of the product to customer module (A4), presents a low contribution, constituting at most 5% (Ozone layer depletion) of the total life cycle impacts. Finally, Transport to waste manager module (C2) presents non-significant contribution, since it represents at most 2% (Abiotic depletion-Elements) of the total life cycle impacts.

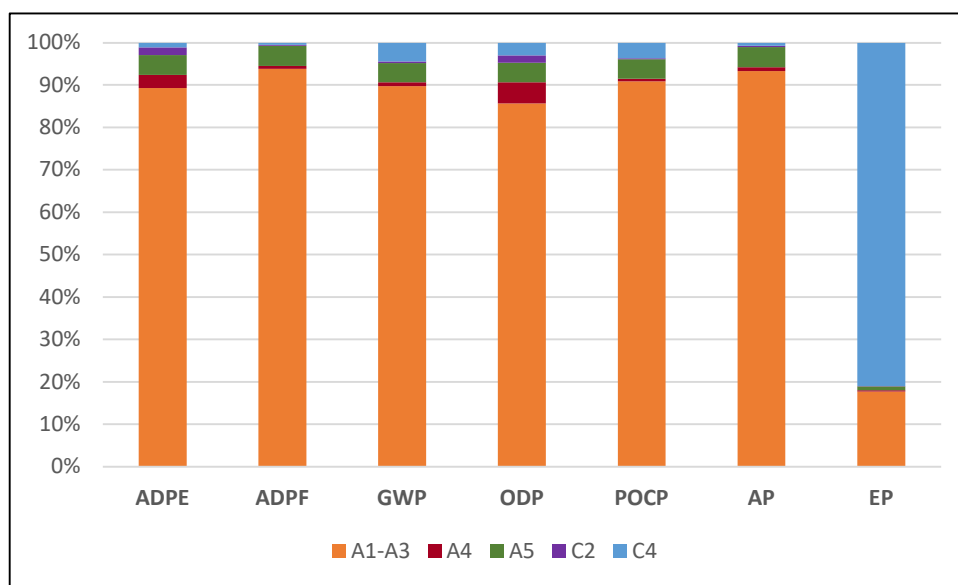
As an example, the impact of 1 m<sup>2</sup> DANOPREN® insulation board with a thickness of 3,4 cm ( $R=1 \text{ m}^2 \cdot \text{K}/\text{W}$ ) on Global Warming indicator equals to car transportation<sup>3</sup> during 24 km.

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<sup>3</sup> CO<sub>2</sub> emissions of Seat Ibiza 1.2 TSI FR Euro 5: 119 g/km

Impact category	A1/A2/A3 Product Stage	A4 Distribution	A5 Installation	C2 Transport to waste manager	C4 Disposal
Global warming (kg CO <sub>2</sub> eq.)	89,8%	0,9%	4,5%	0,3%	4,5%
Ozone layer depletion (kg CFC-11 eq.)	85,7%	5,0%	4,6%	1,7%	3,0%
Acidification of soil and water (Kg SO <sub>2</sub> -eq/m <sup>2</sup> )	93,3%	0,9%	4,7%	0,3%	0,7%
Eutrophication (Kg PO <sub>4</sub> <sup>3-</sup> -eq/m <sup>2</sup> )	17,7%	0,3%	0,9%	0,1%	81,0%
Photochemical oxidation (Kg ethylene-eq/m <sup>2</sup> )	90,8%	0,6%	4,6%	0,2%	3,7%
Abiotic depletion of resources-Elements (Kg Sb-eq)	89,3%	3,0%	4,7%	1,9%	1,1%
Abiotic depletion of resources-Fossil (MJ)	93,8%	0,7%	4,7%	0,2%	0,5%

**Table 10.** Potential environmental impacts of 1 m<sup>2</sup> DANOPREN® insulation board. In percentage.



#### CHART CAPTION

**ADPE:** Abiotic depletion of resources-Elements, **ADPF:** Abiotic depletion of resources-Fossil, **GWP:** Global Warming potential, **ODP:** Ozone layer depletion, **POCP:** Photochemical oxidation, **AP:** Acidification, **EP:** Eutrophication

**Figure 4** Impact contribution chart of the life cycle of 1 m<sup>2</sup> DANOPREN® insulation board for each assessed module.

## 5. DIFFERENCES VERSUS PREVIOUS VERSIONS OF THE EPD®

- The present EPD® has been adapted to the established requirements of Product Category Rule 2012:01 Construction products and construction services v 2.3 and the Sub-PCR-I Thermal Insulation Products.
- The DANOSA's production plant located at Tudela (Navarra, Spain) has been moved to Fontanar (Guadalajara, Spain). As a consequence, it has been modified all inventory data regarding raw materials and energy consumption, as well as distance transportation of the finished product, and the distances concerning raw materials suppliers.
- It has been modified the scenario of A5 module (Installation), taking into account that all generated waste on this phase (product losses and packaging) are intended for recycling. Therefore, following the polluter pays principle, it has been removed the waste treatment process, and it has only been taken into account the environmental impacts arise from waste transportation to recycling plant.
- It has been modified in the LCA product model the process corresponding to recycled polystyrene, in order to achieve an accurate environmental impact assessment.
- Due to the mentioned EPD® modifications in previous points, the results corresponding to the environmental performance of the product, as well as its further interpretation, have been slightly change with regard to the older version of this document.

## 6. VERIFICATION

Standard CEN EN 15804 serves as core PCR	
Product Category Rule (PCR) review was conducted by	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via <a href="mailto:info@environdec.com">info@environdec.com</a>
Independent verification of the declaration and data, according to ISO 14025:2010	External EPD® verification
Third party verifier	TECNALIA R&I Certificación (accreditation no. 125/C-PR283 by ENAC) Name of the verifier: Elisabet Amat <a href="mailto:Eli.amat@tecnaliacertificacion.com">Eli.amat@tecnaliacertificacion.com</a>
Accredited or approved by	The International EPD System®, Operated by EPD International AB <a href="http://www.environdec.com">www.environdec.com</a>  Sweden

## 7. REFERENCES

- GENERAL PROGRAMME INSTRUCTIONS for Environmental Product Declarations, EPD. Version 2.5
- ISO 14025:2010 Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures
- ISO 14040:2006 Environmental management-Life Cycle Assessment-Principles and framework
- ISO 14044:2006 Environmental management-Life Cycle Assessment-Requirements and guidelines
- PCR 2012:01 Construction products and construction services v. 2.3 and its Sub-PCR-I Thermal insulation products of The International EPD® System
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