Environmental Product Declaration

as per ISO 14025 and EN 15804+A2

Owner of the declaration:	PANELES AISLANTES PENINSULARES, S.L.
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Declaration number:	EPD-PANELES AISLANTES PENINSULARES-221-EN
Date of issue:	23.03.2022
Valid for:	22.03.2027

Self-supporting double skin metal faced insulating panel with rigid insulating core in polyisocyanurate

This panel is designed for applications with high thermal insulation requirements: cold rooms, agro-food and pharmaceutical industries, facade enclosures and industrial roofs, logistical centres, etc.

1. General Information

Paneles Aislantes Peninsulares, S.L.

Self-supporting double skin metal faced insulating panel with rigid insulating core in polyisocyanurate

Program operator
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Declaration number
EPD-PANELES AISLANTES PENINSULARES-221-EN

Declared product / declared unit
1m^2 of 100 mm of thickness with thermal resistance of 5 m^{2}K/W.

Product Category Rules
EN 16783:2017 – Thermal insulation products – Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations.

Scope
This EPD refers to 1m^2 of 100mm thick polyisocyanurate (PIR) core insulation panel with a thermal resistance of 5m^{2}K/W. The scope includes all products with similar composition (the 3 commercial brands: FRIGOPAP, COVERPAP and WALLPAP) with thicknesses between 40 and 200mm, manufactured in Paneles Aislantes Peninsulares, S.L with factory in Montalbo – Cuenca (Spain).
Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidence.

Date of issue
23.03.2022

Valid for
22.03.2027

Verification
Standard CEN EN 15804:2012+A2:2020 serves as the core PCR.

Independent verification of the environmental statement and data according to ISO 14025:2011-10

☐ internal ☒ external

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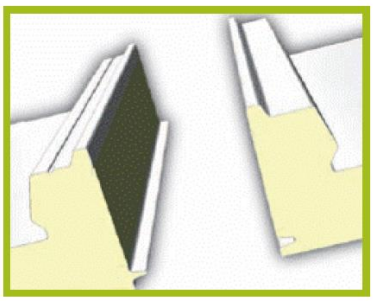
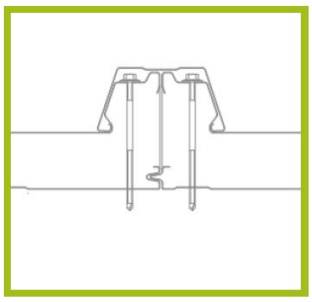
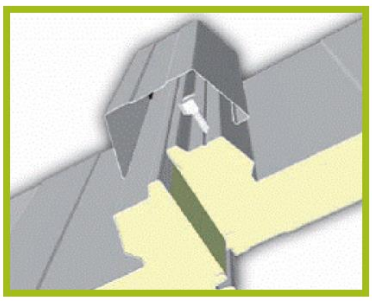
2. Product

2.1 Product description

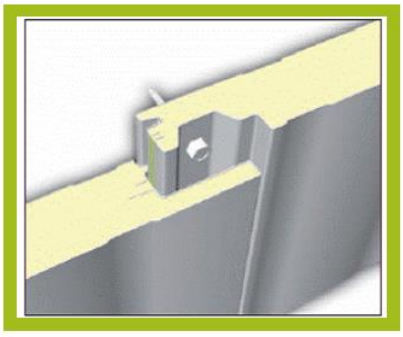
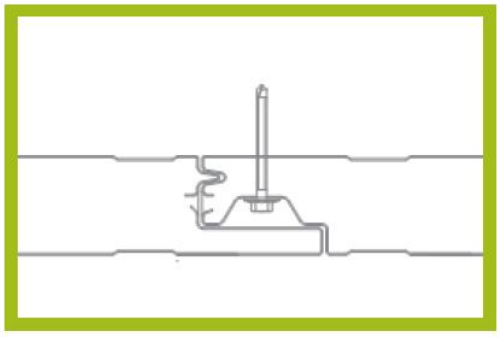
The product under study in this EPD is a self-supporting double skin metal faced insulating panel. It consists of two steel sheets and a core of rigid insulating foam which can be either polyurethane (PUR) or polyisocyanurate (PIR).

The Company Paneles Aislantes Peninsulares manufactures 3 commercial brands. These three panels have the same composition, but differ from each other according to the type of joint and the end use:

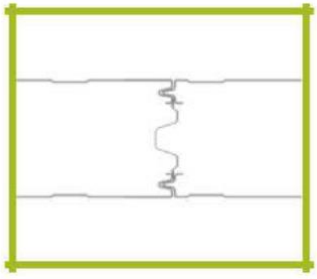
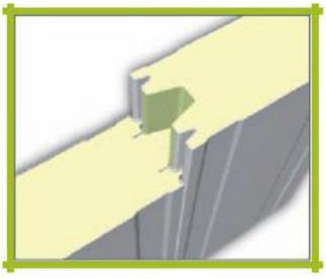
- Roof panel for Construction – COVERPAP+: It can be used for the enclosure of all types of buildings and industrial buildings. The **COVERPAP** panel is supplied together with an easy-to-install flashing profile that guarantees the tightness of the system and hides the fixings.

- Facade panel for Construction – **WALLPAP**: is the ideal solution for facade enclosures. It is assembled in longitudinal direction by means of male/female fitting system made on the shape on a continuous production line, and which design allows to hide the screws in the installation.

- Refrigerating panel – **FRIGOPAP**: is designed for the construction or refrigerated agri-food rooms by installing vertical panels and roof panels. The refrigerating panel is adjusted by milling at the end of the production line in order to guarantee reduced assembly tolerances for an optimal insulation. The panel is available in a wide range of coatings to ensure maximum durability even in the most aggressive environments.

Two types of results are shown in this EPD:
Firstly, the results are shown for the declared unit of 1 m2 of insulating panel of 100 mm thickness and thermal resistance of 5 m2K/W. The data used correspond to the panel that is most commonly manufactured at Paneles Aislantes Peninsulares, S.L., commercial brand FRIGOPAP and 100 mm thick. The results obtained are valid for the three commercial brands.

Secondly, the results are shown so that the impact can be calculated depending on the thickness of the panel. This is because both are directly proportional. As before, these results can be applied to the different commercial brands manufactured in the factory of Paneles Aislantes Peninsulares, S.L. as their values differ by less than 10%.

2.2 Application

According to standard EN 14509:2013 the self-supporting double skin metal faced insulating panels are designed for discontinuous laying of roofs, wall cladding, exterior walls, interior walls (including partition walls) and ceilings inside buildings.

2.3 Technical data

The following table shows the declared performance for the CE marking, according to the harmonised standard, EN 14509:2013 of the different thicknesses of the FRIGOPAP panel. The performance of WALLPAP and COVERPAP panels can be consulted on the following website www.panelespap.com.

Table 1

Essential characteristics	Thickness	Performance
Density	40/60/80/100/120 /150/180/200	40±2 Kg/m^3
Thermal Transmittance U (W/m^{2}K)	40	0,49 W/m^{2}K
	60	0,33 W/m^{2}K
	80	0,25W/m^{2}K
	100	0,20 W/m^{2}K
	120	0,17 W/m^{2}K
	150	0,15 W/m^{2}K
	180	0,11 W/m^{2}K
	200	0,10 W/m^{2}K
Tensile strength	40/60/80/100/120 /150/180/200	0,060 MPa
Shear strength	40/60/80/100/120 /150/180/200	0,070 MPa
Reduced long-term shear strength	40/60/80/100/120 /150/180/200	0,035 MPa
Shear Modulus (Core)	40/60/80/100/120 /150/180/200	2,00 MPa
Creep Coefficient	t= 2000 h	2,4
	t= 100.000 h	7,0
Compressive strength (Core)	40/60/80/100/120 /150/180/200	0,080 MPa
Bending Resistance in Span (Positive bending)	40	2,53 KNm/m
	60	3,89 KNm/m
	80	4,64 KNm/m
	100	6,00 KNm/m

	120	7,16 KNm/m
	150	9,05 KNm/m
	180	10,62 KNm/m
	200	11,78 KNm/m
Bending Resistance in Span (Negative bending)	40	2,31 KNm/m
	60	4,04 KNm/m
	80	4,41 KNm/m
	100	5,46 KNm/m
	120	6,51 KNm/m
	150	8,63 KNm/m
	180	9,66 KNm/m
	200	10,71 KNm/m
Bending Resistance at Internal Support (Positive bending)	40	1,60 KNm/m
	60	2,24 KNm/m
	80	2,88 KNm/m
	100	3,52 KNm/m
	120	4,16 KNm/m
	150	5,12 KNm/m
	180	6,08 KNm/m
	200	6,72 KNm/m
Bending Resistance at Internal Support (Negative bending)	40	1,68 KNm/m
	60	2,70 KNm/m
	80	3,50 KNm/m
	100	4,30 KNm/m
	120	5,54 KNm/m
	150	6,30 KNm/m
	180	7,50 KNm/m
	200	8,08 KNm/m
Wrinkling Stress (external face) / In Span	40	126,61 MPa
	60	122,94 MPa
	80	121,10 MPa
	100	120,00 MPa
	120	119,27 MPa
	150	118,05 MPa
	180	118,05 MPa
	200	117,80 MPa
Wrinkling Stress (external face) / At central support	40	80,91 MPa
	60	74,67 MPa
	80	72,00 MPa
	100	70,40 MPa
	120	69,65 MPa
	150	68,27 MPa
	180	67,56 MPa
	200	67,36 MPa
Wrinkling Stress (internal face) / In Span	40	115,72 MPa
	60	112,15 MPa
	80	110,36 MPa
	100	109,29 MPa
	120	108,57 MPa
	150	107,86 MPa
	180	107,38 MPa
	200	107,14 MPa
Wrinkling Stress (internal face) / At central support	40	85,31 MPa
	60	90,00 MPa
	80	87,50 MPa

	100	86,00 MPa
	120	92,71 MPa
	150	84,00 MPa
	180	83,33 MPa
	200	81,02 MPa
Reaction to fire		B-s1,d0
Fire Resistance		PND
Water permeability		Class A – 1200 Pa
Air permeability		0,006 $m^3/h \cdot m^2$ a 50 Pa n= 1,613817 C= 0,000379
Water vapour permeability		Impermeable
Durability		Pass
Sound absorption		PND
Airborne sound insulation		PND
Resistance to point and access loads	Suitable for repeated loads without additional protection	

2.4 Placing on the market / Application rules

PAP double skin metal faced insulating panels comply with Regulation (EU) 305/2011 of construction products, as well as the requirements for CE marking of this product according to the harmonized standard EN 14509:2013.
The company also has ISO 9001:2015 Quality Management System and ISO 14001:2015 Environmental Management System certificates.
Paneles Aislantes Peninsulares has registered its carbon footprint in accordance with the Royal Decree 163/2014 of March 14th, thus committing to the reduction of greenhouse gases.

2.5 Base materials / Ancillary materials

The insulating panels are composed by two steel sheets bonded by a central insulating core of rigid foam. The foam is produced in the factory and there are two types of foam: PUR or PIR. The most commonly used is the PIR foam and therefore the data used corresponds to this one. The environmental impact is valid for both compositions. The following table shows the percentages of the main components for the 100 mm thick FRIGOPAP insulating panel. The proportion is the same for COVERPAP and WALLPAP panels of the same thickness.

Table 2

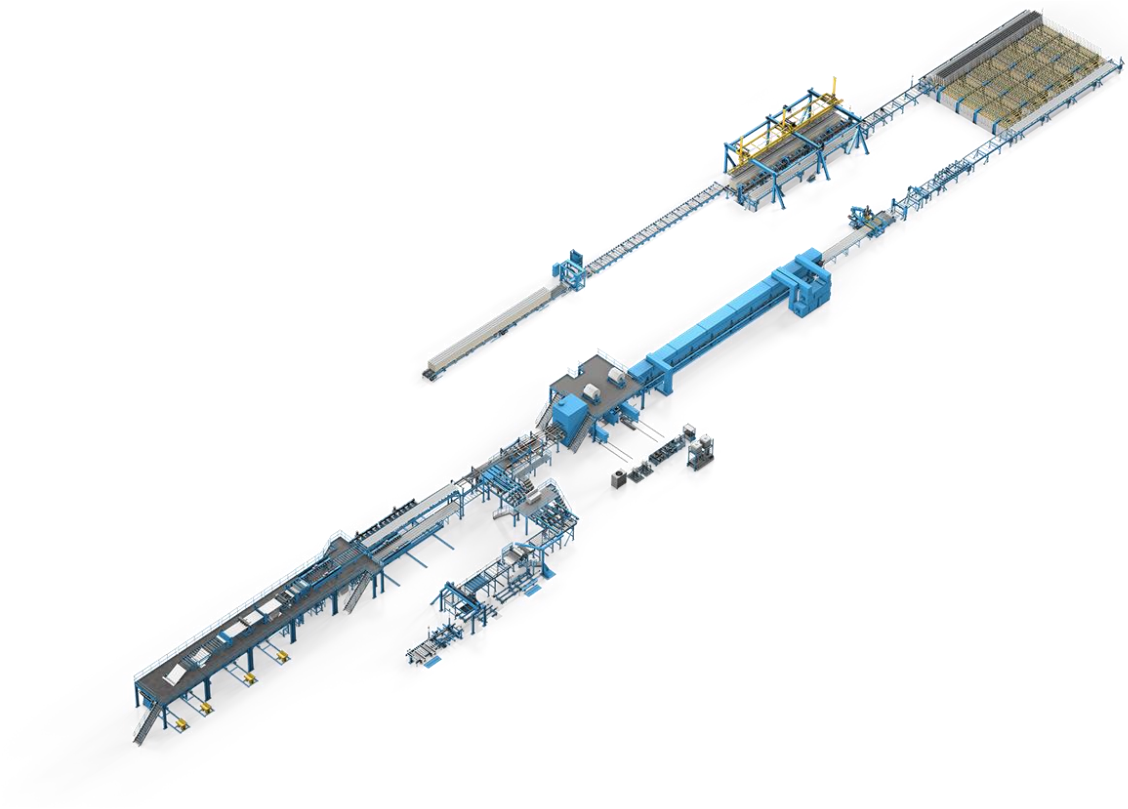
Component		Weight (%)
Steel sheets		68%
Rigid foam	Isocyanate	19%
	Polyol	12%
	Others	1%

2.6 Manufacture

FRIGOPAP, COVERPAP and WALLPAP panels are manufactured in a continuous production line by forming two steel sheets bonded by a central insulating core of rigid foam adhered during the continuous manufacturing process.

The production line is shown in Figure 1, in which the different sections described below can be distinguished. The illustration is interpreted counter-clockwise.

Figure 1



1. PROFILING SECTION:
   It consists mainly of 2 metal sheet profiling lines, a lower and an upper one, profiling the outer and the inner layers respectively.
   Each one of the profiling lines is composed of different areas and elements for different operations on the sheet during the forming process:
   - Loading trolley – introduce the steel coil in the corresponding coil winders.
   - Coil winders – automatically winding steel to supply the production line.
   - Coil opening tables – introduce the heads of new coils in-line.
   - Blunt shear – interrupt the coil when production has to be terminated or when a coil change is required in the next production run.
   - Automatic sheet bending systems – automatically bending the end and the beginning of two different coils when production requires it.
   - Laminating machine – automatically place the protective film on the sheet before it is profiled.
   - Pit – accumulate the sheet so that it serves as a reserve for feeding the production line while any operation that limits the advance of the sheet on its front side is being executed.
   - Steel ribbed machine – define the type of finishing of the sheets.
   - Profiling machines – profiling each one of the panel types that can be manufactured: FRIGOPAP+, WALLPAP+, COVERPAP+.

2. INJECTION SECTION:
   It consists mainly of:
   - INJECTION AREA: it contains all the devices for injecting liquid PUR or PIR foam, as well as the controls to ensure that the process is performed correctly. It is mainly composed of:
     i. heating area – controls the temperature of the steel sheets before the injection.
     ii. high pressure dosing pump for each one of the foam components
     iii. control PC where the Parameters related to the injection are controlled.
   - CURING PRESS (CONTIMAT): here takes place the initial curing of the foam. Parameters such as panel thickness according to panel type, foam type, panel thicknesses, production speed, etc. are defined here.

3. CUTTING / SAWING SECTION:
   The panels are cut to size by means of a chop saw according to the production order that has been loaded onto it in advance. It is a band saw with two types of direction: transverse and longitudinal.

4. STABILISATION / COOLING SECTION:
   Consists of a structure where the panels are stored for a period of time in a vertical position and where the panels release heat generated previously due to exothermic chemical reaction of foam formation.

5. STACKING AREA:
   It consists of an automatic stacking device where the panels are stacked according to the production order that has been previously loaded into the line. The number of panels per stack depends mainly on the thickness of the panels, as well as on the customer's previous indications.

6. PACKAGING SECTION:
   It is composed by a transporting line that takes the already formed packages to an automatic horizontal packing machine where the packages are sealed using a high-resistance stretch film that ensures the correct protection and securing of the package. There are several possibilities regarding the type of packaging and palletising of the product. Depending on the dimensions of the lorry, the product or according to specific customer requests.
   Before packaging and sealing, polystyrene blocks are placed on the panel package in the form of a pallet in order to reach a perfect distribution of the loads of the package both in storage, on construction site, as well as during the transport of the package to the construction site. These blocks also enable a correct handling of the package during loading and unloading operations, minimizing the possibility of the package to suffer any type of damage during these operations.

2.7 Reference Service Life

The reference lifespan of this type of product is 50 years.

3. LCA: Calculation rules

3.1 Declared unit

The declared unit in this EPD is a 1m^2 100mm thick insulation panel with a thermal resistance of 5m^{2}K/W. The thermal resistance value is specific per panel thickness. To calculate it, the inverse of the thermal transmittance specified in Table 1 must be used.

Table 3

	Value	Unit
Declared unit	1	m^2
Specific weight	14,62	kg/m^2

3.2 System boundary

This is an environmental product statement from the cradle to the gate with options. The modules included are:

- **A1 – A3: Product stage**.
- **A4: Transport to the construction site.**
- **A5: installation process**
- **C1 – C4: End of life stage.**
- **D: Benefits and burdens beyond the system limits.**

All transport processes are within the limits of the system.
The outline can be seen in section 4.

3.3 Estimates and assumptions

The following estimates have been taken into account for the calculations:

- The data for PIR foam has been used, the results are extrapolable for the use of PUR foam.
- The data on energy expenditure at the product stage is based on an estimated annual expenditure per unit of product.
- For module A4 it has been taken into account that the panel travels an average of 400Km and is transported with a diesel truck of minimum Euro 5 category.
- For modules C1-C4 the European database EcoInvent 3.5 has been taken into account.

3.4 Cut-off criteria

All process specific data are collected for production modules A1-A3 and A4. All flows that contribute more than 1% to the total mass, energy or environmental impact of the system are considered in the LCA. The sum of all omitted mass and energy processes does not exceed 5% per module. For module A5 the data specified in EN 16783:2017 is used.

3.5 Period under review

The data used for this report is based on the production of 2020.

3.6 Comparability

In principle, a comparison or evaluation of EPD data is only possible if all data sets to be compared have been created in accordance with EN 15804:2012 +A2:2019 and the building context or the product-specific performance characteristics have been taken into account.
The specific characteristics of the product should be considered. Secondary data for modelling the environmental impacts of the production stage are based on the EcoInvent 3.6 database.

4. LCA: Results

The following tables show the results of the impact assessment evaluation, the use of resources, the waste and other outflows. The results obtained are presented in 3 different sets of tables:

- Group 1, corresponding to Table 5, Table 6, Table 7 and Table 8– Shows the total results for the functional unit defined: 1m^2 of 100 mm thickness with thermal resistance of 5m^{2}K/W.
- Group 2, corresponding to Table 9, Table 10, Table 11 and Table 12 – shows the result per module of the solid part. This part refers to the data that do not vary according to the thickness of the panel.
- Group 3, corresponding to Table 13, Table 14, Table 15 and Table 16– shows the results per module of scalable part. This part refers to the data that vary depending on the thickness of the panel. The results obtained are referenced to the thickness of the functional unit (100mm).

In order to know the result of an impact for different thicknesses the following formula should be applied:

$$y = A \cdot \frac{x}{100} + B$$

Where ***y*** is the value taken by each environmental indicator; ***x*** refers to the panel thickness in mm; ***A*** corresponds to data from Group 3 tables; and ***B*** corresponds to data from Group 2 tables.

Below is an example of calculation of the "acidification" impact for module A4 for an 80mm panel using the tables of group 2 and group 3:

Data:
Acidification – solid part: 3.45E-03
Acidification – scalable part: 1.64E-03
Acidification – panel of 80mm:

$$y = 1.64E-03 \cdot \frac{80}{100} + 3.45E-03$$

$$y = 4.762E-03$$

The results for the following environmental impact indicators shall be used with caution, as uncertainties of the results are high and the experience with these Parameters is limited, as stated in standard EN 15804:2012+A2:2019

- Abiotic depletion potential for non-fossil resources (ADP – minerals&metals)
- Abiotic depletion potential for fossil resources (ADP – fossil)
- Water deprivation potential (user), water weighted deprivation consumption (WDP)
- Comparative potential of ecosystem toxic unit (ETP-fw)
- Comparative potential of toxic unit for humans (HTP-c)
- Comparative potential of toxic unit for humans (HTP-nc)
- Land use (SQP)

Table 4

Description of the system limit (X – Included in LCA; MND – Module not declared)																
Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and burdens beyond the system limits
Supply of raw materials	Transport	Manufacture	Transport from manufacturer to place of	Construction / installation process	Use	Maintenance	Repair	Replacement	Renovation	In-service energy use	In-service water use	Deconstruction / Demolition	Transport	Waste procesing	Disposal	Ruse / 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	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Table 5

Results of LCA – Core environmental indicators according to EN 15804+A2: 1m² 100mm thick insulation panel with a thermal resistance of 5m²K/W		
Parameters	**Unit**	**Total**
Depletion of abiotic resources-fossil fuels	MJ, net calorific value	7.02E+02
Depletion of abiotic resources- minerals and metals	Kg Sb eq.	7.05E-04
Acidification of soil and water	mol H+ eq.	2.39E-01
Eutrophication, freshwater	Kg P eq.	2.20E-03
Eutrophication marine	Kg N eq.	6.69E-02
Eutrophication, terrestrial	mol N eq.	5.56E-01
Global warming potential - total	Kg CO2 eq.	5.40E+01
Global warming potential - Biogenic	Kg CO2 eq.	3.59E-01
Global warming potential - Fossil	Kg CO2 eq.	5.36E+01
Global warming potential - Land use and land use change	Kg CO2 eq.	2.38E-02
Ozone layer depletion	Kg CFC 11 eq.	7.23E-06
Photochemical oxidants creation	Kg NMVOC eq.	1.93E-01
Water use	m3 world eq. deprived	2.90E+01

Table 6

Results of LCA – Additional environmental indicators according to EN 15804+A2: 1m² 100mm thick insulation panel with a thermal resistance of 5m²K/W		
Parameters	**Unit**	**Total**
Ecotoxicity, freshwater	CTUe	2.47E+03
Human toxicity, cancer	CTUh	3.88E-07
Human toxicity, non-cancer	CTUh	3.95E-06
Ionising radiation, human health	kBq U235 eq.	1.67E+00
Particulate Matter	Disease incidence	3.09E-06
Land use	dimensionless	1.63E+02

Table 7

Results of LCA – Parameters describing the use of resources according to EN 15804+A2: 1m² 100mm thick insulation panel with a thermal resistance of 5m²K/W		
Parameters	**Unit**	**Total**
Renewable primary energy ex. raw materials	MJ, net calorific value	4.02E+01
Renewable primary energy used as raw materials	MJ, net calorific value	INA
Renewable primary energy total	MJ, net calorific value	4.02E+01
Non-renewable primary energy ex. raw materials	MJ, net calorific value	7.44E+02
Non-renewable primary energy used as raw materials	MJ, net calorific value	5.87E+00
Non-renewable primary energy total	MJ, net calorific value	7.50E+02
Use of secondary material	Kg	3.04E+00
Use of renewable secondary fuels	MJ, net calorific value	INA
Use of non-renewable secondary fuels	MJ, net calorific value	INA
Use of net fresh water	m3	7.64E-01

Table 8

Results of LCA – Parameters describing waste categories to EN 15804+A2: 1m² 100mm thick insulation panel with a thermal resistance of 5m²K/W		
Parameters	**Unit**	**Total**
Hazardous waste disposed	Kg	7.94E-04
Non-hazardous waste disposed	Kg	1.19E+01
Radioactive waste disposed	Kg	1.80E-03
Components for re-use	Kg	INA
Materials for recycling	Kg	9.78E+00
Materials for energy recovery	Kg	INA
Exported energy thermic	MJ per energy carrier	1.73E+00
Exported energy electric	MJ per energy carrier	1.00E+00

Table 9

Results of LCA – Core environmental indicators according to EN 15804+A2: 1m² of insulation panel – Solid part										
Parameters	Unit	Product stage	Construction process stage		End-of-life stage				Benefits and burdens beyond the system limits	Total
		A1 – A3	A4	A5	C1	C2	C3	C4	D	
ADP-fossil	MJ, net calorific value	2.56E+02	1.28E+01	5.62E+00	-	9.55E+00	-	7.27E-02	-1.20E+02	1.64E+02
ADP-minerals&metals	Kg Sb eq.	2.16E-04	3.09E-05	5.27E-06	-	1.60E-05	-	2.38E-08	-3.32E-06	2.65E-04
AP	mol H· eq.	1.05E-01	3.45E-03	2.27E-03	-	3.67E-03	-	2.47E-05	-5.63E-02	5.82E-02
EP-freshwater	Kg P eq.	1.05E-03	7.86E-06	2.16E-05	-	6.39E-06	-	2.92E-08	-5.45E-04	5.44E-04
EP-marine	Kg N eq.	2.26E-02	9.87E-04	5.02E-04	-	1.29E-03	-	8.49E-06	-9.86E-03	1.56E-02
EP-terrestrial	mol N eq.	2.47E-01	1.09E-02	5.49E-03	-	1.43E-02	-	9.36E-05	-1.16E-01	1.61E-01
GWP-biogenic	Kg CO2 eq.	-2.28E-02	4.26E-04	-4.73E-04	-	2.92E-04	-	5.16E-06	7.26E-02	5.01E-02
GWP-fossil	Kg CO2 eq.	2.32E+01	8.62E-01	4.99E-01	-	6.33E-01	-	2.60E-03	-1.18E+01	1.34E+01
GWP-luluc	Kg CO2 eq.	1.10E-02	3.71E-04	2.33E-04	-	2.32E-04	-	7.25E-07	-2.57E-03	9.27E-03
GWP-total	Kg CO2 eq.	2.32E+01	8.62E-01	4.99E-01	-	6.34E-01	-	2.61E-03	-1.17E+01	1.35E+01
ODP	Kg CFC 11 eq.	2.86E-06	1.90E-07	6.41E-08	-	1.40E-07	-	1.07E-09	-5.56E-07	2.70E-06
POCP	Kg NMVOC eq.	1.12E-01	3.36E-03	2.42E-03	-	4.07E-03	-	2.72E-05	-6.27E-02	5.94E-02
WDP	m3 world eq. deprived	7.02E+00	3.93E-02	1.42E-01	-	3.42E-02	-	3.26E-03	-9.40E-01	6.30E+00

ADP-f: Depletion of abiotic resources-fossil fuels; **ADP-mm**: Depletion of abiotic resources- minerals and metals; **AP**: Acidification of soil and water; **EP-fw**: Eutrophication, freshwater; **EP-m**: Eutrophication marine; **EP-T**: Eutrophication, terrestrial; **GWP-b**: Global warming potential - Biogenic; **GWP-f**: Global warming potential - Fossil; **GWP-luluc**: Global warming potential - Land use and land use change; **GWP-total**: Global warming potential; **ODP**: Ozone layer depletion; **POCP**: Photochemical oxidants creation; **WDP**: Water use

Table 10

Results of LCA – Additional environmental indicators according to EN 15804+A2: 1m² of insulation panel – Solid part										
Parameters	Units	Product stage	Construction process stage		End-of-life stage				Benefits and burdens beyond the system limits	Total
		A1 – A3	A4	A5	C1	C2	C3	C4	D	
ETP-fw	CTUe	7.07E+02	1.08E+01	1.47E+01	-	8.52E+00	-	4.72E-02	-3.69E+02	3.72E+02
HTP-c	CTUh	1.25E-07	3.36E-10	2.53E-09	-	2.76E-10	-	1.09E-12	-6.22E-08	6.56E-08
HTP-nc	CTUh	1.16E-06	1.14E-08	2.39E-08	-	9.32E-09	-	3.35E-11	-3.86E-07	8.23E-07
IRP	kBq U235 eq.	5.89E-01	5.60E-02	1.37E-02	-	4.00E-02	-	2.98E-04	-1.31E-01	5.68E-01
PM	Disease incidence	1.90E-06	5.25E-08	4.07E-08	-	5.70E-08	-	4.80E-10	-9.91E-07	1.06E-06
SQP	dimensionless	8.50E+01	7.62E+00	2.03E+00	-	8.28E+00	-	1.53E-01	-2.45E+01	7.86E+01
ETP-fw: Ecotoxicity, freshwater; **HTP-c**: Human toxicity, cancer; **HTP-c**: Human toxicity, non-cancer; **IRP**: Ionising radiation, human health; **PM**: Particulate Matter; **SQP**: Land use										

Table 11

Results of LCA – Parameters describing the use of resources according to EN 15804+A2: 1m² of insulation panel – Solid part										
Parameters	Units	Product stage	Construction process stage		End-of-life stage				Benefits and burdens beyond the system limits	Total
		A1 – A3	A4	A5	C1	C2	C3	C4	D	
PERE	MJ, net calorific value	1.46E+01	2.18E-01	3.00E-01	-	1.20E-01	-	5.88E-04	-2.53E+00	1.27E+01
PERM	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
PERT	MJ, net calorific value	1.46E+01	2.18E-01	3.00E-01	-	1.20E-01	-	5.88E-04	-2.53E+00	1.27E+01
PENRE	MJ, net calorific value	2.67E+02	1.36E+01	5.87E+00	-	1.01E+01	-	7.72E-02	-1.26E+02	1.71E+02
PENRM	MJ, net calorific value	4.30E+00	-	8.59E-02	-	-	-	-	-	4.38E+00
PENRT	MJ, net calorific value	2.72E+02	1.36E+01	5.96E+00	-	1.01E+01	-	7.72E-02	-1.26E+02	1.75E+02
SM	Kg	2.98E+00	-	5.96E-02	-	-	-	-	-	3.04E+00
RSF	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRSF	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
WDP	m3	1.97E-01	1.53E-03	4.01E-03	-	1.16E-03	-	7.77E-05	-2.47E-02	1.79E-01
PERE: renewable primay energy ex. raw materials; **PERM**: renewable primary energy used as raw materials; **PERT**: renewable primary energy total; **PENRE**: non renewable primary energy e. Raw materials; **PENRM**: non-renewable primary energy used as raw materials; **PENRT**: non-renewable primary energy total; **SM**: use of secondary material; **RSF**: use of renewable secondary fuels; **NRSF**: use of non-renewable secondary fuels; **WDP**: use of net fresh water										

Table 12

Results of LCA – Parameters describing waste categories to EN 15804+A2: 1m² of insulation panel – Solid part										
Parameters	**Units**	**Product stage**	**Construction process stage**		**End-of-life stage**				**Benefits and burdens beyond the system limits**	**Total**
		A1 – A3	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**	
HWD	Kg	1.52E-03	3.44E-05	3.20E-05	-	2.42E-05	-	1.09E-07	-1.19E-03	4.19E-04
NHWD	Kg	6.70E+00	5.05E-01	1.66E-01	-	6.06E-01	-	4.94E-01	-4.90E-01	7.99E+00
RWD	Kg	6.43E-04	8.65E-05	1.59E-05	-	6.27E-05	-	4.78E-07	-1.58E-04	6.50E-04
CRU	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
MFR	Kg	1.98E-01	-	1.92E-01	-	-	9.39E+00	-	-	9.78E+00
MER	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
EET	MJ per energy carrier	-	-	-	-	-	-	-	1.29E+00	1.29E+00
EEE	MJ per energy carrier	-	-	-	-	-	-	-	7.49E-01	7.49E-01
HWD: hazarous waste disposed; **NHWD**: non-hazarous waste disposed; **RWD**: radioactive waste disposed; **CRU**: components for re-use; **MFR**: materials for recycling; **MER**: Materials for energy recovery; **EET**: Exported Energy Thermic; **EEE**: Exported Energy Electric										

Table 13

Results of LCA – Core environmental indicators according to EN 15804+A2: 1m² of insulation panel – Scalable part										
Parameters	**Units**	**Product stage**	**Construction process stage**		**End-of-life stage**				**Benefits and burdens beyond the system limits**	**Total**
		A1 – A3	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**	
ADP-fossil	MJ, net calorific value	5.14E+02	6.07E+00	1.06E+01	-	4.58E+00	3.44E+00	6.18E-02	-1.01E+00	5.38E+02
ADP-minerals&metals	Kg Sb eq.	4.05E-04	1.46E-05	8.62E-06	-	7.70E-06	3.96E-06	2.12E-08	-5.04E-08	4.40E-04
AP	mol H· eq.	1.65E-01	1.64E-03	3.55E-03	-	1.76E-03	9.49E-03	2.20E-05	-2.19E-04	1.81E-01
EP-freshwater	Kg P eq.	1.61E-03	3.72E-06	3.25E-05	-	3.07E-06	9.48E-06	4.15E-08	-1.04E-06	1.66E-03
EP-marine	Kg N eq.	4.40E-02	4.68E-04	1.01E-03	-	6.21E-04	4.99E-03	2.89E-04	-3.53E-05	5.13E-02
EP-terrestrial	mol N eq.	3.26E-01	5.18E-03	7.74E-03	-	6.85E-03	4.92E-02	9.13E-05	-3.96E-04	3.94E-01
GWP-biogenic	Kg CO2 eq.	3.01E-01	2.02E-04	6.05E-03	-	1.40E-04	9.58E-04	4.64E-05	-9.05E-05	3.09E-01
GWP-fossil	Kg CO2 eq.	2.76E+01	4.08E-01	7.89E-01	-	3.04E-01	1.11E+01	2.78E-02	-5.27E-02	4.02E+01
GWP-luluc	Kg CO2 eq.	1.40E-02	1.76E-04	2.90E-04	-	1.11E-04	2.39E-04	9.16E-07	-2.03E-04	1.46E-02
GWP-total	Kg CO2 eq.	2.79E+01	4.09E-01	7.95E-01	-	3.04E-01	1.11E+01	2.78E-02	-5.30E-02	4.05E+01
ODP	Kg CFC 11 eq.	4.19E-06	9.00E-08	8.90E-08	-	6.71E-08	1.03E-07	7.72E-10	-6.78E-09	4.53E-06
POCP	Kg NMVOC eq.	1.17E-01	1.59E-03	2.63E-03	-	1.95E-03	1.12E-02	3.00E-05	-1.12E-04	1.34E-01
WDP	m3 world eq. deprived	2.20E+01	1.86E-02	4.46E-01	-	1.64E-02	1.93E-01	3.14E-04	-1.55E-02	2.27E+01

ADP-f: Depletion of abiotic resources-fossil fuels; **ADP-mm**: Depletion of abiotic resources- minerals and metals; **AP**: Acidification of soil and water; **EP-fw**: Eutrophication, freshwater; **EP-m**: Eutrophication marine; **EP-T**: Eutrophication, terrestrial; **GWP-b**: Global warming potential - Biogenic; **GWP-f**: Global warming potential - Fossil; **GWP-luluc**: Global warming potential - Land use and land use change; **GWP-total**: Global warming potential; **ODP**: Ozone layer depletion; **POCP**: Photochemical oxidants creation; **WDP**: Water use

Table 14

Results of LCA – Additional environmental indicators according to EN 15804+A2: 1m² of insulation panel – Scalable part										
Parameters	**Units**	**Product stage**	**Construction process stage**		**End-of-life stage**				**Benefits and burdens beyond the system limits**	**Total**
		A1 – A3	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**	
ETP-fw	CTUe	2.01E+03	5.12E+00	4.12E+01	-	4.09E+00	3.85E+01	5.24E-01	-3.68E-01	2.10E+03
HTP-c	CTUh	3.14E-07	1.59E-10	6.33E-09	-	1.33E-10	2.20E-09	1.60E-12	-9.38E-12	3.23E-07
HTP-nc	CTUh	3.03E-06	5.40E-09	6.13E-08	-	4.47E-09	2.35E-08	5.44E-11	-2.66E-10	3.13E-06
IRP	kBq U235 eq.	1.03E+00	2.65E-02	2.18E-02	-	1.92E-02	1.07E-02	4.08E-04	-5.87E-03	1.10E+00
PM	Disease incidence	1.90E-06	2.49E-08	3.98E-08	-	2.73E-08	3.69E-08	3.85E-10	-5.04E-10	2.03E-06
SQP	dimensionless	7.46E+01	3.61E+00	1.66E+00	-	3.97E+00	8.36E-01	1.40E-01	-1.05E-01	8.47E+01
ETP-fw: Ecotoxicity, freshwater; **HTP-c**: Human toxicity, cancer; **HTP-c**: Human toxicity, non-cancer; **IRP**: Ionising radiation, human health; **PM**: Particulate Matter; **SQP**: Land use										

Table 15

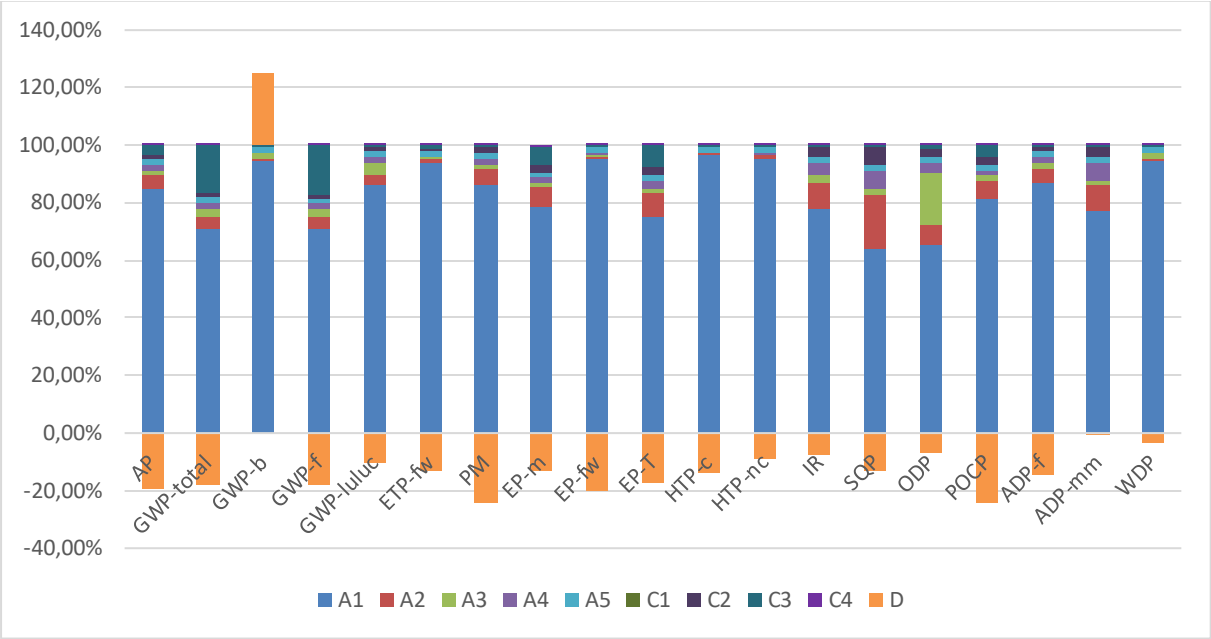
Results of LCA – Parameters describing the use of resources according to EN 15804+A2: 1m² of insulation panel – Scalable part										
Parameters	**Units**	**Product stage**	**Construction process stage**		**End-of-life stage**				**Benefits and burdens beyond the system limits**	**Total**
		A1 – A3	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**	
PERE	MJ, net calorific value	2.67E+01	1.03E-01	5.42E-01	-	5.74E-02	2.45E-01	7.17E-03	-1.24E-01	2.75E+01
PERM	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
PERT	MJ, net calorific value	2.67E+01	1.03E-01	5.42E-01	-	5.74E-02	2.45E-01	7.17E-03	-1.24E-01	2.75E+01
PENRE	MJ, net calorific value	5.48E+02	6.45E+00	1.13E+01	-	4.87E+00	3.70E+00	6.53E-02	-1.09E+00	5.73E+02
PENRM	MJ, net calorific value	1.46E+00	-	2.92E-02	-	-	-	-	-	1.49E+00
PENRT	MJ, net calorific value	5.50E+02	6.45E+00	1.13E+01	-	4.87E+00	3.70E+00	6.53E-02	-1.09E+00	5.75E+02
SM	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
RSF	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRSF	MJ, net calorific value	INA	INA	INA	INA	INA	INA	INA	INA	INA
WDP	m3	5.65E-01	7.22E-04	1.15E-02	-	5.58E-04	6.83E-03	8.33E-05	-2.33E-04	5.85E-01
PERE: renewable primay energy ex. raw materials; **PERM**: renewable primary energy used as raw materials; **PERT**: renewable primary energy total; **PENRE**: non renewable primary energy e. Raw materials; **PENRM**: non-renewable primary energy used as raw materials; **PENRT**: non-renewable primary energy total; **SM**: use of secondary material; **RSF**: use of renewable secondary fuels; **NRSF**: use of non-renewable secondary fuels; **WDP**: use of net fresh water										

Table 16

Results of LCA – Parameters describing waste categories to EN 15804+A2: 1m² of insulation panel – Scalable part										
Parameters	**Units**	**Product stage**	**Construction process stage**		**End-of-life stage**				**Benefits and burdens beyond the system limits**	**Total**
		A1 – A3	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**	
HWD	Kg	3.31E-04	1.63E-05	7.37E-06	-	1.16E-05	9.82E-06	6.81E-08	-8.03E-07	3.75E-04
NHWD	Kg	2.99E+00	2.39E-01	7.71E-02	-	2.91E-01	9.26E-02	2.37E-01	-2.14E-03	3.93E+00
RWD	Kg	1.05E-03	4.10E-05	2.26E-05	-	3.01E-05	1.01E-05	4.44E-07	-4.34E-06	1.15E-03
CRU	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
MFR	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
MER	Kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
EET	MJ per energy carrier	2.15E-03	-	-	-	-	-	-	4.36E-01	4.38E-01
EEE	MJ per energy carrier	1.25E-03	-	-	-	-	-	-	2.53E-01	2.54E-01
HWD: hazarous waste disposed; **NHWD**: non-hazarous waste disposed; **RWD**: radioactive waste disposed; **CRU**: components for re-use; **MFR**: materials for recycling; **MER**: Materials for energy recovery; **EET**: Exported Energy Thermic; **EEE**: Exported Energy Electric										

5. LCA: Interpretation

The contribution of each one of the main environmental impacts is analysed below.



Graph 1: Analysis of the contribution of the modules.

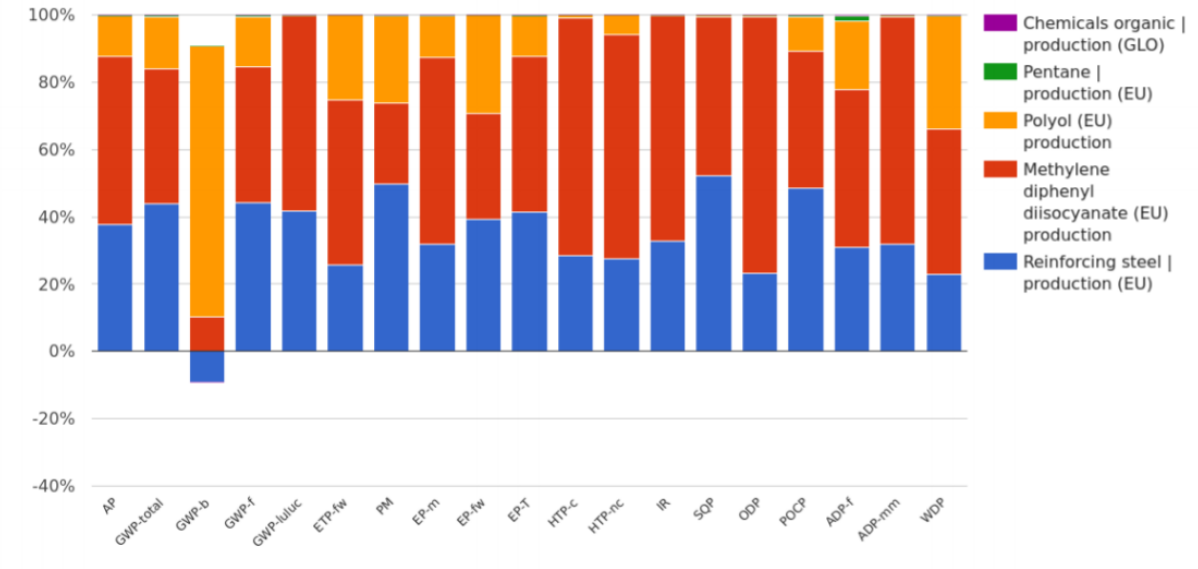
Graph 1 shows that it is stage A1 that has the greatest impact on the environment when studying the extraction and transformation of raw materials.

From stages A2 and A4, impacts related to land use and fossil fuels, such as EP-T, SQP and ADP-mm, stand out. These stages are related to transport, either from the raw materials to the factory gate or the product to the construction place.

The A3 stage, related to packaging, stands out in ODP impact due to the use of non-recyclable plastics, while the end-of-life stages contribute most to fossil GWP and eutrophication of the environment.

The positive GWP-b impact of module D, related to benefits and burdens beyond the system, stands out, although it is not visible in the overall GWP computation.

As shown in Graph 1, stage A1 is the stage that contributes most to the environmental impact of the product. For this reason, Graph 2 has been generated in order to differentiate the contribution of each of the raw materials used.



Graph 2: Analysis of the contribution to raw materials (A1)

This graph shows that Isocyanate is the raw material that contributes the most to all environmental impacts. It stands out as it is not the major component of our product as can be seen in Table 2.

6. Environmental indicator key

Abbreviation	Impact category	Parameters	Unit
ADP –fossil	Resource use – fossil fuels	Abiotic resource depletion potential for fossile resources	MJ. net calorific value
ADP – minerals&metals	Resource use – minerals and metals	Abiotic resource depletion potential for non-fossil resources	Kg Sb-Eq.
AP	Acidification	Acidification potential. cumulative surpluss	mol H+ eq.
EP – freshwater	Eutrophication of freshwater	Eutrophical potential. fraction of nutrients reaching the final freshwater compartment	Kg P eq.
EP - marine	Eutrophication of marine water	Eutrophical potential. fraction of nutrients that reach the final compartment of marine water	Kg N eq.
EP – terrestrial	Eutrophication terrestrial	Eutrophical potential. cumulative surplus	mol N eq.
ETP-fw	Ecotoxicity freshwater	Comparative potential of toxic unit for ecosystems	CTUe
GWP – biogenic	Global warming potential – biogenic	Global warming potential of fossil fuels	Kg CO^{2-}eq.
GWP – fossil	Global warming potential – fossil	Biogenic global warming potential	Kg CO^{2-}eq.
GWP – luluc	Global warming potential – land use and land use change	Global warming potential from land use and land-use change	Kg CO^{2-}eq.
GWP – total	Global warming potential – total	Total global warming potential	Kg CO^{2-}eq.
HTP-c	Human toxicity. cancer	Comparative potential of toxic unit for ecosystems (carcinogenic effects)	CTUh
HTP-nc	Human toxicity. non-cancer	Comparative potential of toxic unit for ecosystems (non-carcinogenic effects)	CTUh
IR	Ionising radiation. human health	Exposure efficiency of the human potential relative to U235	KBq U235 eqv.
ODP	Ozone depletion	Stratospheric ozone depletion potential	Kg CFC 11 eq.
PM	Particulate matter	Potential for disease occurrence due to emissions of particulate matter.	Disease incidences
POCP	Photochemical ozone formation	Potential for tropospheric ozone formation	Kg NMVOC eq.
SQP	Impacts related to land use / land change	land quality potential index	dimensionless
WDP	Water use	Water deprivation potential (user). wighted water deprivation consumption	m^3 world private eq.

7. Abbreviations

EPD: Environmental product declaration

INA: Indicator not assessed

LCA: Life cycle analysis

PAP: Paneles Aislantes Peninsulares. S.L.

PIR: Polyisocyanurate

PND: Undeclared benefit

PUR: Polyurethane

8. References

Calculation basis:

LCA Method: EN 15804:2019+A2
Software of LCA: Simapro 9.1
Characterisation method: EN 15804+A2 Method v1.0
LCA database profiles: EcoInvent version 3.6
Database version: v3.07 (2021-11-08)

EN 14509:2013 – Self-supporting double skin metal faced insulating panels – Factory made products – Specifications.

EN 15804:2012+A1:2013 – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

EN 15804:2012+A2:2019 – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

EN 16783:2017 – Thermal insulation products – Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations.

EN ISO 14025:2010 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures. (ISO 14025:2006)

EN ISO 14040:2006/A1:2020 – Environmental management – Life cycle assessment – Principles and frameworks. (ISO 14040:2006/Amd1: 2020).

EN ISO 14044:2006/A2:2020 – Environmental management – Life cycle assessment – Requirements and guidelines. (ISO 14044:2006/Amd2: 2020).

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