

EPD

2020

ENVIRONMENTAL PRODUCT DECLARATION

SANDWICH PANELS
WITH STEEL FACINGS
AND EXPANDED POLYURETHANE
OR POLYISOCYANURATE INSULATING CORE

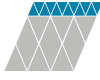

ISOCOP / ISOSMART / ISOBOX / ISOPARETE
ISOPARETE PLUS 2 / ISOPIANO / ISOFROZEN / ISOFROZEN HT
ISOCOP LEAF / ISOBOX LEAF
ISOPARETE PLUS 2 LEAF / ISOPIANO LEAF
ISOFROZEN LEAF / ISOFROZEN HT LEAF
ISODECK PVSTEEL PU / ISODOMUS CLASSIC



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01. GENERAL INFORMATION

NAME AND ADDRESS OF THE MANUFACTURER	Isopan S.p.A. Via Augusto Righi n. 7 37135 Verona (VR) Italia	 ISOPAN INSULATING DESIGN
PROGRAMME OPERATOR	EPD International AB INTERNATIONAL EPD® SYSTEM www.environdec.com	 EPD ® THE INTERNATIONAL EPD® SYSTEM
EPD® PUBLICATION DATE	23/04/2019	
EPD® REVISION DATE	10/03/2021	
EPD® VALIDITY	26/03/2024	
EPD® PRODUCTS	Sandwich panels with steel facings and expanded polyurethane or polyisocyanurate insulating core	
PRODUCT GROUPS	<p>WALL PANELS: thickness from 25 to 200 mm</p> <p>ROOF PANELS: thickness from 30 to 150 mm</p> <p>ISODOMUS CLASSIC: thickness from 30 to 100 mm</p> <p>WALL PANELS WITH LEAF TECHNOLOGY: thickness from 60 to 200 mm</p> <p>ROOF PANELS WITH LEAF TECHNOLOGY: thickness from 60 to 150 mm</p> <p>ISODECK PVSTEEL PU: thickness from 30 to 150 mm</p>	Representative products identified by specific thicknesses of insulating core and steel; the environmental performance results were calculated for additional insulating core and steel thicknesses based on the processing of LCA results.
DECLARED UNIT	1 m ² of insulating panel with a specific thermal resistance	
SYSTEM BOUNDARIES	From cradle to gate with options	The LCA study was carried out considering the Product stage phases (A1-A2-A3), Distribution (A4), End of life (C2-C3-C4), Potential environmental benefits (D) in accordance with EN 15804:2012
REFERENCE SITES FOR THE CALCULATION OF ENVIRONMENTAL PERFORMANCES	Via Giona, 5 - Trenzuelo, VR 37060 - Italia	Strada Prov. Morolense - Z.I, Patrica, FR 03010 - Italia

02. COMPANY PROFILE

THE GROUP

Isopan S.p.A is a company of Manni Group.

Manni Group promotes innovation in the processing and use of steel in all its applications, developing solutions and services for engineering structures, energy efficiency and sustainability, enabling companies, users and consumers in different markets, from large infrastructures, to Oil & Gas and mechanics.

Manni Group is committed to the creation of innovative, low-impact and carbon-emission buildings, in which healthy and safe materials are used, through constant commitment to research and development of products, services and solutions for dry-construction and redevelopment of the buildings.

THE COMPANY

Isopan is one of the world leaders in the production of insulating metal panels for roofs and walls intended for commercial, industrial, civil, zootechnical constructions, and for cold logistics.

The Isopan Group is based in Verona and controls six manufacturing companies in the world. It is present in Italy with two production plants in Frosinone and Verona, and in the world with Isopan Ibérica in Tarragona (Spain), Isopan Est in Bucharest (Romania), Isopan Deutschland in Plötz (Halle, Germany), Isopan Rus in Volžskij (Volgograd, Russia) and Isocindu in Silao (Guanajuato, Mexico). Two commercial companies are the reference for France (Mérignac) and the Czech Republic (Prague). Furthermore, the International Business Division develops specific solutions for the needs of the different countries where Isopan is distributed. The widespread presence on the territory and a consolidated network of commercial contacts allows Isopan to preside over the most important markets in the world.

Isopan has always been committed to the innovation of products and services for buildings, with particular attention to improving the performance of buildings in the fields of environment, safety and energy efficiency. Isopan products contribute to obtaining the prerequisites and credits useful for the most widespread sustainability standards of buildings, such as LEED, BREEAM or Living Building Challenge.

03. PRODUCT SPECIFICATION

DESCRIPTION

Insulating sandwich panels are components for the building's envelope. They consist of two external metal sheet skins, which enclose an insulating core.

This EPD takes into consideration sandwich panels with an insulating core of polyurethane or polyisocyanurate foam. The metal sheets are composed of steel, are profiled and the metal layer is protected against corrosion by galvanization and prepainting. The declared insulation panels can be used for roofs and walls of industrial, commercial, civil buildings, animal husbandry and cold stores. They are light, versatile and easy to assemble, and they assure thermal and acoustic insulation, solidity, air tightness and fire safety.

Isopan offers an extremely wide range of metal panels, which includes different thicknesses, colors and surface finishes to create customized solutions with an innovative design.

WALL PANELS

Wall panel with double metal coating with polyurethane insulation. The joint, with tongue-and-groove joints, can be of the visible (ISOBOX and ISOPIANO) or hidden type (ISOPARETE and ISOPARETE PLUS 2), both with through screw.

There are also panels with high thermal insulation performance and quality of the junction system (ISOFROZEN and ISOFROZEN HT), which make them particularly suitable for the creation of environments where a controlled temperature is required, such as cold rooms and processing chambers.

ROOF PANELS

ISOCOP and ISOSMART are sandwich panels with double metal coating, for roofs with a slope of not less than 7%, insulated in polyurethane, with external profiled sheet with 5 ribs. Fixing is done with through screws and special metal caps with gasket. They are also used in wall cladding.

ISODOMUS CLASSIC

It represents the maximum evolution in the aesthetic sense of an insulated panel intended for roofing in civil buildings. The design in the shape of a tile or coppo allows the creation of functional, aesthetically pleasing, light, safe, waterproof roofs with simple and quick assembly. It is suitable for civil roofing or in the industrial sector with warehouses located in certain urban contexts.

ISODECK PVSteel PU

Ideal panel for making flat or slightly sloping roofs. The panel consists of an external metal support pre-coupled with a PVC / TPO membrane, an internal corrugated support and an insulating polyurethane core; the solution makes it possible to create a completely waterproof covering of high aesthetic value, also ideal for replacing fiber cement covers. The ISODECK PVSteel PU panel takes part in the Isopan GREEN ROOF, a solution for green roofs.

ISODECK PVSteel PU panel is an Isopan patented product.



LEAF

The new LEAF generation insulation formulation gives Isopan wall and roof panels important properties:

1. Reduction of environmental impacts

As part of Isopan's Research and Development processes, always attentive to sustainability issues, LEAF technology represents a further step to minimize the environmental impact of its products. The flame retardants commonly used to improve the fire behavior of materials are based on halogenated compounds, potentially harmful to the environment; thanks to LEAF technology, Isopan is able to guarantee high fire performance without the use of halogenated flame retardants.

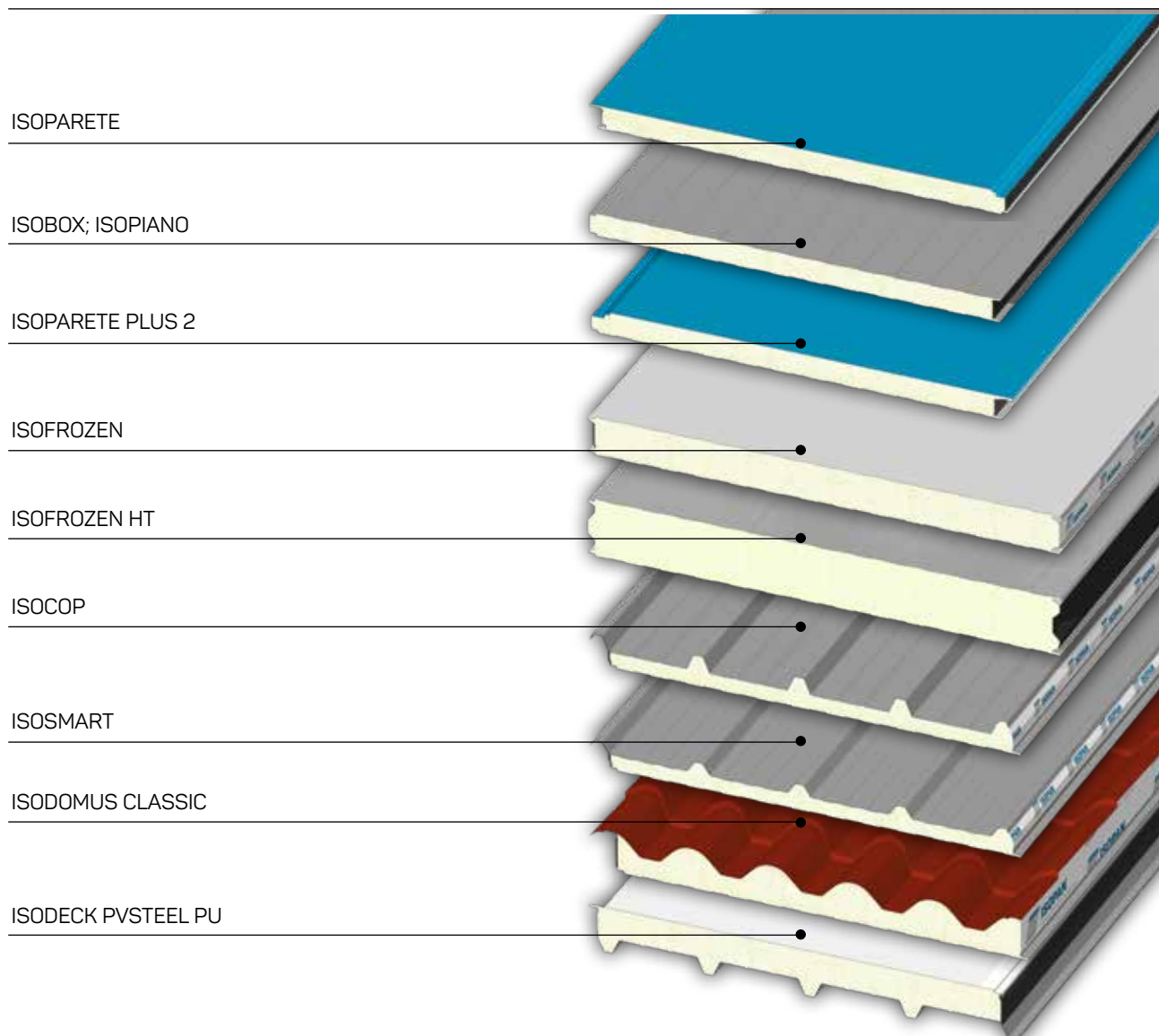
2. Increased fire safety

In a market that is increasingly attentive to safety issues, Isopan is committed to achieving the highest levels of fire performance for its products. In particular, the LEAF solutions have also obtained the highest fire reaction certification in the European field for polyurethane panels, called B-s1, d0. The achievement of the "s1" performance is particularly significant and important for polyurethane panels because it certifies the absence of fumes deriving from exposure to fire of the foam.

3. More comfort, less costs

In order to maximize thermal performance for the increasingly demanding regulations and reference standards, Isopan has worked to innovate production processes and use new generation formulations. The LEAF solution allows to improve the thermal performance of the insulating material, in particular by reducing the thermal conductivity value of the polyurethane foam. Consequently, with the same thickness, it is possible to obtain lower thermal transmittances than a standard product. This technical improvement can result in a reduction of heat losses due to the building envelope by up to 20%.

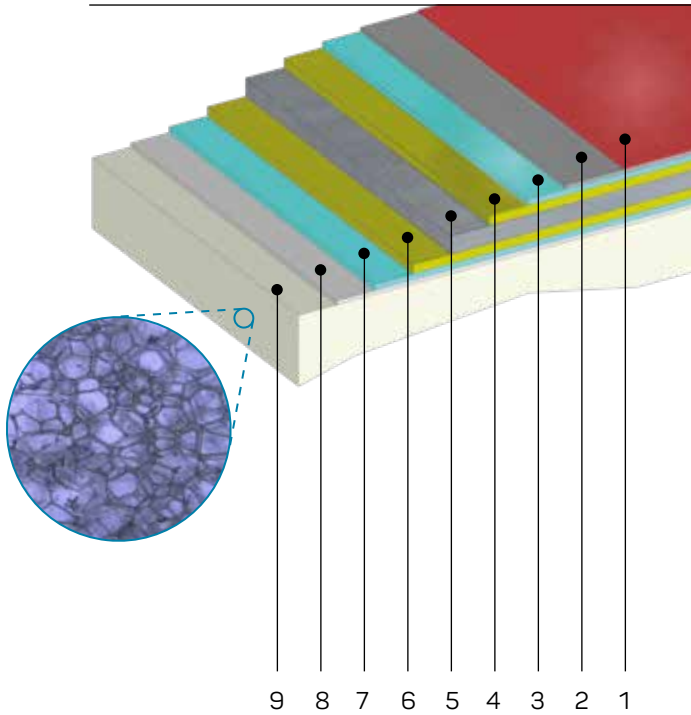
The panels that can be produced with LEAF technology are ISOBOX, ISOPIANO, ISOPARETE PLUS 2, ISOFROZEN and ISOFROZEN HT for the walls and ISOCOP for the roofs. The general characteristics for each product family are summarized in the following section.



GENERAL FEATURES

The insulating core of the panel is made of closed-cell rigid polyurethane or polyisocyanurate foam, a light material that allows for high energy performance by limiting the volumes and weights used in applications.

The panels DO NOT contain SVHC Substances of Very High Concern covered by ECHA's Candidate List in concentrations greater than 0.1% by mass.



METAL PREPAINTED SUPPORTS: COMPOSITION

1. Top coating
2. Primer
3. Pretreatment
4. Galvanizing
5. Steel
6. Galvanizing
7. Pretreatment
8. Back coating
9. Polyurethane foam



For each product family, the general characteristics are shown, such as the type of insulating material and its density, the material that constitutes the internal and external facings of the panel, fire reaction class and the main applications. Further data regard the weight of the panel in kg / m² (depending on the thickness of both the insulation and the internal and external pre-painted steel supports), the composition of the panel (expressed in percentages by weight) and the thermal transmittance coefficient U. Any missing weight or composition data can be estimated by linear interpolation.

WALL PANELS

TABLE 3.1 General characteristics of wall panels

Commercial names	ISOBOX, ISOPIANO, ISOPARETE, ISOPARETE PLUS 2, ISOFROZEN, ISOFROZEN HT
Panel thickness for LCA analysis	40 – 150 mm
Insulating material	PU/PIR
Density of insulating material	38 - 40 kg/m ³
Inner / outer facing material	Organic coated steel
Reaction to fire	Variable according to the required specifications
Applications	Wall

TABLE 3.2 Weight, composition and thermal transmittance of the wall panels

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)											
			25	30	35	40	50	60	80	100	120	150	180	200
			Weight (%) and composition of wall panels											
0.4	0.4	Weight kg/m ²	7.7	7.9	8.1	8.3	8.7	9.1	9.9	10.7	11.5	12.7	13.9	14.7
		% Steel	87.0	84.7	82.6	80.6	76.9	73.5	67.6	62.5	58.1	52.6	48.1	45.4
		% Insulating core	13.0	15.3	17.4	19.4	23.1	26.5	32.4	37.5	41.9	47.4	51.9	54.6
0.4	0.5	Weight kg/m ²	8.5	8.7	8.9	9.1	9.5	9.9	10.7	11.5	12.3	13.5	14.7	15.5
		% Steel	88.2	86.2	84.3	82.4	78.9	75.8	70.1	65.2	61.0	55.6	51.0	48.4
		% Insulating core	11.8	13.8	15.7	17.6	21.1	24.2	29.9	34.8	39.0	44.4	49.0	51.6
0.5	0.5	Weight kg/m ²	9.3	9.5	9.7	9.9	10.3	10.7	11.5	12.3	13.1	14.3	15.5	16.3
		% Steel	89.3	87.4	85.6	83.9	80.6	77.6	72.3	67.6	63.4	58.1	53.6	51.0
		% Insulating core	10.7	12.6	14.4	16.1	19.4	22.4	27.7	32.4	36.6	41.9	46.4	49.0
0.5	0.6	Weight kg/m ²	10.2	10.4	10.6	10.8	11.2	11.6	12.4	13.2	14.0	15.2	16.4	17.2
		% Steel	90.2	88.4	86.7	85.1	82.1	79.2	74.1	69.6	65.6	60.4	56.0	53.4
		% Insulating core	9.8	11.6	13.3	14.9	17.9	20.8	25.9	30.4	34.4	39.6	44.0	46.6
0.6	0.6	Weight kg/m ²	11.0	11.2	11.4	11.6	12.0	12.4	13.2	14.0	14.8	16.0	17.2	18.0
		% Steel	90.9	89.3	87.7	86.2	83.3	80.6	75.8	71.4	67.6	62.5	58.1	55.6
		% Insulating core	9.1	10.7	12.3	13.8	16.7	19.4	24.2	28.6	32.4	37.5	41.9	44.4
Thermal transmittance values U (W/m² K)			0.83	0.70	0.61	0.54	0.44	0.37	0.28	0.22	0.19	0.15	0.12	0.11

ROOF PANELS

TABLE 3.3 General characteristics of roof panels

Commercial names	ISOCOP, ISOSMART
Panel thickness for LCA analysis	40 – 150 mm
Insulating material	PU/PIR
Density of insulating material	38 - 40 kg/m ³
Inner / outer facing material	Organic coated steel
Reaction to fire	Variable according to the required specifications
Applications	Roof - Wall

TABLE 3.4 Weight, composition and thermal transmittance of the roof panels

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)							
			30	40	50	60	80	100	120	150
			Weight (%) and composition of roof panels							
0.4	0.4	Weight kg/m ²	8,7	9,1	9,5	9,9	10,7	11,5	12,3	13,5
		% Steel	83,8	80,1	76,7	73,6	68,1	63,3	59,2	53,9
		% Insulating core	16,2	19,9	23,3	26,4	31,9	36,7	40,8	46,1
0.4	0.5	Weight kg/m ²	9,7	10,1	10,5	10,9	11,7	12,5	13,3	14,5
		% Steel	85,4	82,0	78,9	76,0	70,8	66,2	62,2	57,0
		% Insulating core	14,6	18,0	21,1	24,0	29,2	33,8	37,8	43,0
0.5	0.5	Weight kg/m ²	10,5	10,9	11,3	11,7	12,5	13,3	14,1	15,3
		% Steel	86,6	83,4	80,4	77,7	72,7	68,3	64,4	59,4
		% Insulating core	13,4	16,6	19,6	22,3	27,3	31,7	35,6	40,6
0.5	0.6	Weight kg/m ²	11,5	11,9	12,3	12,7	13,5	14,3	15,1	16,3
		% Steel	87,7	84,8	82,0	79,4	74,7	70,5	66,8	61,8
		% Insulating core	12,3	15,2	18,0	20,6	25,3	29,5	33,2	38,2
0.6	0.6	Weight kg/m ²	12,3	12,7	13,1	13,5	14,3	15,1	15,9	17,1
		% Steel	88,6	85,8	83,1	80,7	76,2	72,1	68,5	63,7
		% Insulating core	11,4	14,2	16,9	19,3	23,8	27,9	31,5	36,3
Thermal transmittance values U (W/m² K)			0.71	0.54	0.44	0.37	0.28	0.22	0.19	0.15

ISODOMUS CLASSIC

TABLE 3.5 General characteristics of Isodomus Classic panels

Commercial names	ISODOMUS CLASSIC
Panel thickness for LCA analysis	40 – 100 mm
Insulating material	PU/PIR
Density of insulating material	38 - 40 kg/m ³
Inner / outer facing material	Organic coated steel
Reaction to fire	Variable according to the required specifications
Applications	Roof

TABLE 3.6 Weight, composition and thermal transmittance of the Isodomus Classic panels

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)					
			30	40	50	60	80	100
			Weight (%) and composition of Isodomus Classic panels					
0.4	0.4	Weight kg/m ²	9.1	9.5	9.9	10.3	11.1	11.9
		% Steel	79.6	76.3	73.2	70.4	65.3	60.9
		% Insulating core	20.4	23.7	26.8	29.6	34.7	39.1
0.4	0.5	Weight kg/m ²	10.1	10.5	10.9	11.3	12.1	12.9
		% Steel	81.6	78.5	75.6	72.9	68.1	63.9
		% Insulating core	18.4	21.5	24.4	27.1	31.9	36.1
0.5	0.5	Weight kg/m ²	10.9	11.3	11.7	12.1	12.9	13.7
		% Steel	83.0	80.1	77.3	74.8	70.2	66.1
		% Insulating core	17.0	19.9	22.7	25.2	29.8	33.9
0.5	0.6	Weight kg/m ²	11.9	12.3	12.7	13.1	13.9	14.7
		% Steel	84.4	81.7	79.1	76.7	72.3	68.3
		% Insulating core	15.6	18.3	20.9	23.3	27.7	31.7
0.6	0.6	Weight kg/m ²	12.8	13.2	13.6	14.0	14.8	15.6
		% Steel	85.4	82.8	80.4	78.1	73.8	70.0
		% Insulating core	14.6	17.2	19.6	21.9	26.2	30.0
Thermal transmittance values U (W/m² K)			0.55	0.43	0.38	0.29	0.24	0.19

ISODECK PVSTEEL PU

TABLE 3.7 General characteristics of Isodeck PVSteel PU panels

Commercial names	ISODECK PVSTEEL PU TPO, ISODECK PVSTEEL PU PVC
Panel thickness for LCA analysis	40 – 150 mm
Insulating material	PU/PIR
Density of insulating material	38 - 40 kg/m ³
Inner / outer facing material	Organic coated steel + TPO / PVC membrane (external side only)
Reaction to fire	Variable according to the required specifications
Applications	Roof

ISODECK PVSTEEL PU - TPO

TABLE 3.8 Weight, composition and thermal transmittance of Isodeck PVSteel panels with TPO membrane

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)							
			30	40	50	60	80	100	120	150
			Weight (%) and composition of Isodeck PVSteel PU - TPO panels							
0.5	0.8	Weight kg/m ²	13.6	14.0	14.4	14.8	15.6	16.4	17.2	18.4
		% Steel	85.3	82.8	80.5	78.3	74.3	70.7	67.4	63.0
		% Insulating core	10.4	12.9	15.4	17.6	21.9	25.7	29.2	33.8
		% TPO	4.4	4.2	4.1	4.0	3.8	3.6	3.4	3.2
0.6	0.8	Weight kg/m ²	14.6	15.0	15.4	15.8	16.6	17.4	18.2	19.4
		% Steel	86.3	84.0	81.8	79.7	75.8	72.4	69.2	64.9
		% Insulating core	9.7	12.1	14.4	16.5	20.6	24.2	27.6	32.1
		% TPO	4.1	4.0	3.9	3.8	3.6	3.4	3.3	3.1
0.7	0.8	Weight kg/m ²	15.5	15.9	16.3	16.7	17.5	18.3	19.1	20.3
		% Steel	87.1	84.9	82.9	80.9	77.2	73.8	70.7	66.6
		% Insulating core	9.1	11.3	13.5	15.6	19.4	22.9	26.2	30.5
		% TPO	3.8	3.7	3.6	3.5	3.4	3.2	3.1	2.9
0.8	0.8	Weight kg/m ²	16.5	16.9	17.3	17.7	18.5	19.3	20.1	21.3
		% Steel	87.9	85.8	83.8	81.9	78.4	75.2	72.2	68.1
		% Insulating core	8.5	10.7	12.7	14.7	18.4	21.8	24.9	29.1
		% TPO	3.6	3.5	3.4	3.3	3.2	3.1	2.9	2.8
Thermal transmittance values U (W/m² K)			0.71	0.54	0.44	0.37	0.28	0.22	0.19	0.15

ISODECK PVSTEEL PU - PVC

TABLE 3.9 Weight, composition and thermal transmittance of Isodeck PVSteel panels with PVC membrane

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)							
			30	40	50	60	80	100	120	150
			Weight (%) and composition of Isodeck PVSteel PU - PVC panels							
0.5	0.8	Weight kg/m ²	14.2	14.6	15.0	15.4	16.2	17.0	17.8	19.0
		% Steel	81.8	79.5	77.4	75.4	71.6	68.3	65.2	61.1
		% Insulating core	9.9	12.4	14.8	17.0	21.1	24.8	28.2	32.7
		% PVC	8.3	8.1	7.9	7.6	7.3	6.9	6.6	6.2
0.6	0.8	Weight kg/m ²	15.1	15.5	15.9	16.3	17.1	17.9	18.7	19.9
		% Steel	82.9	80.8	78.8	76.9	73.3	70.0	67.0	63.0
		% Insulating core	9.3	11.6	13.8	16.0	19.9	23.5	26.7	31.1
		% PVC	7.8	7.6	7.4	7.2	6.9	6.5	6.3	5.9
0.7	0.8	Weight kg/m ²	16.1	16.5	16.9	17.3	18.1	18.9	19.7	20.9
		% Steel	84.0	81.9	80.0	78.2	74.7	71.6	68.7	64.7
		% Insulating core	8.7	10.9	13.0	15.1	18.8	22.2	25.4	29.7
		% PVC	7.3	7.1	6.9	6.8	6.5	6.2	6.0	5.6
0.8	0.8	Weight kg/m ²	17.1	17.5	17.9	18.3	19.1	19.9	20.7	21.9
		% Steel	84.9	83.0	81.1	79.3	76.0	73.0	70.1	66.3
		% Insulating core	8.2	10.3	12.3	14.2	17.8	21.1	24.2	28.3
		% PVC	6.9	6.7	6.6	6.4	6.1	5.9	5.7	5.4
Thermal transmittance values U (W/m² K)			0.71	0.54	0.44	0.37	0.28	0.22	0.19	0.15

LEAF

TABLE 3.10 General characteristics of wall panels with LEAF foam

Commercial names	ISOBOX, ISOPIANO, ISOFROZEN, ISOFROZEN HT, ISOPARETE, ISOPARETE PLUS 2, ISOCOP
Panel thickness for LCA analysis	80 – 150 mm
Insulating material	PIR Leaf
Density of insulating material	40 kg/m ³
Inner / outer facing material	Organic coated steel
Reaction to fire	Bs1d0
Applications	Wall - Roof

LEAF for Wall Panels

TABLE 3.11 Weight, composition and thermal transmittance of LEAF wall panels

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)						
			60	80	100	120	150	180	200
			Weight (%) and composition of LEAF wall panels						
0.5	0.5	Weight kg/m ²	10.7	11.5	12.3	13.1	14.3	15.5	16.3
		% Steel	77.6	72.3	67.6	63.4	58.1	53.6	51.0
		% Insulating core	22.4	27.7	32.4	36.6	41.9	46.4	49.0
0.5	0.6	Weight kg/m ²	11.6	12.4	13.2	14.0	15.2	16.4	17.2
		% Steel	79.2	74.1	69.6	65.6	60.4	56.0	53.4
		% Insulating core	20.8	25.9	30.4	34.4	39.6	44.0	46.6
0.6	0.6	Weight kg/m ²	12.4	13.2	14.0	14.8	16.0	17.2	18.0
		% Steel	80.6	75.8	71.4	67.6	62.5	58.1	55.6
		% Insulating core	19.4	24.2	28.6	32.4	37.5	41.9	44.4
Thermal transmittance values U (W/m² K)			0.33	0.23	0.18	0.15	0.12	0.10	0.09

LEAF for Roof Panels

TABLE 3.12 Weight, composition and thermal transmittance of LEAF roof panels

Internal steel thickness (mm)	External steel thickness (mm)		Insulation thickness (mm)			
			60	80	100	120
			Weight (%) and composition of LEAF roof panels			
0.5	0.5	Weight kg/m ²	11.7	12.5	13.3	14.1
		% Steel	77.7	72.7	68.3	64.4
		% Insulating core	22.3	27.3	31.7	35.6
0.5	0.6	Weight kg/m ²	12.7	13.5	14.3	15.1
		% Steel	79.4	74.7	70.5	66.8
		% Insulating core	20.6	25.3	29.5	33.2
0.6	0.6	Weight kg/m ²	13.5	14.3	15.1	15.9
		% Steel	80.7	76.2	72.1	68.5
		% Insulating core	19.3	23.8	27.9	31.5
Thermal transmittance values U (W/m² K)			0.33	0.23	0.18	0.15

PANELS TECHNICAL FEATURES

Sandwich panels are designed and manufactured in compliance with the technical specifications defined in following regulations:

- EN 14509
- EN 13165
- EN 10346

The panels declared in this EPD are CE marked. With this mark, the manufacturer states that the products comply with all the legislative requirements concerning health and safety and environmental protection.

The sandwich panels with steel skins, according to the conditions of use, have an estimated duration of 40-45 years, as defined on the basis of the methodology for assessing the durability of building components developed by the German Federal Research Institute BBSR (Federal Institute for Building Research, Urban Affairs and Spatial Development) and available on the website: www.nachhaltigesbauen.de/baustoff-und-gebaeuedaten/nutzungsdauern-von-bauteilen.html.

EFFICIENCY AND ENERGY SAVINGS

Isopan insulating panels have high thermal insulation properties. Performance may vary depending on the thickness of the panel and the type of insulation selected. These parameters can be defined and customized at the product order stage, to comply at best the project design needs.

FIRE PERFORMANCE

Isopan sandwich panels offer excellent fire reaction and resistance performance, certified according to EN 13501, parts 1 and 2. Depending on the project specifications, Isopan is able to offer different degrees of performance.

04. SYSTEM BOUNDARIES

In accordance with EN 15804, the following table shows the different phases that make up the life cycle of a construction product and identifies the specific phases (system boundaries) taken into consideration in this declaration.

PRODUCT STAGE	Raw materials	A1	X
	Transport	A2	X
	Manufacturing	A3	X
CONSTRUCTION PROCESS STAGE	Transport	A4	X
	Construction installation	A5	MND
USE STAGE	Use	B1	MND
	Maintenance	B2	MND
	Repair	B3	MND
	Replacement	B4	MND
	Refurbishment	B5	MND
	Operational energy use	B6	MND
	Operational water use	B7	MND
END OF LIFE STAGE	De-construction demolition	C1	MND
	Transport	C2	X
	Waste processing	C3	X
	Disposal	C4	X
RESOURCE RECOVERY STAGE	Reuse - Recovery - Recycling - Potential	D	X

X = Module included in the LCA study

MND = Module not declared

The declared modules include:

A1 Raw materials supply

A2 Raw materials Transport

A3 Manufacturing of the product

A4 Product distribution

C2-C3-C4 Waste Transport / Treatment / Disposal

D Reuse, Recovery, Recycling potential

05. PRODUCTION PROCESS

The production process of Isopan sandwich panels is divided into different phases, ranging from the acquisition of raw materials to the packaging of the finished product. The panels are made with a continuous process, which can be schematized in the following phases: profiling, foaming, cutting and packaging.

PROFILING

Gives the shape to the steel sheets that enclose the insulating material. The production process begins with the unwinding of pre-painted galvanized steel coils, which pass through a series of rollers shaping the geometry of laminates.

FOAMING

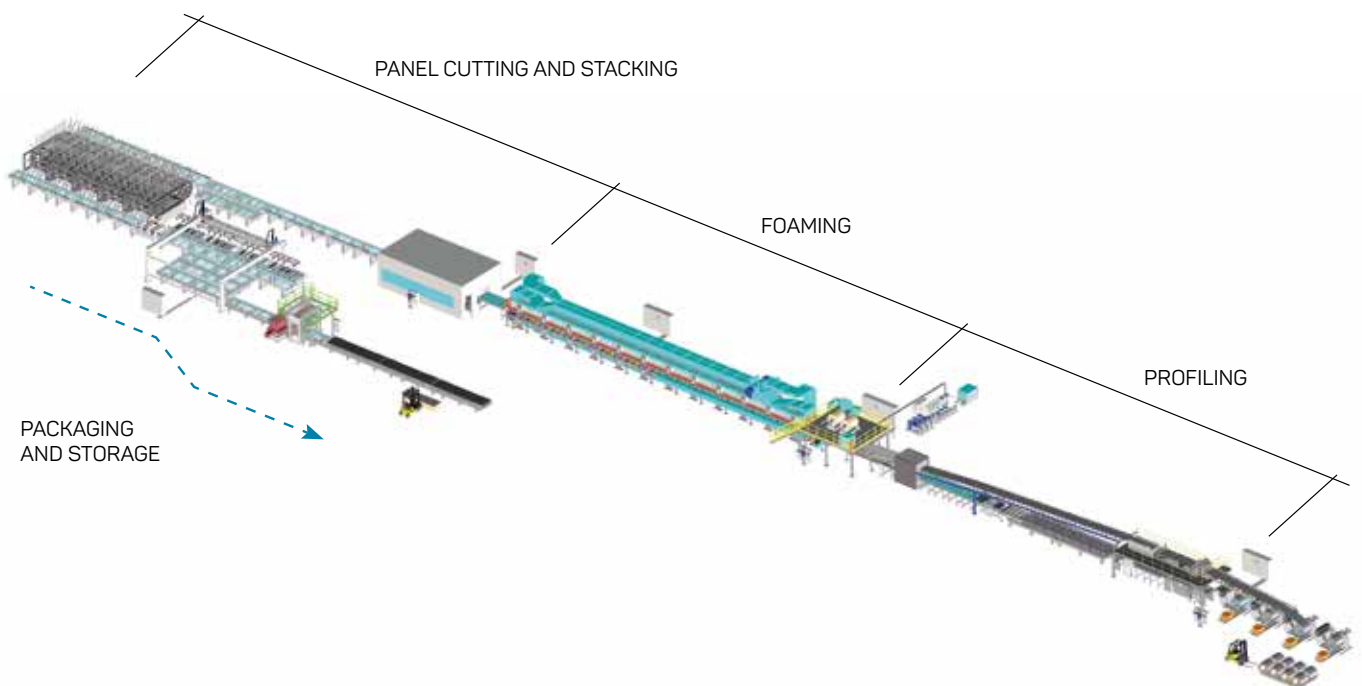
Application of the insulating foam that fills the panel core. The chemical components are mixed and applied between the two steel sheets; the passage through a heated press favors the maturation of the product.

PANEL CUTTING AND STACKING

The product is cut according to the specifications required by the order and stacked for the formation of packages to be delivered to customers.

PACKAGING AND STORAGE

Application of various protective systems to help handling parcels on site and reduce the possibility of material damage during transport.



06. CALCULATION METHODOLOGY

FUNCTIONAL UNIT

The functional unit is 1 m² of insulating panel with specific R-value (Thermal Resistance expressed as m² K/W) depending on the nominal thickness of the panel.

SYSTEM BOUNDARIES

Declaration Type:
Cradle to Gate With Options.

The Product Stage (A1-A3) includes materials and electricity production processes (A1), material transport (A2) and manufacturing at Isopan production sites (A3).

It is also considered:

- phase A4: finished product distribution, based on the average transport distances of the products from the Isopan production plants to the delivery / use sites, by standard road transport
- phases C2 - C3 - C4: transport, treatment, disposal of the panel components at the end of life
- Module D: potential environmental benefits deriving from the recycling / recovery of panel components at the end of their life

The LCA analysis underlying this EPD was carried out in compliance with the international standards ISO 14040/14044 and the European standard EN 15804 on construction products.

Geographical scope: Europe.

DATA COLLECTION

The LCA analysis was performed on the basis of primary data for the year 2019, collected for the Isopan plants in Trevenzuolo (VR) and Patrica (FR).

Primary data relating to both plants were acquired with regard to energy consumption, waste production, atmospheric emissions, consumption of raw materials and auxiliaries, distances and types of transport relating to the production plants concerned.

Secondary data have been used for the modeling of the production processes of raw materials and auxiliary materials, production of packaging materials, transport of materials, treatment of waste and end-of-life materials. The environmental databases used are: World Steel Association for organic coated steel production processes, Plastics Europe for production processes of polyurethane foam ingredients, Ecoinvent 3.5 for production processes of other materials, transport and end-of-life treatment.

The modeling of the LCA system was carried out with SIMAPRO 9.0.0.



END OF LIFE

The management of the panel at the end of its life cannot be controlled by Isopan. The end of life scenarios have been defined on the basis of literature data related to the construction sector or national statistics on waste disposal. Average data from studies conducted in Europe lead to consider that about 90% of the end-of-life panels are collected at the sites of disposal/demolition of buildings and its components are sent for recycling/recovery. Isopan panels are easily disassembled to facilitate the recycling of its components (steel and insulating materials). The steel is collected for recycling, constituting a source of secondary material for the production of new steel. The polyurethane collected by the panels at the end of life is destined to waste-to-energy. The residual percentage of panels, not intended for the collection, separation, recovery and recycling, is destined to landfill. The treatment processes at the end of life of packaging materials has been modeled on the basis of national statistical surveys on recovery and recycling rates of plastic materials.

MODULE D

In accordance with the PCRs of the construction products sector, Module D can be used to declare the potential environmental benefits deriving from the recycling and recovery of the product or parts thereof, outside the boundaries of the system under study. At the end of life, the Isopan panel generates two flows of materials whose treatment can give rise to environmental credits accounted for in Module D of this EPD:

- **steel destined to recycling:** the steel is one of the most recycled materials in the world; to quantify the environmental credit related to the use of scrap steel instead of virgin raw materials in the steel industry, data sets provided by the World Steel Association (WSA) were used for organic coated steel produced respectively in Europe and Asia. Details on context and WSA methodology is available at www.worldsteel.org
- **polyurethane intended to incineration:** the polyurethane incineration in waste to energy plants produces electricity sold to the grid; such energy can replace an equivalent amount of electricity produced by the reference production mix
- **for PVSteel products only:** protective membrane in TPO or PVC plastic with material recovery (recycling) and energy production from incineration, deriving from the membrane at the end of life.

LCA RESULTS

The LCA analysis was carried out considering material and energy flows in and out of the system, normalized with respect to 1 m² of panel having a thickness of 40, 80 or 150 mm and specific Thermal Resistance (R-value) performance. The main function of Isopan panels is to provide thermal insulation for buildings; for this reason the LCA results normalized with respect to a Thermal Resistance unit (1 m² K/W) were also provided, obtaining the environmental load of different panels compared to the same value of Thermal Resistance R. Those values can be calculated with the protocol described in the following section.



07. ENVIRONMENTAL PERFORMANCES

The environmental performance indicators are summarized in the following tables, grouped by product family. Data are reported for the insulation and steel thicknesses used for the LCA study. At the end of each section a table defines the results as a function of insulation and steel thicknesses, using formulas. These expressions can be used to calculate the values of environmental performance indicators in cases not explicitly mentioned.

For example, as regards wall panels, tables 7.1 and 7.2 show the indicators relating to the insulation thickness of 40 and 150 mm respectively. In both cases, the thickness of the steel supports considered is 0.5 / 0.4 mm (external/internal). Indicators for other combinations of insulation thickness and steel supports (for example 100 mm insulation and 0.6 / 0.6 mm external / internal steel) can be calculated with the formulas shown in Table 7.3.

For each environmental performance indicator, the formulas are:

$$A * i + B * m + C = y$$

Where i is the insulation thickness expressed in mm, m is the total (sum) thickness of the steel (internal + external) expressed in mm. A, B and C are constants that vary according to the indicator, the module and the type of panel, y is the value of any of the environmental indicators considered.

As an example, we report the calculation of the Acidification (AP) indicator, on Module A4, for a wall panel of 80 mm thickness with steel supports of 0.5 and 0.6 mm (internal and external side, respectively). From the Table 7.3, the corresponding formula is

$$y (\text{Acidification [AP], A4}) = 3,71E-6 * i + 7,92E-4 * m + 3,83E-5$$

Where $i = 80$ and $m = 0,5 + 0,6 = 1,1$

The calculation is

$$\begin{aligned} y (\text{Acidification [AP], A4}) &= 3,71E-6 * 80 + 7,92E-4 * 1,1 + 3,83E-5 \\ &= 0,0002968 + 0,0008712 + 0,0000421 \\ &= 0,001210 \end{aligned}$$

The reference thicknesses for the insulation and the steel supports can be consulted in the PRODUCT SPECIFICATION section.

The environmental performance indicators are expressed per 1 m² of panel. To obtain the values per unit of thermal resistance, simply multiply the indicator by the thermal transmittance value U, listed in the tables in the PRODUCT SPECIFICATION section.



ENVIRONMENTAL INDICATORS LEGEND

Potential environmental impacts

GWP	Climate change
ODP	Ozone depletion
AP	Acidification of land and water
EP	Eutrophication
POCP	Photochemical ozone creation
ADP - MM	Depletion of abiotic resources (elements)
ADP - F	Depletion of abiotic resources (fossil)

Resource use

PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	Use of renewable primary energy resources used as raw materials
PERT	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	Use of non-renewable primary energy resources used as raw materials
PENRT	Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)
SM	Use of secondary material
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water

Waste production

HW	Hazardous waste disposed
NHW	Non-hazardous waste disposed
RW	Radioactive waste disposed

Output flows

REUSE	Components for re-use
RECYCLE	Materials for recycling
EN-REC	Materials for energy recovery
EE-E	Exported energy-electricity
EE-T	Exported energy-thermal energy

WALL PANELS

ISOBOX, ISOPIANO, ISOPARETE, ISOPARETE PLUS 2, ISOFROZEN, ISOFROZEN HT

TABLE 7.1 Environmental performance indicators for 1 m²

Wall panels – Thickness 40 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	2,70E+01	2,30E-01	2,05E+00	-7,91E+00
ODP	kg CFC-11 eq	1,76E-07	4,28E-08	3,60E-08	-7,12E-08
AP	kg SO ₂ eq	8,19E-02	8,99E-04	1,61E-03	-2,08E-02
EP	kg PO ₄ ³⁻ eq	9,50E-03	2,12E-04	9,50E-04	-2,10E-03
POCP	kg C ₂ H ₄ eq	9,58E-03	3,79E-05	3,94E-05	-3,72E-03
ADP - MM	kg Sb eq	1,25E-04	6,96E-07	8,76E-07	-2,89E-06
ADP - F	MJ	3,42E+02	3,51E+00	3,29E+00	-6,06E+01
PERE	MJ	1,82E+01	3,77E-02	4,76E-02	-2,75E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,82E+01	3,77E-02	4,76E-02	-2,75E+00
PENRE	MJ	3,63E+02	3,79E+00	3,60E+00	-6,30E+01
PENRM	MJ	6,21E+01	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	4,25E+02	3,79E+00	3,60E+00	-6,30E+01
SM	kg	4,22E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	3,60E+00	5,80E-04	3,93E-03	4,22E-03
HW	kg	2,49E-05	2,25E-06	3,89E-06	-2,77E-05
NHW	kg	5,72E-01	1,68E-01	1,05E+00	-1,59E-02
RW	kg	1,03E-04	2,41E-05	1,68E-05	-3,65E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,10E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	5,41E+00	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	1,62E+01	0,00E+00

TABLE 7.2 Environmental performance indicators for 1 m²
Wall panels – Thickness 150 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,01E+01	3,35E-01	7,26E+00	-7,13E+00
ODP	kg CFC-11 eq	4,97E-07	6,23E-08	7,36E-08	-2,59E-07
AP	kg SO ₂ eq	1,19E-01	1,31E-03	4,89E-03	-3,27E-02
EP	kg PO ₄ ³⁻ eq	1,85E-02	3,09E-04	3,14E-03	-4,49E-03
POCP	kg C ₂ H ₄ eq	1,17E-02	5,51E-05	8,59E-05	-4,08E-03
ADP - MM	kg Sb eq	1,30E-04	1,01E-06	1,46E-06	-3,58E-06
ADP - F	MJ	6,17E+02	5,11E+00	7,16E+00	-8,24E+01
PERE	MJ	3,26E+01	5,48E-02	1,08E-01	-9,94E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,26E+01	5,48E-02	1,08E-01	-9,94E+00
PENRE	MJ	6,74E+02	5,51E+00	7,87E+00	-9,22E+01
PENRM	MJ	2,26E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	9,00E+02	5,51E+00	7,87E+00	-9,22E+01
SM	kg	4,22E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	3,84E+00	8,44E-04	1,36E-02	-2,46E-02
HW	kg	6,26E-05	3,28E-06	1,01E-05	-1,02E-04
NHW	kg	1,28E+00	2,44E-01	1,60E+00	-5,08E-02
RW	kg	1,97E-04	3,51E-05	2,83E-05	-1,31E-04
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,15E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	1,99E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	5,98E+01	0,00E+00

TABLE 7.3 Environmental performance indicators for 1 m²

Wall panels – Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,19E-1 * i + 2,33E+1 * m + 1,18E+0$	$9,51E-4 * i + 2,03E-1 * m + 9,82E-3$	$4,74E-2 * i + 1,31E-1 * m + 3,78E-2$	$7,15E-3 * i - 8,67E+0 * m - 3,98E-1$
ODP	kg CFC-11 eq	$2,92E-9 * i + 4,51E-8 * m + 1,73E-8$	$1,77E-10 * i + 3,77E-8 * m + 1,82E-9$	$3,42E-10 * i + 2,35E-8 * m + 1,17E-9$	$-1,71E-9 * i - 2,76E-9$
AP	kg SO ₂ eq	$3,34E-4 * i + 7,19E-2 * m + 3,82E-3$	$3,71E-6 * i + 7,92E-4 * m + 3,83E-5$	$2,99E-5 * i + 4,32E-4 * m + 2,28E-5$	$-1,08E-4 * i - 1,72E-2 * m - 1,05E-3$
EP	kg PO ₄ ³⁻ eq	$8,22E-5 * i + 6,29E-3 * m + 5,48E-4$	$8,77E-7 * i + 1,87E-4 * m + 9,05E-6$	$1,99E-5 * i + 1,08E-4 * m + 5,38E-5$	$-2,17E-5 * i - 1,24E-3 * m - 1,20E-4$
POCP	kg C ₂ H ₄ eq	$1,94E-5 * i + 7,17E-3 * m + 2,34E-3$	$1,56E-7 * i + 3,33E-5 * m + 1,61E-6$	$4,23E-7 * i + 2,35E-5 * m + 1,36E-6$	$-3,24E-6 * i - 3,80E-3 * m - 1,74E-4$
ADP - MM	kg Sb eq	$4,83E-8 * i + 1,30E-4 * m + 5,73E-6$	$2,87E-9 * i + 6,13E-7 * m + 2,97E-8$	$5,34E-9 * i + 6,98E-7 * m + 3,41E-8$	$-6,29E-9 * i - 2,77E-6 * m - 1,47E-7$
ADP - F	MJ	$2,50E+0 * i + 2,51E+2 * m + 1,55E+1$	$1,45E-2 * i + 3,09E+0 * m + 1,50E-1$	$3,51E-2 * i + 1,99E+0 * m + 9,94E-2$	$-1,98E-1 * i - 5,40E+1 * m - 3,97E+0$
PERE	MJ	$1,31E-1 * i + 1,23E+1 * m + 1,66E+0$	$1,56E-4 * i + 3,32E-2 * m + 1,61E-3$	$5,45E-4 * i + 2,71E-2 * m + 1,38E-3$	$-6,54E-2 * i - 1,32E-1$
PERM	MJ	0	0	0	0
PERT	MJ	$1,31E-1 * i + 1,23E+1 * m + 1,66E+0$	$1,56E-4 * i + 3,32E-2 * m + 1,61E-3$	$5,45E-4 * i + 2,71E-2 * m + 1,38E-3$	$-6,54E-2 * i - 1,32E-1$
PENRE	MJ	$2,83E+0 * i + 2,58E+2 * m + 1,70E+1$	$1,56E-2 * i + 3,34E+0 * m + 1,62E-1$	$3,88E-2 * i + 2,15E+0 * m + 1,08E-1$	$-2,66E-1 * i - 5,33E+1 * m - 4,35E+0$
PENRM	MJ	$1,49E+0 * i + 2,43E+0$	0	0	0
PENRT	MJ	$4,32E+0 * i + 2,58E+2 * m + 1,94E+1$	$1,56E-2 * i + 3,34E+0 * m + 1,62E-1$	$3,88E-2 * i + 2,15E+0 * m + 1,08E-1$	$-2,66E-1 * i - 5,33E+1 * m - 4,35E+0$
SM	kg	$4,48E+0 * m + 1,88E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,23E-3 * i + 3,71E+0 * m + 1,62E-1$	$2,40E-6 * i + 5,11E-4 * m + 2,47E-5$	$8,76E-5 * i + 4,51E-4 * m + 2,13E-5$	$-2,62E-4 * i + 1,68E-2 * m - 3,99E-4$
HW	kg	$3,46E-7 * i + 6,03E-6 * m + 4,89E-6$	$9,30E-9 * i + 1,98E-6 * m + 9,60E-8$	$5,63E-8 * i + 1,70E-6 * m + 1,15E-7$	$-6,73E-7 * i - 7,79E-7$
NHW	kg	$6,42E-3 * i + 3,04E-1 * m + 3,99E-2$	$6,93E-4 * i + 1,48E-1 * m + 7,16E-3$	$5,03E-3 * i + 8,90E-1 * m + 4,69E-2$	$-3,18E-4 * i - 3,09E-3$
RW	kg	$8,51E-7 * i + 6,32E-5 * m + 1,23E-5$	$9,97E-8 * i + 2,13E-5 * m + 1,03E-6$	$1,05E-7 * i + 1,32E-5 * m + 6,53E-7$	$-8,63E-7 * i - 1,94E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$3,89E-4 * i + 7,50E+0 * m + 3,39E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,32E-1 * i + 1,23E-1$	0
EE-T	MJ	0	0	$3,96E-1 * i + 3,69E-1$	0

ROOF PANELS

ISOCOP, ISOSMART

TABLE 7.4 Environmental performance indicators for 1 m²

Roof panels – Thickness 40 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	2,97E+01	2,85E-01	2,32E+00	-8,67E+00
ODP	kg CFC-11 eq	1,94E-07	5,29E-08	4,00E-08	-8,09E-08
AP	kg SO ₂ eq	9,03E-02	1,11E-03	1,80E-03	-2,30E-02
EP	kg PO ₄ ³⁻ eq	1,05E-02	2,62E-04	1,08E-03	-2,35E-03
POCP	kg C ₂ H ₄ eq	1,03E-02	4,68E-05	4,39E-05	-4,09E-03
ADP - MM	kg Sb eq	1,37E-04	8,60E-07	9,68E-07	-3,18E-06
ADP - F	MJ	3,79E+02	4,34E+00	3,66E+00	-6,70E+01
PERE	MJ	1,96E+01	4,66E-02	5,29E-02	-3,13E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,96E+01	4,66E-02	5,29E-02	-3,13E+00
PENRE	MJ	4,02E+02	4,69E+00	4,00E+00	-6,97E+01
PENRM	MJ	7,06E+01	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	4,73E+02	4,69E+00	4,00E+00	-6,97E+01
SM	kg	4,62E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	3,94E+00	7,17E-04	4,43E-03	4,06E-03
HW	kg	2,55E-05	2,79E-06	4,35E-06	-3,15E-05
NHW	kg	6,33E-01	2,08E-01	1,16E+00	-1,84E-02
RW	kg	1,15E-04	2,98E-05	1,85E-05	-4,16E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,79E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	6,13E+00	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	1,84E+01	0,00E+00

TABLE 7.5 Environmental performance indicators for 1 m²
 Roof panels – Thickness 150 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,44E+01	4,17E-01	8,19E+00	-7,77E+00
ODP	kg CFC-11 eq	5,58E-07	7,74E-08	8,24E-08	-2,92E-07
AP	kg SO ₂ eq	1,31E-01	1,63E-03	5,51E-03	-3,63E-02
EP	kg PO ₄ ³⁻ eq	2,07E-02	3,84E-04	3,53E-03	-5,01E-03
POCP	kg C ₂ H ₄ eq	1,27E-02	6,85E-05	9,62E-05	-4,48E-03
ADP - MM	kg Sb eq	1,43E-04	1,26E-06	1,63E-06	-3,95E-06
ADP - F	MJ	6,89E+02	6,35E+00	8,02E+00	-9,09E+01
PERE	MJ	3,54E+01	6,82E-02	1,21E-01	-1,12E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,54E+01	6,82E-02	1,21E-01	-1,12E+01
PENRE	MJ	7,53E+02	6,85E+00	8,82E+00	-1,02E+02
PENRM	MJ	2,55E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,01E+03	6,85E+00	8,82E+00	-1,02E+02
SM	kg	4,62E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	4,21E+00	1,05E-03	1,53E-02	-2,80E-02
HW	kg	6,73E-05	4,07E-06	1,13E-05	-1,15E-04
NHW	kg	1,43E+00	3,04E-01	1,78E+00	-5,65E-02
RW	kg	2,20E-04	4,37E-05	3,15E-05	-1,48E-04
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,83E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	2,25E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	6,75E+01	0,00E+00

TABLE 7.6 Environmental performance indicators for 1 m²

Roof panels – Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,34E-1 * i + 2,54E+1 * m + 1,47E+0$	$1,20E-3 * i + 2,48E-1 * m + 1,39E-2$	$5,34E-2 * i + 1,43E-1 * m + 5,50E-2$	$8,19E-3 * i - 9,44E+0 * m - 4,95E-1$
ODP	kg CFC-11 eq	$3,31E-9 * i + 4,92E-8 * m + 1,62E-8$	$2,23E-10 * i + 4,60E-8 * m + 2,58E-9$	$3,85E-10 * i + 2,56E-8 * m + 1,49E-9$	$-1,92E-9 * i - 3,98E-9$
AP	kg SO ₂ eq	$3,74E-4 * i + 7,83E-2 * m + 4,81E-3$	$4,68E-6 * i + 9,67E-4 * m + 5,42E-5$	$3,37E-5 * i + 4,70E-4 * m + 3,11E-5$	$-1,21E-4 * i - 1,87E-2 * m - 1,36E-3$
EP	kg PO ₄ ³⁻ eq	$9,24E-5 * i + 6,85E-3 * m + 6,77E-4$	$1,10E-6 * i + 2,28E-4 * m + 1,28E-5$	$2,23E-5 * i + 1,18E-4 * m + 7,51E-5$	$-2,42E-5 * i - 1,35E-3 * m - 1,61E-4$
POCP	kg C ₂ H ₄ eq	$2,17E-5 * i + 7,82E-3 * m + 2,43E-3$	$1,97E-7 * i + 4,07E-5 * m + 2,28E-6$	$4,76E-7 * i + 2,56E-5 * m + 1,77E-6$	$-3,61E-6 * i - 4,14E-3 * m - 2,17E-4$
ADP - MM	kg Sb eq	$5,40E-8 * i + 1,42E-4 * m + 6,97E-6$	$3,62E-9 * i + 7,48E-7 * m + 4,19E-8$	$6,01E-9 * i + 7,60E-7 * m + 4,32E-8$	$-6,99E-9 * i - 3,01E-6 * m - 1,87E-7$
ADP - F	MJ	$2,82E+0 * i + 2,74E+2 * m + 1,95E+1$	$1,83E-2 * i + 3,78E+0 * m + 2,12E-1$	$3,96E-2 * i + 2,17E+0 * m + 1,28E-1$	$-2,18E-1 * i - 5,89E+1 * m - 5,18E+0$
PERE	MJ	$1,45E-1 * i + 1,35E+1 * m + 1,53E+0$	$1,96E-4 * i + 4,05E-2 * m + 2,27E-3$	$6,15E-4 * i + 2,95E-2 * m + 1,78E-3$	$-7,33E-2 * i - 1,89E-1$
PERM	MJ	0	0	0	0
PERT	MJ	$1,45E-1 * i + 1,35E+1 * m + 1,53E+0$	$1,96E-4 * i + 4,05E-2 * m + 2,27E-3$	$6,15E-4 * i + 2,95E-2 * m + 1,78E-3$	$-7,33E-2 * i - 1,89E-1$
PENRE	MJ	$3,19E+0 * i + 2,81E+2 * m + 2,15E+1$	$1,97E-2 * i + 4,07E+0 * m + 2,28E-1$	$4,38E-2 * i + 2,34E+0 * m + 1,38E-1$	$-2,92E-1 * i - 5,80E+1 * m - 5,71E+0$
PENRM	MJ	$1,67E+0 * i + 3,50E+0$	0	0	0
PENRT	MJ	$4,86E+0 * i + 2,81E+2 * m + 2,50E+1$	$1,97E-2 * i + 4,07E+0 * m + 2,28E-1$	$4,38E-2 * i + 2,34E+0 * m + 1,38E-1$	$-2,92E-1 * i - 5,80E+1 * m - 5,71E+0$
SM	kg	$4,90E+0 * m + 2,10E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,48E-3 * i + 4,05E+0 * m + 1,97E-1$	$3,02E-6 * i + 6,24E-4 * m + 3,49E-5$	$9,89E-5 * i + 4,92E-4 * m + 3,35E-5$	$-2,92E-4 * i + 1,83E-2 * m - 6,88E-4$
HW	kg	$3,84E-7 * i + 6,57E-6 * m + 3,32E-6$	$1,17E-8 * i + 2,42E-6 * m + 1,36E-7$	$6,34E-8 * i + 1,85E-6 * m + 1,49E-7$	$-7,57E-7 * i - 1,14E-6$
NHW	kg	$7,21E-3 * i + 3,32E-1 * m + 4,48E-2$	$8,74E-4 * i + 1,81E-1 * m + 1,01E-2$	$5,65E-3 * i + 9,70E-1 * m + 5,97E-2$	$-3,47E-4 * i - 4,33E-3$
RW	kg	$9,55E-7 * i + 6,88E-5 * m + 1,50E-5$	$1,26E-7 * i + 2,60E-5 * m + 1,45E-6$	$1,18E-7 * i + 1,44E-5 * m + 8,29E-7$	$-9,67E-7 * i - 2,77E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$3,52E-4 * i + 8,17E+0 * m + 4,22E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,49E-1 * i + 1,71E-1$	0
EE-T	MJ	0	0	$4,46E-1 * i + 5,14E-1$	0

ISODOMUS CLASSIC

TABLE 7.7 Environmental performance indicators for 1 m²
Isodomus Classic – Thickness 40 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	3,17E+01	8,97E-01	3,13E+00	-8,54E+00
ODP	kg CFC-11 eq	2,48E-07	1,67E-07	4,58E-08	-1,10E-07
AP	kg SO ₂ eq	9,55E-02	3,50E-03	2,32E-03	-2,48E-02
EP	kg PO ₄ ³⁻ eq	1,17E-02	8,27E-04	1,41E-03	-2,70E-03
POCP	kg C ₂ H ₄ eq	1,06E-02	1,48E-04	5,11E-05	-4,14E-03
ADP - MM	kg Sb eq	1,38E-04	2,71E-06	1,06E-06	-3,28E-06
ADP - F	MJ	4,20E+02	1,37E+01	4,26E+00	-6,99E+01
PERE	MJ	2,30E+01	1,47E-01	6,22E-02	-4,22E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,30E+01	1,47E-01	6,22E-02	-4,22E+00
PENRE	MJ	4,48E+02	1,48E+01	4,66E+00	-7,37E+01
PENRM	MJ	9,56E+01	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	5,44E+02	1,48E+01	4,66E+00	-7,37E+01
SM	kg	4,62E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	3,98E+00	2,26E-03	5,94E-03	-1,38E-04
HW	kg	3,59E-05	8,78E-06	5,31E-06	-4,28E-05
NHW	kg	7,44E-01	6,54E-01	1,24E+00	-2,30E-02
RW	kg	1,29E-04	9,40E-05	2,03E-05	-5,59E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,79E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	8,37E+00	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	2,51E+01	0,00E+00

TABLE 7.8 Environmental performance indicators for 1 m²
Isodomus Classic – Thickness 100 mm – Steel thickness 0,5/0,4 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,27E+01	1,19E+00	7,54E+00	-7,84E+00
ODP	kg CFC-11 eq	5,01E-07	2,21E-07	7,77E-08	-2,68E-07
AP	kg SO ₂ eq	1,25E-01	4,65E-03	5,11E-03	-3,47E-02
EP	kg PO ₄ ³⁻ eq	1,89E-02	1,10E-03	3,24E-03	-4,68E-03
POCP	kg C ₂ H ₄ eq	1,24E-02	1,96E-04	9,04E-05	-4,43E-03
ADP - MM	kg Sb eq	1,42E-04	3,60E-06	1,56E-06	-3,85E-06
ADP - F	MJ	6,48E+02	1,82E+01	7,54E+00	-8,73E+01
PERE	MJ	3,22E+01	1,95E-01	1,13E-01	-1,03E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,22E+01	1,95E-01	1,13E-01	-1,03E+01
PENRE	MJ	7,06E+02	1,96E+01	8,29E+00	-9,72E+01
PENRM	MJ	2,34E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	9,40E+02	1,96E+01	8,29E+00	-9,72E+01
SM	kg	4,62E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	4,16E+00	3,00E-03	1,41E-02	-2,39E-02
HW	kg	5,44E-05	1,16E-05	1,06E-05	-1,05E-04
NHW	kg	1,33E+00	8,68E-01	1,71E+00	-5,06E-02
RW	kg	2,05E-04	1,25E-04	3,01E-05	-1,35E-04
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	7,81E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	2,06E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	6,19E+01	0,00E+00

TABLE 7.9 Environmental performance indicators for 1 m² Isodomus Classic - Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,82E-1 * i + 2,53E+1 * m + 1,72E+0$	$4,88E-3 * i + 7,29E-1 * m + 4,55E-2$	$7,36E-2 * i + 1,42E-1 * m + 5,70E-2$	$1,15E-2 * i - 9,38E+0 * m - 5,51E-1$
ODP	kg CFC-11 eq	$4,23E-9 * i + 4,89E-8 * m + 3,36E-8$	$9,08E-10 * i + 1,36E-7 * m + 8,46E-9$	$5,32E-10 * i + 2,55E-8 * m + 1,64E-9$	$-2,64E-9 * i - 4,11E-9$
AP	kg SO ₂ eq	$5,00E-4 * i + 7,78E-2 * m + 5,45E-3$	$1,91E-5 * i + 2,85E-3 * m + 1,78E-4$	$4,66E-5 * i + 4,67E-4 * m + 3,35E-5$	$-1,65E-4 * i - 1,86E-2 * m - 1,48E-3$
EP	kg PO ₄ ³⁻ eq	$1,20E-4 * i + 6,81E-3 * m + 7,86E-4$	$4,50E-6 * i + 6,72E-4 * m + 4,19E-5$	$3,05E-5 * i + 1,17E-4 * m + 7,87E-5$	$-3,31E-5 * i - 1,34E-3 * m - 1,72E-4$
POCP	kg C ₂ H ₄ eq	$2,91E-5 * i + 7,77E-3 * m + 2,49E-3$	$8,03E-7 * i + 1,20E-4 * m + 7,48E-6$	$6,56E-7 * i + 2,54E-5 * m + 1,93E-6$	$-4,90E-6 * i - 4,11E-3 * m - 2,41E-4$
ADP - MM	kg Sb eq	$6,31E-8 * i + 1,41E-4 * m + 8,39E-6$	$1,48E-8 * i + 2,20E-6 * m + 1,37E-7$	$8,28E-9 * i + 7,55E-7 * m + 4,78E-8$	$-9,47E-9 * i - 2,99E-6 * m - 2,06E-7$
ADP - F	MJ	$3,81E+0 * i + 2,72E+2 * m + 2,27E+1$	$7,45E-2 * i + 1,11E+1 * m + 6,94E-1$	$5,47E-2 * i + 2,15E+0 * m + 1,40E-1$	$-2,90E-1 * i - 5,85E+1 * m - 5,62E+0$
PERE	MJ	$1,56E-1 * i + 1,34E+1 * m + 4,57E+0$	$8,00E-4 * i + 1,19E-1 * m + 7,45E-3$	$8,48E-4 * i + 2,93E-2 * m + 1,96E-3$	$-1,01E-1 * i - 1,95E-1$
PERM	MJ	0	0	0	0
PERT	MJ	$1,56E-1 * i + 1,34E+1 * m + 4,57E+0$	$8,00E-4 * i + 1,19E-1 * m + 7,45E-3$	$8,48E-4 * i + 2,93E-2 * m + 1,96E-3$	$-1,01E-1 * i - 1,95E-1$
PENRE	MJ	$4,29E+0 * i + 2,80E+2 * m + 2,49E+1$	$8,04E-2 * i + 1,20E+1 * m + 7,49E-1$	$6,04E-2 * i + 2,33E+0 * m + 1,52E-1$	$-3,91E-1 * i - 5,77E+1 * m - 6,17E+0$
PENRM	MJ	$2,30E+0 * i + 3,57E+0$	0	0	0
PENRT	MJ	$6,59E+0 * i + 2,80E+2 * m + 2,85E+1$	$8,04E-2 * i + 1,20E+1 * m + 7,49E-1$	$6,04E-2 * i + 2,33E+0 * m + 1,52E-1$	$-3,91E-1 * i - 5,77E+1 * m - 6,17E+0$
SM	kg	$4,88E+0 * m + 2,31E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$3,07E-3 * i + 4,02E+0 * m + 2,37E-1$	$1,23E-5 * i + 1,84E-3 * m + 1,15E-4$	$1,37E-4 * i + 4,89E-4 * m + 3,48E-5$	$-3,97E-4 * i + 1,82E-2 * m - 6,46E-4$
HW	kg	$3,13E-7 * i + 6,53E-6 * m + 1,69E-5$	$4,78E-8 * i + 7,13E-6 * m + 4,45E-7$	$8,75E-8 * i + 1,84E-6 * m + 1,60E-7$	$-1,04E-6 * i - 1,17E-6$
NHW	kg	$9,73E-3 * i + 3,30E-1 * m + 5,75E-2$	$3,56E-3 * i + 5,32E-1 * m + 3,32E-2$	$7,75E-3 * i + 9,63E-1 * m + 6,57E-2$	$-4,61E-4 * i - 4,51E-3$
RW	kg	$1,27E-6 * i + 6,84E-5 * m + 1,61E-5$	$5,12E-7 * i + 7,64E-5 * m + 4,77E-6$	$1,63E-7 * i + 1,43E-5 * m + 9,15E-7$	$-1,33E-6 * i - 2,87E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$3,42E-4 * i + 8,12E+0 * m + 4,70E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$2,05E-1 * i + 1,79E-1$	0
EE-T	MJ	0	0	$6,14E-1 * i + 5,36E-1$	0

ISODECK PVSTEEL PU - TPO

TABLE 7.10 Environmental performance indicators for 1 m²
Isodeck PVSteel PU TPO – Thickness 40 mm – Steel thickness 0,8/0,5 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,08E+01	3,93E-01	2,43E+00	-1,28E+01
ODP	kg CFC-11 eq	2,80E-07	7,30E-08	5,23E-08	-8,13E-08
AP	kg SO ₂ eq	1,24E-01	1,53E-03	2,04E-03	-3,23E-02
EP	kg PO ₄ ³⁻ eq	1,40E-02	3,62E-04	3,27E-03	-3,13E-03
POCP	kg C ₂ H ₄ eq	1,35E-02	6,46E-05	6,42E-05	-5,68E-03
ADP - MM	kg Sb eq	1,90E-04	1,19E-06	1,30E-06	-4,22E-06
ADP - F	MJ	5,26E+02	5,99E+00	4,72E+00	-1,18E+02
PERE	MJ	2,53E+01	6,43E-02	6,77E-02	-3,36E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,53E+01	6,43E-02	6,77E-02	-3,36E+00
PENRE	MJ	5,59E+02	6,46E+00	5,14E+00	-1,25E+02
PENRM	MJ	9,78E+01	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	6,57E+02	6,46E+00	5,14E+00	-1,25E+02
SM	kg	6,47E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	5,44E+00	9,89E-04	4,77E-03	2,78E-03
HW	kg	4,66E-05	3,84E-06	5,25E-06	-3,15E-05
NHW	kg	8,49E-01	2,86E-01	2,00E+00	-2,79E-02
RW	kg	1,55E-04	4,12E-05	2,55E-05	-4,17E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	1,13E+01	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	6,13E+00	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	1,84E+01	0,00E+00

TABLE 7.11 Environmental performance indicators for 1 m²
 Isodeck PVSteel PU TPO – Thickness 150 mm – Steel thickness 0,8/0,5 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	5,55E+01	5,24E-01	8,30E+00	-1,19E+01
ODP	kg CFC-11 eq	6,45E-07	9,75E-08	9,47E-08	-2,92E-07
AP	kg SO ₂ eq	1,65E-01	2,05E-03	5,75E-03	-4,56E-02
EP	kg PO ₄ ³⁻ eq	2,41E-02	4,83E-04	5,72E-03	-5,79E-03
POCP	kg C ₂ H ₄ eq	1,59E-02	8,62E-05	1,17E-04	-6,07E-03
ADP - MM	kg Sb eq	1,96E-04	1,58E-06	1,96E-06	-4,99E-06
ADP - F	MJ	8,36E+02	8,00E+00	9,07E+00	-1,42E+02
PERE	MJ	4,11E+01	8,59E-02	1,35E-01	-1,14E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	4,11E+01	8,59E-02	1,35E-01	-1,14E+01
PENRE	MJ	9,09E+02	8,63E+00	9,96E+00	-1,57E+02
PENRM	MJ	2,55E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,16E+03	8,63E+00	9,96E+00	-1,57E+02
SM	kg	6,47E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	5,71E+00	1,32E-03	1,56E-02	-2,93E-02
HW	kg	8,85E-05	5,13E-06	1,22E-05	-1,15E-04
NHW	kg	1,64E+00	3,82E-01	2,62E+00	-6,60E-02
RW	kg	2,60E-04	5,50E-05	3,85E-05	-1,48E-04
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	1,14E+01	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	2,25E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	6,75E+01	0,00E+00

TABLE 7.12 Environmental performance indicators for 1 m²

Isodeck PVSteel PU TPO - Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,34E-1 * i + 2,75E+1 * m - 2,84E-1$	$1,20E-3 * i + 2,68E-4 * m - 3,81E-3$	$5,34E-2 * i + 1,54E-1 * m + 9,66E-2$	$8,19E-3 * i - 9,97E+0 * m - 1,69E-1$
ODP	kg CFC-11 eq	$3,31E-9 * i + 4,82E-8 * m + 8,39E-8$	$2,23E-10 * i + 4,98E-8 * m - 7,07E-10$	$3,85E-10 * i + 2,77E-8 * m + 8,58E-10$	$-1,92E-9 * i - 4,39E-9$
AP	kg SO ₂ eq	$3,74E-4 * i + 8,40E-2 * m + -3,45E-4$	$4,68E-6 * i + 1,05E-3 * m + -1,49E-5$	$3,37E-5 * i + 5,09E-4 * m + 2,89E-5$	$-1,21E-4 * i - 1,97E-2 * m - 1,76E-3$
EP	kg PO ₄ ³⁻ eq	$9,24E-5 * i + 7,33E-3 * m + 7,34E-4$	$1,10E-6 * i + 2,47E-4 * m + -3,51E-6$	$2,23E-5 * i + 1,27E-4 * m + 2,21E-3$	$-2,42E-5 * i - 1,42E-3 * m - 3,02E-4$
POCP	kg C ₂ H ₄ eq	$2,17E-5 * i + 8,43E-3 * m + 1,71E-3$	$1,97E-7 * i + 4,41E-5 * m + -6,26E-7$	$4,76E-7 * i + 2,77E-5 * m + 9,14E-6$	$-3,61E-6 * i - 4,37E-3 * m + 1,49E-4$
ADP - MM	kg Sb eq	$5,40E-8 * i + 1,54E-4 * m + -1,20E-5$	$3,62E-9 * i + 8,10E-7 * m + -1,15E-8$	$6,01E-9 * i + 8,23E-7 * m + -7,15E-9$	$-6,99E-9 * i - 3,18E-6 * m + 2,00E-7$
ADP - F	MJ	$2,82E+0 * i + 2,96E+2 * m + 2,83E+1$	$1,83E-2 * i + 4,09E+0 * m - 5,81E-2$	$3,96E-2 * i + 2,34E+0 * m + 8,43E-2$	$-2,18E-1 * i - 6,22E+1 * m - 2,85E+1$
PERE	MJ	$1,45E-1 * i + 1,45E+1 * m + 3,56E-1$	$1,96E-4 * i + 4,39E-2 * m + -6,23E-4$	$6,15E-4 * i + 3,19E-2 * m + 1,65E-3$	$-7,33E-2 * i - 4,20E-1$
PERM	MJ	0	0	0	0
PERT	MJ	$1,45E-1 * i + 1,45E+1 * m + 3,56E-1$	$1,96E-4 * i + 4,39E-2 * m + -6,23E-4$	$6,15E-4 * i + 3,19E-2 * m + 1,65E-3$	$-7,33E-2 * i - 4,20E-1$
PENRE	MJ	$3,19E+0 * i + 3,04E+2 * m + 3,59E+1$	$1,97E-2 * i + 4,41E+0 * m - 6,26E-2$	$4,38E-2 * i + 2,54E+0 * m + 9,29E-2$	$-2,92E-1 * i - 6,13E+1 * m - 3,35E+1$
PENRM	MJ	$1,45E+0 * i + 3,24E+1$	0	0	0
PENRT	MJ	$4,64E+0 * i + 3,04E+2 * m + 6,82E+1$	$1,97E-2 * i + 4,41E+0 * m - 6,26E-2$	$4,38E-2 * i + 2,54E+0 * m + 9,29E-2$	$-2,92E-1 * i - 6,13E+1 * m - 3,35E+1$
SM	kg	$5,45E+0 * m - 6,15E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,48E-3 * i + 4,38E+0 * m - 3,57E-1$	$3,02E-6 * i + 6,75E-4 * m + -9,59E-6$	$9,89E-5 * i + 5,32E-4 * m + 1,18E-4$	$-2,92E-4 * i + 1,93E-2 * m - 1,06E-2$
HW	kg	$3,84E-7 * i + 6,81E-6 * m + 2,16E-5$	$1,17E-8 * i + 2,62E-6 * m + -3,72E-8$	$6,34E-8 * i + 2,00E-6 * m + 1,07E-7$	$-7,57E-7 * i - 1,19E-6$
NHW	kg	$7,21E-3 * i + 3,61E-1 * m + 9,04E-2$	$8,74E-4 * i + 1,95E-1 * m + -2,77E-3$	$5,65E-3 * i + 1,05E+0 * m + 4,13E-1$	$-3,47E-4 * i - 1,38E-2$
RW	kg	$9,55E-7 * i + 7,15E-5 * m + 2,40E-5$	$1,26E-7 * i + 2,81E-5 * m - 3,99E-7$	$1,18E-7 * i + 1,56E-5 * m + 4,82E-7$	$-9,67E-7 * i - 2,87E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$3,52E-4 * i + 8,84E+0 * m - 1,88E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,49E-1 * i + 1,71E-1$	0
EE-T	MJ	0	0	$4,46E-1 * i + 5,14E-1$	0

ISODECK PVSTEEL PU - PVC

TABLE 7.13 Environmental performance indicators for 1 m²
 Isodeck PVSteel PU PVC – Thickness 40 mm – Steel thickness 0,8/0,5 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,63E+01	4,09E-01	2,45E+00	-1,42E+01
ODP	kg CFC-11 eq	1,52E-06	7,59E-08	5,48E-08	-8,26E-08
AP	kg SO ₂ eq	1,40E-01	1,59E-03	2,09E-03	-3,57E-02
EP	kg PO ₄ ³⁻ eq	1,81E-02	3,77E-04	3,41E-03	-3,99E-03
POCP	kg C ₂ H ₄ eq	1,54E-02	6,72E-05	6,72E-05	-5,79E-03
ADP - MM	kg Sb eq	2,25E-04	1,23E-06	1,36E-06	-4,26E-06
ADP - F	MJ	6,16E+02	6,23E+00	4,93E+00	-1,35E+02
PERE	MJ	2,94E+01	6,69E-02	7,09E-02	-4,13E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,94E+01	6,69E-02	7,09E-02	-4,13E+00
PENRE	MJ	6,59E+02	6,72E+00	5,37E+00	-1,53E+02
PENRM	MJ	1,41E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,00E+02	6,72E+00	5,37E+00	-1,53E+02
SM	kg	6,47E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	5,45E+00	1,03E-03	4,87E-03	-2,10E-01
HW	kg	2,41E-04	4,00E-06	5,43E-06	-3,17E-05
NHW	kg	9,19E-01	2,98E-01	2,32E+00	-1,06E-01
RW	kg	3,31E-04	4,28E-05	2,69E-05	-4,22E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	1,18E+01	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	6,13E+00	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	1,84E+01	0,00E+00

TABLE 7.14 Environmental performance indicators for 1 m²
Isodeck PVSteel PU PVC – Thickness 150 mm – Steel thickness 0,8/0,5 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	6,10E+01	5,40E-01	8,32E+00	-1,33E+01
ODP	kg CFC-11 eq	1,89E-06	1,00E-07	9,71E-08	-2,94E-07
AP	kg SO ₂ eq	1,82E-01	2,11E-03	5,80E-03	-4,90E-02
EP	kg PO ₄ ³⁻ eq	2,83E-02	4,98E-04	5,87E-03	-6,65E-03
POCP	kg C ₂ H ₄ eq	1,77E-02	8,89E-05	1,20E-04	-6,19E-03
ADP - MM	kg Sb eq	2,31E-04	1,63E-06	2,02E-06	-5,03E-06
ADP - F	MJ	9,26E+02	8,24E+00	9,29E+00	-1,59E+02
PERE	MJ	4,52E+01	8,85E-02	1,39E-01	-1,22E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	4,52E+01	8,85E-02	1,39E-01	-1,22E+01
PENRE	MJ	1,01E+03	8,89E+00	1,02E+01	-1,85E+02
PENRM	MJ	2,84E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,29E+03	8,89E+00	1,02E+01	-1,85E+02
SM	kg	6,47E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	5,72E+00	1,36E-03	1,58E-02	-2,42E-01
HW	kg	2,83E-04	5,29E-06	1,24E-05	-1,15E-04
NHW	kg	1,71E+00	3,94E-01	2,94E+00	-1,44E-01
RW	kg	4,36E-04	5,66E-05	3,99E-05	-1,49E-04
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	1,19E+01	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	2,25E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	6,75E+01	0,00E+00

TABLE 7.15 Environmental performance indicators for 1 m²

Isodeck PVSteel PU PVC - Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,34E-1 * i + 2,75E+1 * m + 5,20E+0$	$1,20E-3 * i + 2,68E-1 * m + 1,21E-2$	$5,34E-2 * i + 1,54E-1 * m + 1,11E-1$	$8,19E-3 * i - 9,97E+0 * m - 1,61E+0$
ODP	kg CFC-11 eq	$3,31E-9 * i + 4,82E-8 * m + 1,33E-6$	$2,23E-10 * i + 4,98E-8 * m + 2,26E-9$	$3,85E-10 * i + 2,77E-8 * m + 3,29E-9$	$-1,92E-9 * i - 5,63E-9$
AP	kg SO ₂ eq	$3,74E-4 * i + 8,40E-2 * m + 1,62E-2$	$4,68E-6 * i + 1,05E-3 * m + 4,74E-5$	$3,37E-5 * i + 5,09E-4 * m + 8,04E-5$	$-1,21E-4 * i - 1,97E-2 * m - 5,13E-3$
EP	kg PO ₄ ³⁻ eq	$9,24E-5 * i + 7,33E-3 * m + 4,88E-3$	$1,10E-6 * i + 2,47E-4 * m + 1,12E-5$	$2,23E-5 * i + 1,27E-4 * m + 2,35E-3$	$-2,42E-5 * i - 1,42E-3 * m - 1,16E-3$
POCP	kg C ₂ H ₄ eq	$2,17E-5 * i + 8,43E-3 * m + 3,52E-3$	$1,97E-7 * i + 4,41E-5 * m + 2,00E-6$	$4,76E-7 * i + 2,77E-5 * m + 1,21E-5$	$-3,61E-6 * i - 4,37E-3 * m + 3,59E-5$
ADP - MM	kg Sb eq	$5,40E-8 * i + 1,54E-4 * m + 2,31E-5$	$3,62E-9 * i + 8,10E-7 * m + 3,67E-8$	$6,01E-9 * i + 8,23E-7 * m + 4,57E-8$	$-6,99E-9 * i - 3,18E-6 * m + 1,60E-7$
ADP - F	MJ	$2,82E+0 * i + 2,96E+2 * m + 1,18E+2$	$1,83E-2 * i + 4,09E+0 * m + 1,85E-1$	$3,96E-2 * i + 2,34E+0 * m + 2,97E-1$	$-2,18E-1 * i - 6,22E+1 * m - 4,52E+1$
PERE	MJ	$1,45E-1 * i + 1,45E+1 * m + 4,53E+0$	$1,96E-4 * i + 4,39E-2 * m + 1,99E-3$	$6,15E-4 * i + 3,19E-2 * m + 4,81E-3$	$-7,33E-2 * i - 1,19E+0$
PERM	MJ	0	0	0	0
PERT	MJ	$1,45E-1 * i + 1,45E+1 * m + 4,53E+0$	$1,96E-4 * i + 4,39E-2 * m + 1,99E-3$	$6,15E-4 * i + 3,19E-2 * m + 4,81E-3$	$-7,33E-2 * i - 1,19E+0$
PENRE	MJ	$3,19E+0 * i + 3,04E+2 * m + 1,36E+2$	$1,97E-2 * i + 4,41E+0 * m + 2,00E-1$	$4,38E-2 * i + 2,54E+0 * m + 3,24E-1$	$-2,92E-1 * i - 6,13E+1 * m - 6,18E+1$
PENRM	MJ	$1,34E+0 * i + 7,64E+1$	0	0	0
PENRT	MJ	$4,53E+0 * i + 3,04E+2 * m + 2,12E+2$	$1,97E-2 * i + 4,41E+0 * m + 2,00E-1$	$4,38E-2 * i + 2,54E+0 * m + 3,24E-1$	$-2,92E-1 * i - 6,13E+1 * m - 6,18E+1$
SM	kg	$5,45E+0 * m - 6,15E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,48E-3 * i + 4,38E+0 * m - 3,44E-1$	$3,02E-6 * i + 6,75E-4 * m + 3,06E-5$	$9,89E-5 * i + 5,32E-4 * m + 2,25E-4$	$-2,92E-4 * i + 1,93E-2 * m - 2,23E-1$
HW	kg	$3,84E-7 * i + 6,81E-6 * m + 2,16E-4$	$1,17E-8 * i + 2,62E-6 * m + 1,19E-7$	$6,34E-8 * i + 2,00E-6 * m + 2,85E-7$	$-7,57E-7 * i - 1,33E-6$
NHW	kg	$7,21E-3 * i + 3,61E-1 * m + 1,61E-1$	$8,74E-4 * i + 1,95E-1 * m + 8,85E-3$	$5,65E-3 * i + 1,05E+0 * m + 7,32E-1$	$-3,47E-4 * i - 9,16E-2$
RW	kg	$9,55E-7 * i + 7,15E-5 * m + 2,00E-4$	$1,26E-7 * i + 2,81E-5 * m + 1,27E-6$	$1,18E-7 * i + 1,56E-5 * m + 1,86E-6$	$-9,67E-7 * i - 3,36E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$3,52E-4 * i + 8,84E+0 * m + 3,36E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,49E-1 * i + 1,71E-1$	0
EE-T	MJ	0	0	$4,46E-1 * i + 5,14E-1$	0

LEAF - WALL PANELS

ISOBOX LEAF, ISOPARETE PLUS 2 LEAF, ISOPARETE LEAF, ISOPIANO LEAF, ISOFROZEN LEAF, ISOFROZEN HT LEAF

TABLE 7.16 Environmental performance indicators for 1 m²

Wall panels LEAF – Thickness 80 mm – Steel thickness 0,6/0,6 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	3,90E+01	6,95E-01	4,15E+00	-1,02E+01
ODP	kg CFC-11 eq	3,50E-07	1,29E-07	5,80E-08	-1,44E-07
AP	kg SO ₂ eq	1,17E-01	2,71E-03	3,05E-03	-3,04E-02
EP	kg PO ₄ ³⁻ eq	1,39E-02	6,41E-04	1,81E-03	-3,36E-03
POCP	kg C ₂ H ₄ eq	1,24E-02	1,14E-04	6,48E-05	-4,99E-03
ADP - MM	kg Sb eq	1,66E-04	2,10E-06	1,32E-06	-3,97E-06
ADP - F	MJ	5,27E+02	1,06E+01	5,43E+00	-8,39E+01
PERE	MJ	2,51E+01	1,14E-01	7,95E-02	-5,50E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,51E+01	1,14E-01	7,95E-02	-5,50E+00
PENRE	MJ	5,62E+02	1,14E+01	5,94E+00	-8,86E+01
PENRM	MJ	1,28E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	6,89E+02	1,14E+01	5,94E+00	-8,86E+01
SM	kg	5,14E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	4,77E+00	1,75E-03	7,93E-03	-1,21E-03
HW	kg	3,36E-05	6,80E-06	6,86E-06	-5,66E-05
NHW	kg	1,00E+00	5,07E-01	1,53E+00	-2,68E-02
RW	kg	1,70E-04	7,28E-05	2,53E-05	-7,27E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	9,35E+00	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	1,11E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	3,34E+01	0,00E+00

TABLE 7.17 Environmental performance indicators for 1 m²

Wall panels LEAF - Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,28E-1 * i + 2,33E+1 * m + 7,81E-1$	$2,13E-3 * i + 4,25E-1 * m + 1,51E-2$	$5,03E-2 * i + 1,31E-1 * m + -3,39E-2$	$7,13E-3 * i - 8,67E+0 * m - 3,35E-1$
ODP	kg CFC-11 eq	$3,71E-9 * i + 4,21E-8 * m + 3,22E-9$	$3,96E-10 * i + 7,89E-8 * m + 2,81E-9$	$3,62E-10 * i + 2,35E-8 * m + 7,78E-10$	$-1,83E-9 * i + 2,84E-9$
AP	kg SO ₂ eq	$3,40E-4 * i + 7,25E-2 * m + 2,52E-3$	$8,32E-6 * i + 1,66E-3 * m + 5,89E-5$	$3,15E-5 * i + 4,32E-4 * m + 9,84E-6$	$-1,18E-4 * i - 1,72E-2 * m - 3,99E-4$
EP	kg PO ₄ ³⁻ eq	$7,42E-5 * i + 6,35E-3 * m + 2,97E-4$	$1,96E-6 * i + 3,91E-4 * m + 1,39E-5$	$2,16E-5 * i + 1,08E-4 * m + -4,96E-5$	$-2,37E-5 * i - 1,24E-3 * m + 1,50E-5$
POCP	kg C ₂ H ₄ eq	$1,96E-5 * i + 7,19E-3 * m + 2,19E-3$	$3,50E-7 * i + 6,98E-5 * m + 2,48E-6$	$4,50E-7 * i + 2,35E-5 * m + 5,67E-7$	$-3,59E-6 * i - 3,80E-3 * m - 1,46E-4$
ADP - MM	kg Sb eq	$4,83E-8 * i + 1,30E-4 * m + 5,47E-6$	$6,44E-9 * i + 1,28E-6 * m + 4,56E-8$	$5,68E-9 * i + 6,98E-7 * m + 2,43E-8$	$-7,00E-9 * i - 2,77E-6 * m - 8,68E-8$
ADP - F	MJ	$2,74E+0 * i + 2,51E+2 * m + 6,49E+0$	$3,25E-2 * i + 6,48E+0 * m + 2,30E-1$	$3,72E-2 * i + 1,99E+0 * m + 6,43E-2$	$-2,30E-1 * i - 5,40E+1 * m - 6,48E-1$
PERE	MJ	$1,21E-1 * i + 1,24E+1 * m + 6,56E-1$	$3,49E-4 * i + 6,95E-2 * m + 2,47E-3$	$5,77E-4 * i + 2,71E-2 * m + 8,44E-4$	$-7,05E-2 * i + 1,33E-1$
PERM	MJ	0	0	0	0
PERT	MJ	$1,21E-1 * i + 1,24E+1 * m + 6,56E-1$	$3,49E-4 * i + 6,95E-2 * m + 2,47E-3$	$5,77E-4 * i + 2,71E-2 * m + 8,44E-4$	$-7,05E-2 * i + 1,33E-1$
PENRE	MJ	$3,07E+0 * i + 2,58E+2 * m + 6,55E+0$	$3,51E-2 * i + 6,99E+0 * m + 2,48E-1$	$4,11E-2 * i + 2,15E+0 * m + 6,94E-2$	$-3,06E-1 * i - 5,33E+1 * m - 2,23E-1$
PENRM	MJ	$1,43E+0 * i + 5,30E+0 * m + 6,09E+0$	0	0	0
PENRT	MJ	$4,50E+0 * i + 2,63E+2 * m + 1,26E+1$	$3,51E-2 * i + 6,99E+0 * m + 2,48E-1$	$4,11E-2 * i + 2,15E+0 * m + 6,94E-2$	$-3,06E-1 * i - 5,33E+1 * m - 2,23E-1$
SM	kg	$4,15E+0 * m + 1,63E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,00E-3 * i + 3,71E+0 * m + 1,52E-1$	$5,37E-6 * i + 1,07E-3 * m + 3,80E-5$	$9,23E-5 * i + 4,51E-4 * m + 5,14E-6$	$-2,90E-4 * i + 1,68E-2 * m + 1,79E-3$
HW	kg	$3,24E-7 * i + 5,98E-6 * m + 4,65E-7$	$2,08E-8 * i + 4,15E-6 * m + 1,48E-7$	$5,96E-8 * i + 1,70E-6 * m + 5,35E-8$	$-7,18E-7 * i + 8,26E-7$
NHW	kg	$8,21E-3 * i + 2,70E-1 * m + 2,18E-2$	$1,55E-3 * i + 3,10E-1 * m + 1,10E-2$	$5,41E-3 * i + 8,90E-1 * m + 2,80E-2$	$-3,73E-4 * i + 2,96E-3$
RW	kg	$1,10E-6 * i + 6,16E-5 * m + 8,19E-6$	$2,23E-7 * i + 4,45E-5 * m + 1,58E-6$	$1,12E-7 * i + 1,32E-5 * m + 4,52E-7$	$-9,33E-7 * i + 1,94E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$6,98E-4 * i + 7,50E+0 * m + 2,94E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,40E-1 * i - 1,16E-1$	0
EE-T	MJ	0	0	$4,21E-1 * i - 3,49E-1$	0

LEAF - ROOF PANELS

ISOCOP LEAF

TABLE 7.18 Environmental performance indicators for 1 m²
Roof panels LEAF - Thickness 80 mm – Steel thickness 0,6/0,6 mm (external/internal)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	4,16E+01	6,47E-01	4,17E+00	-1,11E+01
ODP	kg CFC-11 eq	3,56E-07	1,20E-07	6,06E-08	-1,45E-07
AP	kg SO ₂ eq	1,25E-01	2,52E-03	3,10E-03	-3,24E-02
EP	kg PO ₄ ³⁻ eq	1,46E-02	5,96E-04	1,84E-03	-3,51E-03
POCP	kg C ₂ H ₄ eq	1,32E-02	1,06E-04	6,74E-05	-5,41E-03
ADP - MM	kg Sb eq	1,80E-04	1,95E-06	1,39E-06	-4,27E-06
ADP - F	MJ	5,56E+02	9,86E+00	5,65E+00	-9,02E+01
PERE	MJ	2,65E+01	1,06E-01	8,25E-02	-5,54E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,65E+01	1,06E-01	8,25E-02	-5,54E+00
PENRE	MJ	5,91E+02	1,06E+01	6,18E+00	-9,49E+01
PENRM	MJ	1,26E+02	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	7,17E+02	1,06E+01	6,18E+00	-9,49E+01
SM	kg	5,58E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	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
FW	m ³	5,17E+00	1,63E-03	7,98E-03	3,25E-04
HW	kg	3,44E-05	6,33E-06	7,05E-06	-5,68E-05
NHW	kg	1,03E+00	4,71E-01	1,63E+00	-2,76E-02
RW	kg	1,78E-04	6,78E-05	2,67E-05	-7,32E-05
REUSE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RECYCLE	kg	4,80E-01	0,00E+00	1,02E+01	0,00E+00
EN-REC	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE-E	MJ	0,00E+00	0,00E+00	1,12E+01	0,00E+00
EE-T	MJ	0,00E+00	0,00E+00	3,35E+01	0,00E+00

TABLE 7.19 Environmental performance indicators for 1 m²

Roof panels LEAF - Formulas for the calculation according to the insulation thickness (i) and total thickness of metal supports (m)

IMPACT CATEGORY	UNIT	A1-A3	A4	C2-C3-C4	D
GWP	kg CO ₂ eq	$1,28E-1 * i + 2,53E+1 * m + 1,23E+0$	$1,85E-3 * i + 4,01E-1 * m + 2,00E-2$	$5,02E-2 * i + 1,42E-1 * m + -1,82E-2$	$7,18E-3 * i - 9,38E+0 * m - 4,86E-1$
ODP	kg CFC-11 eq	$3,70E-9 * i + 4,55E-8 * m + 5,56E-9$	$3,45E-10 * i + 7,45E-8 * m + 3,71E-9$	$3,62E-10 * i + 2,55E-8 * m + 1,22E-9$	$-1,83E-9 * i + 1,81E-9$
AP	kg SO ₂ eq	$3,39E-4 * i + 7,85E-2 * m + 3,92E-3$	$7,24E-6 * i + 1,56E-3 * m + 7,79E-5$	$3,15E-5 * i + 4,67E-4 * m + 1,87E-5$	$-1,18E-4 * i - 1,86E-2 * m - 7,95E-4$
EP	kg PO ₄ ³⁻ eq	$7,43E-5 * i + 6,87E-3 * m + 4,28E-4$	$1,71E-6 * i + 3,69E-4 * m + 1,84E-5$	$2,15E-5 * i + 1,17E-4 * m + -2,72E-5$	$-2,36E-5 * i - 1,34E-3 * m - 3,00E-5$
POCP	kg C ₂ H ₄ eq	$1,96E-5 * i + 7,79E-3 * m + 2,32E-3$	$3,05E-7 * i + 6,59E-5 * m + 3,28E-6$	$4,49E-7 * i + 2,54E-5 * m + 1,09E-6$	$-3,57E-6 * i - 4,11E-3 * m - 2,12E-4$
ADP - MM	kg Sb eq	$4,82E-8 * i + 1,41E-4 * m + 7,58E-6$	$5,60E-9 * i + 1,21E-6 * m + 6,03E-8$	$5,67E-9 * i + 7,55E-7 * m + 3,72E-8$	$-6,96E-9 * i - 2,99E-6 * m - 1,42E-7$
ADP - F	MJ	$2,74E+0 * i + 2,72E+2 * m + 1,21E+1$	$2,83E-2 * i + 6,11E+0 * m + 3,04E-1$	$3,72E-2 * i + 2,15E+0 * m + 1,02E-1$	$-2,27E-1 * i - 5,85E+1 * m - 2,14E+0$
PERE	MJ	$1,21E-1 * i + 1,34E+1 * m + 9,06E-1$	$3,04E-4 * i + 6,56E-2 * m + 3,27E-3$	$5,77E-4 * i + 2,93E-2 * m + 1,36E-3$	$-7,03E-2 * i + 8,43E-2$
PERM	MJ	0	0	0	0
PERT	MJ	$1,21E-1 * i + 1,34E+1 * m + 9,06E-1$	$3,04E-4 * i + 6,56E-2 * m + 3,27E-3$	$5,77E-4 * i + 2,93E-2 * m + 1,36E-3$	$-7,03E-2 * i + 8,43E-2$
PENRE	MJ	$3,06E+0 * i + 2,79E+2 * m + 1,25E+1$	$3,05E-2 * i + 6,59E+0 * m + 3,28E-1$	$4,11E-2 * i + 2,33E+0 * m + 1,10E-1$	$-3,03E-1 * i - 5,77E+1 * m - 1,85E+0$
PENRM	MJ	$1,83E+0 * i - 2,05E+1$	0	0	0
PENRT	MJ	$4,90E+0 * i + 2,79E+2 * m + -8,00E+0$	$3,05E-2 * i + 6,59E+0 * m + 3,28E-1$	$4,11E-2 * i + 2,33E+0 * m + 1,10E-1$	$-3,03E-1 * i - 5,77E+1 * m - 1,85E+0$
SM	kg	$4,47E+0 * m + 2,48E-1$	0	0	0
RSF	MJ	0	0	0	0
NRSF	MJ	0	0	0	0
FW	m ³	$2,00E-3 * i + 4,02E+0 * m + 2,12E-1$	$4,67E-6 * i + 1,01E-3 * m + 5,03E-5$	$9,23E-5 * i + 4,89E-4 * m + 1,39E-5$	$-2,88E-4 * i + 1,82E-2 * m + 1,65E-3$
HW	kg	$3,22E-7 * i + 6,47E-6 * m + 8,82E-7$	$1,81E-8 * i + 3,92E-6 * m + 1,95E-7$	$5,96E-8 * i + 1,84E-6 * m + 9,10E-8$	$-7,17E-7 * i + 5,35E-7$
NHW	kg	$8,21E-3 * i + 2,92E-1 * m + 2,89E-2$	$1,35E-3 * i + 2,92E-1 * m + 1,45E-2$	$5,40E-3 * i + 9,63E-1 * m + 4,57E-2$	$-3,68E-4 * i + 1,82E-3$
RW	kg	$1,10E-6 * i + 6,67E-5 * m + 9,70E-6$	$1,94E-7 * i + 4,20E-5 * m + 2,09E-6$	$1,12E-7 * i + 1,43E-5 * m + 7,00E-7$	$-9,30E-7 * i + 1,23E-6$
REUSE	kg	0	0	0	0
RECYCLE	kg	4,80E-1	0	$6,65E-4 * i + 8,12E+0 * m + 4,22E-1$	0
EN-REC	kg	0	0	0	0
EE-E	MJ	0	0	$1,40E-1 * i - 7,11E-2$	0
EE-T	MJ	0	0	$4,21E-1 * i - 2,13E-1$	0

08. ADDITIONAL INFORMATION

DIFFERENCES VERSUS PREVIOUS VERSION

With this version of the EPD, the environmental performance results of all the products declared in the previous version (Isobox, Isoparete, Isoparete Plus, Isofrozen, Isocop, Isosmart) have been updated through the acquisition of new primary data for LCA inventory updated to 2019 and using the most up-to-date versions of environmental databases as regards secondary data.

The environmental performances obtained in this version show impact values related to climate change without substantial differences compared to those of the previous version, while improvements in performance related to the Resource Depletion (both fossil and mineral resources) are recorded. In addition to the product families indicated above, this version includes the environmental performance of the following Isopan products: Isodomus Classic, PVSteel and products that use insulating foam with Isopan LEAF technology. The calculation specifications (equations) are also provided to obtain the environmental performance values of all the above products, with respect to any thickness combination of insulation / steel facings, in order to provide a complete overview of the environmental impacts of the Isopan product range.

BENEFITS OF ISOPAN LEAF TECHNOLOGY

The update of the Isopan EPDs made it possible to compare the environmental performance of panels produced with standard technology with those of panels produced using LEAF technology. It emerged that, with the same insulating capacity (i.e. with the same thermal resistance R), the LEAF technology has 16-20% lower impacts compared to standard polyurethane. LEAF technology also provides for the use of flame retardants free of halogenated compounds, while still offering excellent fire reaction performance (class Bs1d0).

SUSTAINABILITY POLICY

Manni Group has a document that addresses the sustainability strategies of the Group companies, including Isopan. This document, updated in 2020, identifies the priorities on which to base the development, namely:

- Governance
- Internationalization
- Supply chain responsibility
- Innovation
- Responsible production
- Sustainable construction
- Health and safety
- Training
- Renewable sources
- Fight against climate change
- Energy efficiency

INNOVATION

Isopan has a Research and Development division dedicated to product and process innovation, which has allowed the introduction of new more sustainable technologies, more performing products and new international certificates.

CERTIFICATIONS

Isopan has a UNI EN ISO 9001: 2015 certified global management system for all group companies.

SUPPLY CHAIN RESPONSABILITY

Manni Group and Isopan suppliers are evaluated and selected considering product quality, ethical, environmental, social parameters, reduction of the impacts generated, company strategies. The procurement policies are contained in the Manni Group Sourcing Policy, published in 2018. Isopan thus intends to consolidate its market leadership by contributing, through products with high socio-environmental performance, to an evolution in the demand for more sustainable products and services.

PRODUCT END OF LIFE

Different types of Isopan panels are designed and built to be disassembled and reused. The individual parts can be separated and destined for recycling, recovery or disposal depending on the type of material.

INFORMATION ON CORRECT INSTALLATION AND USE OF THE PANEL

Isopan provides customers and users of the products with extensive documentation on storage, handling and use of the sandwich panels. Furthermore, the Product Technical Manuals contain technical information useful in the design and installation phases. Tutorials installation videos are also available for most of the Isopan product range. Each content can be consulted and downloaded from Isopan website: www.isopan.com

MAINTENANCE

Isopan sandwich panels have an estimated life of 40-45 years depending on the conditions of use, according to the BBSR table. The product does not require special maintenance activities. The products are easily washable and their cleaning does not require chemicals harmful to the environment.



BUILDING SUSTAINABILITY RATING AND GREEN PUBLIC PROCUREMENT

The use of Isopan insulating panels contributes to the prerequisites and credits for the most important building sustainability assessment systems, including LEED, BREEAM and Living Building Challenge.

Isopan was also the first Italian company to endow some products with the Declare environmental label.

The technical characteristics and the certificates obtained provide credits for these certifications and make them meet the environmental criteria required by many states in the world on construction products used in their territory.

Specifically, it is specified that:

- During the production process no flame retardants are used which are subject to restrictions or prohibitions provided for by applicable national or community regulations;
- During the production process, no blowing agents are used with an ozone reduction potential greater than zero;
- No lead catalysts are used during the production process.

The 2019 production also recorded the following average circularity characteristics:

- Recycled content > 25% for sandwich panels in PIR / PUR Polyurethane Foam.

These percentage values vary depending on the type of panel, the thickness of the insulation and the sheets and finally the raw materials used.

The polyurethane PIR foam used has a recycled content of 2.1%.

OTHER ENVIRONMENTAL INFORMATION

At the Isopan factories there are no water discharges deriving from the panel production process. Isopan has obtained certifications on VOC emissions in accordance with UNI EN ISO 16000-9.

09. CONTACTS

The following contacts are available for more information on ISOPAN Group activities or on this product declaration:

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Technical support for the preparation of the LCA study was provided by:
Bureau Veritas Nexta Srl - www.nexta.bureauveritas.it.

10. VERIFICATION AND REGISTRATION

CEN STANDARD EN 15804 SERVED AS THE CORE PCR

PCR:

PCR 2012:01 ver 2.3, 2018-11-15
"Construction products and construction services"
Sub-PCR-I Thermal insulation products (EN 16783)

PCR review was conducted by:

The Technical Committee of the International EPD® System.
Chair: Filippo Sessa
Contact via info@environdec.com

Independent verification of the declaration and data, according to ISO 14025:

EPD process certification (Internal)
EPD verification (External)

Third party verifier:

Ugo Pretato - Recognized Individual Verifier

Accredited or approved by:

Technical Committee of "The International EPD® System"

STATEMENTS

EPD for construction products may not be comparable if they do not comply with EN 15804.

EPD of the same product category but coming from different programs may not be comparable.





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11. REFERENCES

General Programme Instructions for the International EPD® System, ver 3.0.

PCR 2012:01 ver 2.3, 2018-11-15

"Construction products and construction services"

EN 15804:2012 + A1:2013

Sustainability of construction works
Environmental product declarations
Core rules for the product category of construction products.

UNI EN ISO 14025:2010

Environmental labels and declarations
Type III environmental declarations
Principles and procedures

UNI EN ISO 14040:2006

Life cycle assessment - Principles and framework

UNI EN ISO 14044:2006

Life cycle assessment - Requirements and guidelines

UNI EN 16783

Thermal insulation
Thermal insulation products
Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

Sub-PCR-I Thermal insulation products (EN 16783)

Life Cycle Assessment Technical Report Rev2, March 2019

Bureau Veritas Nexta Srl

Life Cycle Assessment Technical Report Rev2, December 2020

Bureau Veritas Nexta Srl

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