Environmental Product Declaration Type III ITB No. 247 /2021

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Sandwich panels with **PIR core and PIR MAX core**



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Basic information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically. a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (point 5.3 of the standard).

Life cycle analysis (LCA):A1-A3,C1-C4 and Din accordance with EN 15804 (Cradle to Gate with options)
The year of preparing the EPD: 2021
Product standard: EN 14509:2013
Service Life:50 years
PCR:ITB-PCR A (PCR based on EN 15804)
Declaredunit:1 m^2 of sandwich panel with PIR core and PIR MAX core
Reasons for performing LCA: B2B
Representativeness: Polish production

MANUFACTURER

Gór-Stal has been on the market for producers of building materials for over 18 years providing solutions for industrial. Residential and agricultural construction offering a wide range of wall, roof and cooling sandwich panels. Gór-Stal mainly specializes in the production of PIR panels which are one of the component parts during thermal insulation works. Company offer high-quality insulation panels and sandwich panels made of raw materials from reputable and responsible suppliers. ISO 9001 and 14001 certificates confirm the company's compliance with international standards regarding quality management and environmental protection.

List of products covered by this EPD manufactured by Gór-Stal in Gorlice is provided in a Table 1. Sandwich panels are constructions composed of rationally selected and properly connected structural and insulation-constructional materials. They consist of two claddings made of profiled sheet steel and an insulating core with appropriate thermal insulation and mechanical properties.

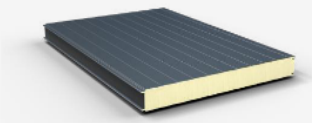
Figure 1. A view of the Gór-Stal production plant in Gorlice (Poland).

As cladding, galvanized steel sheet with organic polyester varnish with a coating thickness of 25 microns is used. Organically coated sheet metal is subject to constant control both after each production process and after delivery to the warehouse in Gorlice.

In sandwich panels, polyisocyanurate (PIR) foam with a density of 37,5 kg/m^3 and a design thermal conductivity coefficient of λ = 0.22 W / m·K is used as the core. From 2020 boards are available in the MAX version with a core coefficient of λ = 0.019 W/m·K. Isocyanurate structures in PIR foams decompose at temperatures above 300^{O}C. The carbonized layer protects against high temperature penetration through the board, which in turn provides effective fire protection. Steel sheet, galvanized on both sides, grade S220-S280GD according to EN 10346 with organic polyester varnish with a coating thickness of 25 μm is used as cladding of sandwich panels. Due to the increased anti-corrosion requirements, it is possible to manufacture panels with coatings dedicated to C4 and C5 environments and to aggressive environments inside the facilities (also made of 1.4301 stainless steel). The boards are protected with foil against mechanical damage that may occur during transport or assembly. There are three basic groups of panels: wall, roof and coldstore panels. Wall sandwich panels named GS insPIRe S / GS insPIRe S MAX (with standard cam-lock) have thickness 40, 60, 80, 100, 120 mm and GS insPIRe U / GS insPIRe U MAX (hidden cam-lock) have thickness 60, 80, 100, 120, 140 mm. Roof sandwich panels GS PIR D / GS PIR D MAX (roof cam-lock) have thickness 40, 60, 80. 100. 120, 140, 160, 200 mm. Coldstore panels GS insPIRe CH / GS insPIRe CH MAX (cold storage cam-lock) have thickness: 100, 120, 160, 200 mm. The basic technical data concerning the range of manufactured sandwich panels with PIR core and PIR MAX are presented in the Table 1.

Table 1. Basic technical information on products groups covered by EPD

GS insPIRe® S MAX / GS insPIRe® S
Polyisocyanurate wall panel



Information about the sandwich panel:

GS InsPIRe® S MAX / GS InsPIRe® S wall panels are designed for external curtain walls and internal partition walls in skeletal structures. The panels can be installed both vertically and horizontally as single and multi-span wall elements. The plate cladding is galvanized steel sheet on both sides according to EN 10346 with organic polyester varnish with a coating thickness of 25 µm. The tightness of panel joints is ensured by the PUS polyurethane gasket applied at the production stage.

Thickness [mm]		40	60	80	100	120
Mass* [kg/m²]		10,0	11,0	11,8	12,6	13,4
Maximum length [m]		16,5				
Modular width [mm]		1000 / 1140 (for thickness. ≥ 60 mm and profiliation L, M and F)				
Exterior lining profiling	module 1000	L - Linear, M - Microfiltered, F - Wavy, R - Grooved, P - Flat				
	module 1140	L - Linear, M - Microfiltered, F - Wavy, P - Flat				
Interior lining profiling		L - Linear, P - Flat				

GS insPIRe® S MAX - Polyisocyanurate wall panel						
Declared heat transfer coefficient λ_D		0,019				
Ratio $U_{c,i}$ [W/m²K]		0,52	0,33	0,24	0,19	0,16
Fire resistance classification ***		-				EI 30
Fire resistance ***		B-s1, d0				
Fire spread		NRO				
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Certificate of Business Continuity EN 14509,				

GS insPIRe® S - Polyisocyanurate wall panel						
Declared heat transfer coefficient λ_D		0,022				
Ratio $U_{c,i}$ [W/m²K]		0,60	0,38	0,28	0,22	0,19
Fire resistance classification ***		-		EI 20		EI 30
Fire resistance ***		B-s1, d0				
The impact of external fire on the roof		NRO				
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Hygienic Certificate, Certificate of Business Continuity EN 14509, Fire resistance classification				

GS insPIRe® U MAX / GS insPIRe® U
Polyisocyanurate wall panel

Information about the sandwich panel:

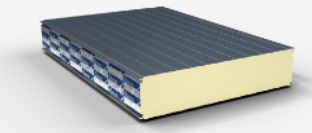
GS InsPIRe® U MAX / GS InsPIRe® U wall panels are designed for external curtain walls and internal partition walls in skeletal structures. The panels can be installed both vertically and horizontally as single and multi-span wall elements. Hidden fastening, invisible from the facade, makes these panels very attractive in terms of architecture and functionality. The plate cladding is galvanized steel sheet on both sides according to EN 10346 with organic polyester varnish with a coating thickness of 25 µm. The tightness of panel joints is ensured by the PUS polyurethane gasket applied at the production stage.

Thickness [mm]		60	80	100	120	140
Mass* [kg/m²]		11,3	12,1	12,9	13,7	14,5
Maximum length [m]		16,5				
Modular width [mm]		1000				
Exterior lining profiling	module 1000	L - Linear, M - Microfiltered, F - Wavy, R - Grooved, P - Flat				
	-	-				
Interior lining profiling		L - Linear, P - Flat				

GS insPIRe® U MAX - Polyisocyanurate wall panel						
Declared heat transfer coefficient λ_D		0,019				
Ratio $U_{c,i}$ [W/m²K]		0,38	0,26	0,20	0,16	0,14
Fire resistance classification ***		-				
Fire resistance ***		B-s1, d0				
Fire spread		NRO				
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Certificate of Business Continuity EN 14509,				

GS insPIRe® U - Polyisocyanurate wall panel						
Declared heat transfer coefficient λ_D		0,022				
Ratio $U_{c,i}$ [W/m²K]		0,44	0,29	0,23	0,19	0,16
Fire resistance classification ***		-		EI 15		EI 30
Fire resistance ***		B-s1, d0				
The impact of external fire on the roof		NRO				
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Hygienic Certificate, Certificate of Business Continuity EN 14509, Fire resistance classification				

GS insPIRe® CH MAX / GS insPIRe® CH
Polyisocyanurate cooling panel



Information about the sandwich panel:

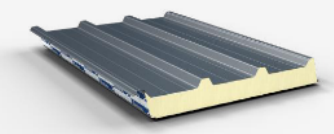
GS InsPIRe® CH MAX / GS InsPIRe® CH cooling panel is designed for walls and ceilings in rooms with reduced temperature, i.e. in cold rooms (> 0 °) and freezers (< -0 °) and other facilities with controlled temperature and humidity. The panels can be used to erect free-standing buildings and make cold rooms or freezers inside existing buildings. The panels can be mounted both vertically and horizontally as single and multi-span elements.

Thickness [mm]		100	120	160	200
Mass* [kg/m²]		12,6	13,4	15,0	16,6
Maximum length [m]		16,5			
Modular width [mm]		1000 / 1140 (for thickness. ≥ 60 mm and profiliation L, M and F)			
Exterior lining profiling	module 1000	L - Linear, M - Microfiltered, F - Wavy, R - Grooved			
	module 1140	L - Linear, M - Microfiltered, F - Wavy, P - Flat			
Interior lining profiling		L - Linear, P - Flat			

GS insPIRe® CH MAX - Polyisocyanurate cooling panel					
Declared heat transfer coefficient λ_D		0,019			
Ratio $U_{c,i}$ [W/m²K]		0,19	0,16	0,12	0,10
Fire resistance classification ***		EI 30			
Fire resistance ***		B-s1, d0			
Fire spread		NRO			
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Certificate of Business Continuity EN 14509, Fire resistance classification			

GS insPIRe® CH - Polyisocyanurate cooling panel					
Declared heat transfer coefficient λ_D		0,022			
Ratio $U_{c,i}$ [W/m²K]		0,22	0,18	0,14	0,11
Fire resistance classification ***		EI 30			
Fire resistance ***		B-s1, d0			
Fire spread		NRO			
Certificates, approvals, seals of approval		DWU CE according to EN 14509, Hygienic Certificate, Certificate of Business Continuity EN 14509, Fire resistance classification			

GS PIR D MAX / GS PIR D
Polyisocyanurate roof panel



Information about the sandwich panel:

GS PIR D MAX / GS PIR D roof panels are designed for roofing. They are characterized by a very deep profiling of the trapezoidal outer cladding. This is related to the transmission of long-term service loads. The boards are fastened with screws to the wooden, steel or reinforced concrete structure. The minimum roof pitch is 3 ° (5.2%) without skylights and 5 ° (8.7%) for covering panels joined along their length. The plate cladding is galvanized steel sheet on both sides according to EN 10346 with organic polyester varnish with a coating thickness of 25 µm.

Thickness [mm]	40 / 80	60 / 100	80 / 120	100 / 140	120 / 160	160 / 200
Mass* [kg/m²]	10,4	11,2	12,0	12,8	13,6	15,4
Maximum length [m]	16,5					
Modular width [mm]	1000					
Exterior lining profiling	T - Trapezoidal					
Interior lining profiling	L - Linear, P - Flat					

GS PIR D MAX - Polyisocyanurate roof panel						
Declared heat transfer coefficient λ_D	0,020					
Ratio $U_{c,i}$ [W/m²K]	0,50	0,33	0,25	0,20	0,17	0,13
Fire resistance classification ***	-			RE 30 / REI 20		
Fire resistance ***	B-s1, d0					
Fire spread	BROOF					
Certificates, approvals, seals of approval	DWU CE according to EN 14509, Certificate of Business Continuity EN 14509, Fire resistance classification					

GS PIR D - PPolyisocyanurate roof panel						
Declared heat transfer coefficient λ_D	0,022					
Ratio $U_{c,i}$ [W/m²K]	0,55	0,37	0,27	0,22	0,18	0,14
Fire resistance classification ***	-		REI 30 / RE 120			
Fire resistance ***	B-s1, d0					
Fire spread	BROOF					
Certificates, approvals, seals of approval	DWU CE according to EN 14509, Hygienic Certificate, Certificate of Business Continuity EN 14509, Fire resistance classification					

TECHNICAL PROPERTIES and CERTIFICATES

All technical properties of sandwich panels in the field of: fire reaction, fire resistance, flame propagation, thermal physics, acoustic insulation, corrosion resistance, staticsare detailed in the technical catalogs which can be downloaded at producer web-site.

- Type of core – polyisocyanurate (PIR)
- Apparent density of PIR core [kg/m^3] – 37,5
- Declared heat conductivity coefficient λ_D[W/m*K] - λ_D = 0.022 and 0.019 (MAX)
- Board facing – steel (with several profilation types (mikro, grooving, linear, flat, wavy, trapezoidal)
- Thickness [mm] - from 40 to 200 mm

PRODUCT APPLICATION

Sandwich panels are constructed from materials which consist of construction elements (external steel facings) and construction – insulation layers (PIR core of the panel). The idea of sandwich panels is permanent connection construction of facings with core on whole surface in order to get the static collaboration among them. The application type for the product is construction of industrial and investment faicilites (walls androofs), cold stores and freezers. Panels can be mounted in both vertical and horizontal position, as single-span or multi-span wall elements.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Declared unit

Declared unit DU is 1 m^2 of sandwich panel with PIR core

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production of the sandwich panels is a line process in a factory located in Gorlice (Poland). Allocation for production A1-A3 (PIR core vs Mineral Wool core production) is done on a production volume basis. All impacts from raw materials extraction and production (including: steel profiles production, PIR, addhesive, gasket packaging and energy carriers and water) are allocated in A1 module. 100% of impacts from line production were inventoried. Module A2 includes transport of raw materials such as steel products, chemicals, additives and ancillary materials from their suppliers to manufacturing plant. Municipal wastes of factory were allocated to module A3. Energy supply was inventoried for whole factory and was allocated to the PIR sandwich panels production (mass basis). Emissions in the factory (fuels) were estimated by using national conversion factors (KOBIZE, 2020) and were allocated to module A3.

System limits

The life cycle analysis of the declared products covers “Product Stage”, A1-A3, C1-C4 and D modules (Cradle to Gate with options) accordance with EN 15804 and ITB PCR A. The input materials and energy consumption inventoried in factories and were included in calculation. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilized thermal energy, internal fuel and electric power consumption. It is assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804, machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 and A2 Modules: Raw materials supply and transport

In order to produce a sandwich panel, core insulation material and facings are required (0.5/0.5 mm). In the case of PIR sandwich panels family a core material is a rigid polyurethane (or

polyisocyanurate) foam obtained in a controlled chemical reaction during production process. A vast majority of liquid components, necessary for chemical reactions, are sourced from inventored suppliers the steel sheets are being used as facings. Steel sheet coils are being sourced at domestic steel suppliers. The remaining ancillary materials such protective films, as well as all packaging materials are supplied by local producers. The transport to the factory has been fully inventorized (LCI questionnaire), taking into account the number of deliveries, type of vehicles, the size of the delivery and the distance from the manufacturer to the factory for all materials and raw materials.

A3: Production

PIR sandwich panelsare being produced in a continuous production process. Production process itself (Gorlice, Poland) can be divided into several stages;

1. Profiling of facings material

During this stage, designated steel coils are being unwind. One of steel sheets will be used as a façade facing, while the other one as internal facing. Then internal sides of each steel sheets are being treated by corona discharge to improve adhesion process at the subsequent foaming in the case of PIR core. At the end of this stage, designed surface's profiling and the side profiling (to form panel's joint) is taking place.

2. Foaming of the insulation core

Rigid PIR insulation core material is being formed as a product of chemical reactions. Main components are polymeric isocyanate and polyols. To control reaction speed catalysts are being used. Pentane is used as a physical blowing agent, but due to its very low thermal conductivity, is also responsible for superior heat insulation properties of panels with PIR core. All components, according to formulation, are being precisely dosed and mixed at high pressure in a liquid form. Such a reactive mixture is being evenly distributed across internal side of profiled façade facing. Foaming process starts and two facings are reaching double belt laminator, where expanding chemical mixture fills volume with very fine cells structure foam. Double belt laminator ensure dimension (thickness and width of sandwich panel), as well as necessary conditions for foam to harden.

3. Cutting to length and cool down

At this stage, panels are being cut to length, according to customer request, by flying saw synchronised with production line speed. Next, panels are being transported into a cooling buffer, where need to spend relevant time to reach temperature stability.

4. Packaging

In the end of the process panels are stacked to form a parcel, which is subsequently wrapped with foil. Next ready parcels need to stabilise for 48 hours (for PIR). Finally, parcels are being load on trucks and deliver to customer.

C1 – C4: End of life

The end of life scenario for a sandwich panel with PIR core is provided in Table 2. The product is disassembled using a mechanical jack and electric tools.

Table 2. End of life scenario

Parameter	Contribution
Collection rate	100%
Reuse	10%
Recycling steel	98% of cladding
Landfilling steel	2% of cladding
Incineration of PIR	50% of PIR core
Landfilling PIR	50% of PIR core

D: Re-use, recovery, recycling potential
Benefits beyond the system boundary were calculated for steel cladding using a net scrap formulation proposed by World Steel Association in Life cycle inventory methodology report (2017) where the net scrap is determined as a difference between the amount of steel recycled at end-of-life and the scrap input from previous product life cycle.

Data collection period
The data for manufacture of the declared products refer to year 2020. The life cycle assessments were prepared for Poland as reference area.

Data input quality
The values determined to calculate the LCA originate from LCI verified inventory data provided by Górstal.

Assumptions and estimates
The impacts of the panels were aggregated using mass of production. The impacts of the sandwich panels were aggregated using volume of production. Impacts were inventoried and calculated for all products of the sandwich panels.

Calculation rules
LCA was done in accordance with ITB PCR A document.

Databases
The data for the processes come from the following databases: PIR (Gór-stal), Ecoinvent v.3.7 (adhesive, gasket, water), specific EPDs (steel profile producers), Kobize/Tauron (energy carriers: electricity, ON, natural gas and LPG). Specific data quality analysis was a part of external ISO 14001 audit. Characterization factors are CML ver. 4.2 based on EN 15804:2013+A1 version (PN-EN 15804+A1:2014-04).

LIFE CYCLE ASSESSMENT (LCA)– Results

Declared/functional unit

The declaration refers to declared unit (DU) – 1 m^2 of the PIR sandwich panel manufactured by Gór-Stal (Table 3).The following tables 4-12 present the environmental impact in relation to 1 m^2 for all offered product thicknesses (40-200mm).

Table 3. System boundaries (modlues included) for the environmental characteristic of the sandwich panels.

Environmental assessment information (MNA – Module not assessed. MD – Module Declared. INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
MD	**MD**	**MD**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 4. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 40 mm thickness

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.29E+01	8.99E-01	7.13E-02	1.57E-01	2.04E-01	1.23E+00	1.35E-02	-6.62E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	6.60E-06	0.00E+00	3.65E-09	1.73E-09	0.00E+00	9.25E-08	2.80E-09	-1.32E-06
Acidification potential of soil and water	kg SO_2 eq.	1.14E-01	2.07E-02	7.65E-05	1.38E-04	5.02E-03	5.38E-03	1.11E-04	-2.77E-02
Formation potential of tropospheric ozone	kg Ethene eq.	2.04E-02	4.52E-04	2.50E-05	7.17E-04	1.02E-04	1.20E-05	2.62E-06	-4.93E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	9.56E-03	1.13E-03	2.36E-04	5.77E-06	2.55E-04	1.09E-02	1.77E-04	-2.38E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	7.47E-03	0.00E+00	8.85E-07	1.17E-03	0.00E+00	1.92E-04	2.39E-08	-1.61E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.47E+02	6.81E+00	2.98E+00	1.80E+00	1.62E+00	7.88E+00	2.67E-01	-6.78E+00
Environmental aspects: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.29E+01	4.28E-01	2.98E-02	2.70E-01	2.62E-01	1.42E-01	4.38E-03	-3.70E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.62E+02	6.96E+00	3.19E+00	1.98E+00	1.68E+00	8.37E+00	2.81E-01	-6.98E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	4.48E-01	0.00E+00	0.00E+00	1.08E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	1.51E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.53E-05
Net use of fresh water	m^3	1.12E-01	3.93E-06	5.47E-04	5.69E-04	1.44E-03	4.80E-05	1.92E-04	-2.44E-02
Other environmental information describing waste categories: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4.00E-03	2.05E-05	0.00E+00	2.40E-06	3.77E-06	2.42E-06	4.80E-03	-1.00E-03
Non-hazardous waste disposed	kg	3.74E-01	1.20E-02	8.68E-03	2.17E-02	1.75E-03	1.02E-02	6.64E-01	-1.08E-01
Radioactive waste disposed	kg	6.64E-05	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-1.32E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	2.48E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 5. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 60 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.42E+01	9.49E-01	8.54E-02	1.57E-01	2.06E-01	1.82E+00	1.45E-02	-6.88E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	9.90E-06	0.00E+00	4.37E-09	1.73E-09	0.00E+00	1.01E-07	3.15E-09	-1.97E-06
Acidification potential of soil and water	kg SO_2 eq.	1.45E-01	2.11E-02	9.16E-05	1.38E-04	5.04E-03	5.71E-03	1.18E-04	-3.40E-02
Formation potential of tropospheric ozone	kg Ethene eq.	2.65E-02	4.78E-04	3.00E-05	7.17E-04	1.03E-04	1.20E-05	2.87E-06	-6.14E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.20E-02	1.19E-03	2.82E-04	5.77E-06	2.58E-04	1.26E-02	1.89E-04	-2.87E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.06E-02	0.00E+00	1.06E-06	1.17E-03	0.00E+00	2.88E-04	2.39E-08	-2.25E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.78E+02	7.26E+00	3.57E+00	1.80E+00	1.70E+00	8.06E+00	3.00E-01	-7.40E+01
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.37E+01	4.37E-01	3.57E-02	2.70E-01	3.42E-01	1.66E-01	6.06E-03	-3.86E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.97E+02	7.33E+00	3.82E+00	1.98E+00	1.66E+00	8.56E+00	3.16E-01	-7.68E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	4.71E-01	0.00E+00	0.00E+00	1.12E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	1.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.54E-05
Net use of fresh water	m^3	1.58E-01	4.53E-06	6.55E-04	5.69E-04	2.16E-03	7.20E-05	2.88E-04	-3.36E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4.98E-03	2.33E-05	0.00E+00	2.40E-06	3.79E-06	2.92E-06	7.20E-03	-1.20E-03
Non-hazardous waste disposed	kg	3.95E-01	1.46E-02	1.04E-02	2.17E-02	1.76E-03	1.50E-02	9.00E-01	-1.12E-01
Radioactive waste disposed	kg	9.96E-05	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-1.99E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	2.97E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 6. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 80 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.54E+01	9.98E-01	9.95E-02	1.57E-01	2.09E-01	2.41E+00	1.56E-02	-7.13E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	1.32E-05	0.00E+00	5.09E-09	1.73E-09	0.00E+00	1.10E-07	3.50E-09	-2.63E-06
Acidification potential of soil and water	kg SO_2 eq.	1.77E-01	2.15E-02	1.07E-04	1.38E-04	5.05E-03	6.05E-03	1.26E-04	-4.04E-02
Formation potential of tropospheric ozone	kg Ethene eq.	3.25E-02	5.04E-04	3.49E-05	7.17E-04	1.05E-04	1.20E-05	3.13E-06	-7.34E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.44E-02	1.26E-03	3.29E-04	5.77E-06	2.61E-04	1.42E-02	2.00E-04	-3.36E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.38E-02	0.00E+00	1.23E-06	1.17E-03	0.00E+00	3.84E-04	2.39E-08	-2.88E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.08E+02	7.72E+00	4.15E+00	1.80E+00	1.77E+00	8.24E+00	3.34E-01	-8.01E+01
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.45E+01	4.46E-01	4.15E-02	2.70E-01	4.21E-01	1.90E-01	7.74E-03	-4.03E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.32E+02	7.81E+00	4.45E+00	1.98E+00	1.74E+00	8.74E+00	3.50E-01	-8.38E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	4.95E-01	0.00E+00	0.00E+00	1.16E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.55E-05
Net use of fresh water	m^3	2.04E-01	5.13E-06	7.63E-04	5.69E-04	2.88E-03	9.60E-05	3.84E-04	-4.28E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	5.96E-03	2.60E-05	0.00E+00	2.40E-06	3.80E-06	3.43E-06	9.60E-03	-1.40E-03
Non-hazardous waste disposed	kg	4.16E-01	1.71E-02	1.21E-02	2.17E-02	1.78E-03	1.98E-02	1.14E+00	-1.16E-01
Radioactive waste disposed	kg	1.33E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-2.65E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	3.46E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 7. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 100 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.67E+01	1.05E+00	1.03E-01	4.72E-01	2.11E-01	3.00E+00	1.66E-02	-7.38E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	1.65E-05	0.00E+00	5.26E-09	5.20E-09	0.00E+00	1.18E-07	3.84E-09	-3.29E-06
Acidification potential of soil and water	kg SO_2 eq.	2.09E-01	2.18E-02	1.10E-04	4.15E-04	5.07E-03	6.38E-03	1.33E-04	-4.67E-02
Formation potential of tropospheric ozone	kg Ethene eq.	3.85E-02	5.30E-04	3.61E-05	2.15E-03	1.06E-04	1.20E-05	3.38E-06	-8.55E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.69E-02	1.32E-03	3.40E-04	1.73E-05	2.64E-04	1.59E-02	2.12E-04	-3.84E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.70E-02	0.00E+00	1.27E-06	3.50E-03	0.00E+00	4.80E-04	2.39E-08	-3.52E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.39E+02	8.17E+00	4.29E+00	5.40E+00	1.85E+00	8.41E+00	3.68E-01	-8.63E+01
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.53E+01	4.56E-01	4.29E-02	8.10E-01	5.01E-01	2.14E-01	9.42E-03	-4.19E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.67E+02	8.29E+00	4.60E+00	5.94E+00	1.82E+00	8.93E+00	3.85E-01	-9.08E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	5.19E-01	0.00E+00	0.00E+00	1.20E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.56E-05
Net use of fresh water	m^3	2.50E-01	5.73E-06	7.88E-04	1.71E-03	3.60E-03	1.20E-04	4.80E-04	-5.20E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	6.94E-03	2.88E-05	0.00E+00	7.20E-06	3.82E-06	3.93E-06	1.20E-02	-1.59E-03
Non-hazardous waste disposed	kg	4.37E-01	1.97E-02	1.25E-02	6.50E-02	1.79E-03	2.46E-02	1.37E+00	-1.21E-01
Radioactive waste disposed	kg	1.66E-04	0.00E+00	0.00E+00	7.20E-06	0.00E+00	3.60E-06	3.15E-07	-3.31E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	3.58E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 120 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.79E+01	1.10E+00	1.28E-01	1.57E-01	2.13E-01	3.58E+00	1.76E-02	-7.63E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	1.98E-05	0.00E+00	6.53E-09	1.73E-09	0.00E+00	1.27E-07	4.19E-09	-3.95E-06
Acidification potential of soil and water	kg SO_2 eq.	2.41E-01	2.22E-02	1.37E-04	1.38E-04	5.09E-03	6.72E-03	1.41E-04	-5.30E-02
Formation potential of tropospheric ozone	kg Ethene eq.	4.45E-02	5.56E-04	4.48E-05	7.17E-04	1.07E-04	1.20E-05	3.64E-06	-9.76E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	1.93E-02	1.39E-03	4.22E-04	5.77E-06	2.67E-04	1.76E-02	2.24E-04	-4.33E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.02E-02	0.00E+00	1.58E-06	1.17E-03	0.00E+00	5.76E-04	2.39E-08	-4.16E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.70E+02	8.62E+00	5.33E+00	1.80E+00	1.93E+00	8.59E+00	4.01E-01	-9.24E+01
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.61E+01	4.65E-01	5.33E-02	2.70E-01	5.81E-01	2.38E-01	1.11E-02	-4.35E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4.03E+02	8.77E+00	5.71E+00	1.98E+00	1.90E+00	9.12E+00	4.20E-01	-9.79E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	5.43E-01	0.00E+00	0.00E+00	1.24E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.58E-05
Net use of fresh water	m^3	2.96E-01	6.33E-06	9.79E-04	5.69E-04	4.32E-03	1.44E-04	5.76E-04	-6.12E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	7.92E-03	3.16E-05	0.00E+00	2.40E-06	3.83E-06	4.44E-06	1.44E-02	-1.79E-03
Non-hazardous waste disposed	kg	4.58E-01	2.23E-02	1.55E-02	2.17E-02	1.81E-03	2.94E-02	1.61E+00	-1.25E-01
Radioactive waste disposed	kg	1.99E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-3.97E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	4.44E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 140 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.92E+01	1.15E+00	1.42E-01	6.61E-01	2.15E-01	4.17E+00	1.86E-02	-7.88E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.31E-05	0.00E+00	7.25E-09	7.28E-09	0.00E+00	1.36E-07	4.53E-09	-4.61E-06
Acidification potential of soil and water	kg SO_2 eq.	2.73E-01	2.26E-02	1.52E-04	5.81E-04	5.10E-03	7.06E-03	1.48E-04	-5.94E-02
Formation potential of tropospheric ozone	kg Ethene eq.	5.05E-02	5.82E-04	4.97E-05	3.01E-03	1.08E-04	1.20E-05	3.89E-06	-1.10E-02
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	2.18E-02	1.45E-03	4.69E-04	2.42E-05	2.70E-04	1.93E-02	2.35E-04	-4.82E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.34E-02	0.00E+00	1.76E-06	4.90E-03	0.00E+00	6.72E-04	2.39E-08	-4.80E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.01E+02	9.08E+00	5.92E+00	7.56E+00	2.00E+00	8.77E+00	4.35E-01	-9.85E+01
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.70E+01	4.74E-01	5.92E-02	1.13E+00	6.61E-01	2.62E-01	1.28E-02	-4.52E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4.38E+02	9.15E+00	6.34E+00	8.32E+00	1.98E+00	9.30E+00	4.55E-01	-9.99E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.78E-02	5.67E-01	0.00E+00	0.00E+00	1.28E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.59E-05
Net use of fresh water	m^3	3.42E-01	6.93E-06	1.09E-03	2.39E-03	5.04E-03	1.68E-04	6.72E-04	-7.05E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	8.90E-03	3.43E-05	0.00E+00	1.01E-05	3.85E-06	4.94E-06	1.68E-02	-1.98E-03
Non-hazardous waste disposed	kg	4.79E-01	2.48E-02	1.72E-02	9.10E-02	1.82E-03	3.42E-02	1.84E+00	-1.29E-01
Radioactive waste disposed	kg	2.32E-04	0.00E+00	0.00E+00	1.01E-05	0.00E+00	3.60E-06	3.15E-07	-4.63E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	4.93E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 10. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 160 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	3.04E+01	1.20E+00	1.56E-01	7.55E-01	2.18E-01	4.76E+00	1.96E-02	-8.14E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.64E-05	0.00E+00	7.97E-09	8.32E-09	0.00E+00	1.44E-07	4.88E-09	-5.26E-06
Acidification potential of soil and water	kg SO_2 eq.	3.04E-01	2.29E-02	1.67E-04	6.64E-04	5.12E-03	7.39E-03	1.56E-04	-6.57E-02
Formation potential of tropospheric ozone	kg Ethene eq.	5.66E-02	6.08E-04	5.47E-05	3.44E-03	1.09E-04	1.20E-05	4.14E-06	-1.22E-02
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	2.42E-02	1.52E-03	5.15E-04	2.77E-05	2.73E-04	2.10E-02	2.47E-04	-5.31E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.65E-02	0.00E+00	1.93E-06	5.60E-03	0.00E+00	7.68E-04	2.39E-08	-5.44E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.32E+02	9.53E+00	6.51E+00	8.64E+00	2.08E+00	8.95E+00	4.68E-01	-1.05E+02
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.78E+01	4.83E-01	6.51E-02	1.30E+00	7.41E-01	2.86E-01	1.45E-02	-4.68E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4.73E+02	9.52E+00	6.97E+00	9.50E+00	2.06E+00	9.49E+00	4.90E-01	-6.19E+01
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.79E-02	5.90E-01	0.00E+00	0.00E+00	1.32E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.55E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.60E-05
Net use of fresh water	m^3	3.88E-01	7.53E-06	1.19E-03	2.74E-03	5.76E-03	1.92E-04	7.68E-04	-7.97E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	9.88E-03	3.71E-05	0.00E+00	1.15E-05	3.86E-06	5.44E-06	1.92E-02	-2.18E-03
Non-hazardous waste disposed	kg	5.00E-01	2.74E-02	1.89E-02	1.04E-01	1.83E-03	3.90E-02	2.08E+00	-1.33E-01
Radioactive waste disposed	kg	2.66E-04	0.00E+00	0.00E+00	1.15E-05	0.00E+00	3.60E-06	3.15E-07	-5.30E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	5.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 11. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 180 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	3.17E+01	1.25E+00	1.70E-01	1.57E-01	2.20E-01	5.35E+00	2.06E-02	-8.39E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.97E-05	0.00E+00	8.69E-09	1.73E-09	0.00E+00	1.53E-07	5.23E-09	-5.92E-06
Acidification potential of soil and water	kg SO_2 eq.	3.36E-01	2.33E-02	1.82E-04	1.38E-04	5.14E-03	7.73E-03	1.63E-04	-7.21E-02
Formation potential of tropospheric ozone	kg Ethene eq.	6.26E-02	6.34E-04	5.96E-05	7.17E-04	1.11E-04	1.20E-05	4.40E-06	-1.34E-02
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	2.66E-02	1.58E-03	5.62E-04	5.77E-06	2.76E-04	2.26E-02	2.59E-04	-5.80E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.97E-02	0.00E+00	2.11E-06	1.17E-03	0.00E+00	8.64E-04	2.39E-08	-6.07E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.62E+02	9.99E+00	7.09E+00	1.80E+00	2.15E+00	9.12E+00	5.02E-01	-1.11E+02
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.86E+01	4.92E-01	7.09E-02	2.70E-01	8.20E-01	3.10E-01	1.61E-02	-4.84E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	5.08E+02	1.05E+01	7.60E+00	1.98E+00	2.14E+00	9.68E+00	5.24E-01	-1.22E+02
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.79E-02	6.14E-01	0.00E+00	0.00E+00	1.36E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.61E-05
Net use of fresh water	m^3	4.34E-01	8.13E-06	1.30E-03	5.69E-04	6.48E-03	2.16E-04	8.64E-04	-8.89E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.09E-02	3.98E-05	0.00E+00	2.40E-06	3.88E-06	5.95E-06	2.16E-02	-2.37E-03
Non-hazardous waste disposed	kg	5.21E-01	2.99E-02	2.07E-02	2.17E-02	1.85E-03	4.38E-02	2.32E+00	-1.37E-01
Radioactive waste disposed	kg	2.99E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-5.96E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	5.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12. Environmental product characteristic – 1 m^2 of sandwich panel with PIR core of 200 mm thickness

Environmental impacts: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	3.30E+01	1.30E+00	1.84E-01	1.57E-01	2.22E-01	5.94E+00	2.16E-02	-8.64E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	3.30E-05	0.00E+00	9.41E-09	1.73E-09	0.00E+00	1.62E-07	5.57E-09	-6.58E-06
Acidification potential of soil and water	kg SO_2 eq.	3.68E-01	2.37E-02	1.97E-04	1.38E-04	5.15E-03	8.06E-03	1.70E-04	-7.84E-02
Formation potential of tropospheric ozone	kg Ethene eq.	6.86E-02	6.60E-04	6.45E-05	7.17E-04	1.12E-04	1.20E-05	4.65E-06	-1.46E-02
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	2.91E-02	1.64E-03	6.09E-04	5.77E-06	2.79E-04	2.43E-02	2.70E-04	-6.28E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	3.29E-02	0.00E+00	2.28E-06	1.17E-03	0.00E+00	9.60E-04	2.39E-08	-6.71E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.93E+02	1.04E+01	7.68E+00	1.80E+00	2.23E+00	9.30E+00	5.36E-01	-1.17E+02
Environmental aspects: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.94E+01	5.01E-01	7.68E-02	2.70E-01	9.00E-01	3.34E-01	1.78E-02	-5.01E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	5.43E+02	1.15E+01	8.23E+00	1.98E+00	2.22E+00	9.86E+00	5.59E-01	-1.29E+02
Use of secondary material	kg	6.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.92E-01
Use of renewable secondary fuels	MJ	1.79E-02	6.38E-01	0.00E+00	0.00E+00	1.40E-01	0.00E+00	0.00E+00	-5.35E-03
Use of non-renewable secondary fuels	MJ	1.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.63E-05
Net use of fresh water	m^3	4.80E-01	8.73E-06	1.41E-03	5.69E-04	7.20E-03	2.40E-04	9.60E-04	-9.81E-02
Other environmental information describing waste categories: (FU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.18E-02	4.26E-05	0.00E+00	2.40E-06	3.89E-06	6.45E-06	2.40E-02	-2.57E-03
Non-hazardous waste disposed	kg	5.42E-01	3.25E-02	2.24E-02	2.17E-02	1.86E-03	4.86E-02	2.55E+00	-1.42E-01
Radioactive waste disposed	kg	3.32E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	3.15E-07	-6.62E-05
Components for re-use	kg	1.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.76E-02
Materials for recycling	kg	1.18E-02	0.00E+00	6.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.54E-03
Materials for energy recover	kg	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.74E-03
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Results interpretation

The environmental impact of sandwich panel (cradle to gate with options) is mainly dependent on the energy-intensive production of steel claddings on which the manufacturer has only a little influence. The amount of carbon dioxide necessary to produce raw materials for production is almost 26.7 kg CO_2/ m^2 for a 100mm panel and the primary energy input (non renawable) is 367 MJ / m^2 (where steel itself gives highest impact – 77%). Any search for improvement of the environmental quality of the products may take place through the purchase of ecological steel. The impact carbon of the PIR insulation increases with the thickness of the panel. For the thickest panel variant 200 mm carbon impact is 34.4 kg/m^2. The production of steel as input material (module A1) therefore has the greatest impact on the environmental characteristic. The transport of raw materials from considerable distances is not significant to overall values. The sandwich panel products due to the 10% potential for reuse, energy recovery potential from PIR incineration and the potential for recycling potential for steel has observable environmental gains in module D.

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification this EPD is valid for a 5-year-period EPD does not have to be recalculated after 5 years if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) [x] external [ ] internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA.LCI audit and input data verification: Ph.D. D.Sc.Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl

Basically. a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context. respectively the product-specific characteristics of performance. are taken into account.

Normative references

- PU Europe - the European association of PU insulation manufacturers (www.pu-europe.eu)
- ITB PCR A General Product Category Rules for Construction Products
- PN EN 14509 Samonośne płyty warstwowe z rdzeniem z materiału termoizolacyjnego w obustronnej okładzinie z blachy -- Wyroby produkowane fabrycznie - Właściwości
- PN-EN 14509:2013-12 Samonośne izolacyjno-konstrukcyjne płyty warstwowe z dwustronną okładziną metalową -- Wyroby fabryczne -- Specyfikacje
- ISO 14025:2006. Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework

- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service-life and service-life estimation
- EN 15804:2012+A1:2013 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO_2. SO_2. NO_x. CO i pyłu całkowitego dla energii elektrycznej. 2020
- PN-EN 13165+A2:2016-08 Wyroby do izolacji cieplnej w budownictwie - Wyroby ze sztywnej pianki poliuretanowej (PU) produkowane fabrycznie
- PN-EN 10346:2015-09 Wyroby płaskie stalowe powlekane ogniowo w sposób ciągły do obróbki plastycznej na zimno -- Warunki techniczne dostawy

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CERTIFICATE № 247/2021
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Górstal sandwich panels with PIR core produced by Gór-Stal Sp. z o.o.

Manufacturer:

Gór-Stal Sp. z o.o.

ul. Przemysłowa 11, 38-300 Gorlice, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804+A1

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

This certificate, issued for the first time on 1st September 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director
for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, September 2021