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## Sandwich panels with Mineral Wool core



### EPD Program Operator:

Instytut Techniki Budowlanej (ITB)  
Address: Filtrowa 1. 00-611 Warsaw. Poland  
Website: [www.itb.pl](http://www.itb.pl)  
Contact: Michał Piasecki. PhD eng.  
[m.piasecki@itb.pl](mailto:m.piasecki@itb.pl). [energia@itb.pl](mailto:energia@itb.pl)

### Owner of the EPD:

Gór – Stal Sp. z o.o.  
Address ul. Przemysłowa 11  
Gorlice. Poland  
Postcode: 38-300  
Telephone number: +48 18 353 98 00  
Internet address: [www.gor-stal.pl](http://www.gor-stal.pl)  
E-mail address: [info@gor-stal.pl](mailto:info@gor-stal.pl)

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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 D in 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)

**Declared unit:** 1 m<sup>2</sup> of sandwich panel with mineral wool core

**Reasons for performing LCA:** B2B

**Representativeness:** Polish product

**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. The core of the panel is made hard mineral wool board with thermal insulating and fire-resistance properties. The double-sided cladding panel is made of galvanized steel. The sandwich panels with a mineral wool core are non-flammable and are used in places requiring a fire protection and a acoustic performance.

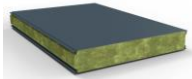

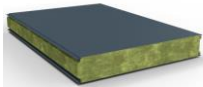
Sandwich panels are very easy and quick to install, and thanks to the use of compatible locks, they can be combined with PIR panels.

**Table 1.** Decription of products gropus covered by EPD

<b>Product</b>	<b>Description</b>
GS MW S	GS MW S wall panels with visible fastening are intended for the construction of external and internal walls on a building frame. Steel sheet galvanized on both sides according to EN 10346 and coated with an organic polyester coating with a coat thickness of 25 µm is used as facing. The panels can be installed both in a vertical and horizontal arrangement. They ensure maximum fire protection and sound reduction.
GS MW U	S MW U wall panels are intended for the construction of external and internal walls on a building frame. Concealed fasteners, which cannot be seen if viewed from the facade, contribute to panels being architecturally attractive and functional. Steel sheet galvanized on both sides according to EN 10346 and coated with an organic polyester coating with a coat thickness of 25 µm is used as facing. The panels can be installed both in a vertical and horizontal arrangement. They ensure maximum fire protection and sound reduction.
GS MW CH	S MW CH wall panels with visible fastening are intended for external and internal walls on a skeleton structure. Steel sheet galvanized on both sides according to EN 10346 and coated with an organic polyester coating with a coat thickness of 25 µm is used as facing. The panels can be installed both in a vertical and horizontal arrangement. They ensure maximum fire protection and sound reduction.

Sandwich panels are made of the mineral wool (MW) core in steel claddings. A core material is a mineral wool with density of approx. 108 kg/m<sup>3</sup>. A vast majority of mineral wool is sourced from domestic suppliers (providing specific EPDs). The basic technical data concerning the range of manufactured sandwich panels with MW core are presented in the Figure 3.

**Table 2.** Basic technical information on products groups covered by EPD

Name of product	View	Thickness mm	MW core density kg/m <sup>3</sup>	Type of facing	Technical data on product
GS MW S		80	108	Steel	<a href="#">link</a>
GS MW U		80-120	108	Steel	<a href="#">link</a>
GS MW CH		100-250	108	Steel	<a href="#">link</a>

### 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, statics are detailed in the technical catalogs which can be downloaded [at producer web-site](#).

- Type of core – mineral wool (MW)
- Apparent density of core [kg/m<sup>3</sup>] - 108
- Declared heat conductivity coefficient  $\lambda D$  [W/m<sup>2</sup>\*K] -  $\lambda D = 0.044$
- Board facing – steel
- Thickness [mm] - from 80 to 250 mm
- Fire reaction classification A2-s1, d0
- Fire resistance– EI 60 and EI 120 for 160-250mm
- Compressive strength – 0.55 Mpa
- Tensile strength 0.05 Mpa
- Acoustic Insulation – 31 dB (-2, -3)

### PRODUCT APPLICATION

Sandwich panels are constructed from materials which consist of construction elements (external steel facings) and construction – insulation layers (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 facilities, cold stores and freezers.

### LIFE CYCLE ASSESSMENT (LCA) – general rules applied

#### Declared unit

Declared unit DU is 1 m<sup>2</sup> of sandwich panel with mineral wool 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, mineral wool, adhesive, 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 MW 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 mm). In the case of sandwich panels family a core material is a mineral wool mainly produced in Poland with density of 108 kg/m<sup>3</sup>. Steel sheet coils (EAF and BOF) are being sourced at domestic and foreign steel mills. Main two largest steel delivery producers provide more than 90%% of steel profiles. This producers have specific data of their products (used for calculation). 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 components and raw materials.

#### A3: Production

The sandwich panels, regardless insulation core used, are being produced in a continuous production process. Necessary stops are required for change overs between panel types. Production process itself 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. The protective foil is applied to prevent from unwanted coating defects, that can appear during production or transport. 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) or bonding (in the case of mineral wool) process. At

the end of this stage, designed surface's profiling and the side profiling (to form panel's joint) is taking place.

**2. Forming of the insulation core**

Depending on the produced type of sandwich panels the insulation core is either foamed (in case of PIR) or formed (in case of mineral wool).

**3. Forming**

Mineral wool is being deliver to production line in slabs, which are being transported one by one and cut by multi saw to form lamellas of desired hight. Next, lamellas are being turned by 90 degrees (fibres must be perpendicular to facings) and arrange by pusher to form continuous core between metal facings. Then, polyurethane, 2-component adhesive is being applied between metal facings and core material. Double belt laminator ensure dimension (thickness and width of sandwich panel), as well as necessary conditions for adhesive to harden and permanently connect facings to mineral wool core.

**4. 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.

**5. 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 24h (for mineral wool) indoors warehouse. 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 MW core is provided in Table 1. Mechanical disassembly requires power tools and a hoist.

**Table 3.** End of life scenario (C modules) for a sandwich panel with MW core

<b>Parameter</b>	<b>Contribution</b>
Collection rate	100%
Reuse	10%
Recycling steel	98% of cladding
Landfilling steel	2% of cladding
Recycling MW	20% of MW core
Landfill MW	80% of MWcore

**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. 10% of "reuse benefit" is calculated for A1-A3 values of sandwich MW panel production.

**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 Górsstal.

**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: Ecoinvent v.3.7 (adhesive, gasket, water), specific EPDs (steel profile producers, Mineral Wool producer), 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<sup>2</sup> of the sandwich panel manufactured by Górsstal (Table 4). The following tables 5-9 present the environmental impact in relation to 1 m<sup>2</sup> for all offered product thicknesses (80mm-250mm).

**Table 4.** System boundaries (modules included) for the environmental characteristic of the sandwich panels.

<b>Environmental assessment information (MNA – Module not assessed. MD – Module Declared. INA – Indicator Not Assessed)</b>																
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

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**Table 5.** Environmental product characteristic – 1 m<sup>2</sup> of sandiwch panle with MW core of 80 mm thickness

Environmental impacts: (DU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	2.38E+01	8.10E-01	3.16E+00	1.57E-01	2.31E-01	5.64E-02	2.89E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.32E-07	0.00E+00	2.40E-07	1.73E-09	0.00E+00	7.53E-08	1.27E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	6.12E-02	2.01E-02	7.04E-03	1.38E-04	5.00E-03	4.70E-03	4.19E-04	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	1.38E-02	4.05E-04	4.20E-04	7.17E-04	1.01E-04	1.20E-05	6.22E-05	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	9.88E-03	1.01E-03	1.00E-03	5.77E-06	2.52E-04	7.53E-03	3.12E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	3.58E-02	0.00E+00	4.21E-03	1.17E-03	0.00E+00	5.75E-08	5.54E-03	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.44E+02	6.04E+00	3.12E+01	1.80E+00	1.49E+00	7.53E+00	1.40E+00	-5.56E+01
Environmental aspects: (DU) 1 m <sup>2</sup>									
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	3.34E+01	4.20E-01	1.59E+00	2.70E-01	1.04E-01	9.41E-02	1.25E+00	-3.37E+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	2.56E+02	5.85E+00	3.25E+01	1.98E+00	#ARG!	8.00E+00	1.46E+00	-5.74E+00
Use of secondary material	kg	8.59E-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	9.13E-02	4.07E-01	0.00E+00	0.00E+00	1.01E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	7.63E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	1.89E-01	1.11E-05	1.59E-03	5.69E-04	2.07E-06	0.00E+00	9.24E-04	-5.91E-03
Other environmental information describing waste categories: (DU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.00E-03	4.52E-05	2.60E-03	2.40E-06	8.73E-06	1.41E-06	1.85E-06	-6.12E-04
Non-hazardous waste disposed	kg	5.87E-01	4.28E-02	2.94E-02	2.17E-02	7.64E-03	6.13E-04	4.82E+00	-9.96E-02
Radioactive waste disposed	kg	4.79E-05	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	6.97E-06	0.00E+00
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	1.60E-02	0.00E+00	1.86E+00	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

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**Table 6.** Environmental product characteristic – 1 m<sup>2</sup> of sandwich panel with MW core of 100 mm thickness

Environmental impacts: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	2.47E+01	8.13E-01	5.69E+00	2.29E-01	2.39E-01	5.64E-02	3.58E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.90E-07	0.00E+00	4.34E-07	2.53E-09	0.00E+00	7.53E-08	1.53E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	6.41E-02	2.01E-02	1.28E-02	2.02E-04	5.00E-03	4.70E-03	5.00E-04	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	1.52E-02	4.07E-04	7.39E-04	1.05E-03	1.01E-04	1.20E-05	7.72E-05	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	1.12E-02	1.02E-03	1.57E-03	8.41E-06	2.52E-04	7.53E-03	3.52E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	4.45E-02	0.00E+00	7.68E-03	1.70E-03	0.00E+00	5.75E-08	6.93E-03	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.59E+02	6.08E+00	5.37E+01	2.63E+00	1.50E+00	7.53E+00	1.70E+00	-5.56E+01
Environmental aspects: (FU) 1 m <sup>2</sup>									
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	3.89E+01	4.22E-01	2.87E+00	3.94E-01	1.04E-01	9.41E-02	1.56E+00	-3.37E+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	2.72E+02	5.88E+00	5.59E+01	2.89E+00	#ARG!	8.00E+00	1.77E+00	-5.74E+01
Use of secondary material	kg	9.14E-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	1.10E-01	4.09E-01	0.00E+00	0.00E+00	1.01E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	9.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	2.31E-01	1.32E-05	2.29E-03	8.30E-04	2.42E-06	0.00E+00	1.16E-03	-5.91E-03
Other environmental information describing waste categories: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.24E-03	5.28E-05	4.74E-03	3.50E-06	9.98E-06	1.41E-06	2.29E-06	-6.12E-04
Non-hazardous waste disposed	kg	6.51E-01	5.17E-02	4.40E-02	3.16E-02	9.12E-03	6.13E-04	5.98E+00	-9.96E-02
Radioactive waste disposed	kg	5.99E-05	0.00E+00	0.00E+00	3.50E-06	0.00E+00	3.60E-06	8.63E-06	0.00E+00
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	1.71E-02	0.00E+00	3.40E+00	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



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**Table 7.** Environmental product characteristic – 1 m<sup>2</sup> of sandiwch panle with MW core of 120 mm thickness

Environmental impacts: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	2.56E+01	8.15E-01	4.72E+00	1.57E-01	2.47E-01	5.64E-02	4.27E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	3.48E-07	0.00E+00	3.59E-07	1.73E-09	0.00E+00	7.53E-08	1.80E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	6.69E-02	2.01E-02	1.05E-02	1.38E-04	5.01E-03	4.70E-03	5.81E-04	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	1.65E-02	4.08E-04	6.22E-04	7.17E-04	1.01E-04	1.20E-05	9.22E-05	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	1.25E-02	1.02E-03	1.43E-03	5.77E-06	2.53E-04	7.53E-03	3.91E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	5.32E-02	0.00E+00	6.32E-03	1.17E-03	0.00E+00	5.75E-08	8.32E-03	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.74E+02	6.11E+00	4.60E+01	1.80E+00	1.51E+00	7.53E+00	2.00E+00	-5.56E+01
Environmental aspects: (FU) 1 m <sup>2</sup>									
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	4.44E+01	4.25E-01	2.38E+00	2.70E-01	1.05E-01	9.41E-02	1.87E+00	-3.37E+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	2.89E+02	5.92E+00	4.78E+01	1.98E+00	#ARG!	8.00E+00	2.09E+00	-5.74E+00
Use of secondary material	kg	9.68E-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	1.28E-01	4.11E-01	0.00E+00	0.00E+00	1.02E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	2.73E-01	1.53E-05	2.21E-03	5.69E-04	2.76E-06	0.00E+00	1.39E-03	-5.91E-03
Other environmental information describing waste categories: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.48E-03	6.03E-05	3.90E-03	2.40E-06	1.12E-05	1.41E-06	2.73E-06	-6.12E-04
Non-hazardous waste disposed	kg	7.15E-01	6.07E-02	4.14E-02	2.17E-02	1.06E-02	6.13E-04	7.14E+00	-9.96E-02
Radioactive waste disposed	kg	7.18E-05	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	1.03E-05	0.00E+00
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	1.81E-02	0.00E+00	2.79E+00	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

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**Table 8.** Environmental product characteristic – 1 m<sup>2</sup> of sandwich panle with MW core of 160 mm thickness

Environmental impacts: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	2.69E+01	8.19E-01	5.89E+00	1.57E-01	2.59E-01	5.64E-02	5.31E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	4.35E-07	0.00E+00	4.48E-07	1.73E-09	0.00E+00	7.53E-08	2.19E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	7.11E-02	2.02E-02	1.32E-02	1.38E-04	5.01E-03	4.70E-03	7.02E-04	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	1.86E-02	4.10E-04	7.74E-04	7.17E-04	1.01E-04	1.20E-05	1.15E-04	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	1.44E-02	1.03E-03	1.76E-03	5.77E-06	2.54E-04	7.53E-03	4.51E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	6.62E-02	0.00E+00	7.89E-03	1.17E-03	0.00E+00	5.75E-08	1.04E-02	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.96E+02	6.16E+00	5.70E+01	1.80E+00	1.51E+00	7.53E+00	2.45E+00	-5.56E+01
Environmental aspects: (FU) 1 m <sup>2</sup>									
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	5.27E+01	4.28E-01	2.97E+00	2.70E-01	1.05E-01	9.41E-02	2.34E+00	-3.37E+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	3.13E+02	5.98E+00	5.93E+01	1.98E+00	#ARG!	8.00E+00	2.55E+00	-5.74E+00
Use of secondary material	kg	1.05E+00	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	1.56E-01	4.14E-01	0.00E+00	0.00E+00	1.02E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	1.43E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	3.36E-01	1.85E-05	2.68E-03	5.69E-04	3.28E-06	0.00E+00	1.73E-03	-5.91E-03
Other environmental information describing waste categories: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.84E-03	7.16E-05	4.87E-03	2.40E-06	1.31E-05	1.41E-06	3.39E-06	-6.12E-04
Non-hazardous waste disposed	kg	8.11E-01	7.41E-02	5.04E-02	2.17E-02	1.28E-02	6.13E-04	8.87E+00	-9.96E-02
Radioactive waste disposed	kg	8.98E-05	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	1.28E-05	0.00E+00
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	1.97E-02	0.00E+00	3.49E+00	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

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**Table 9.** Environmental product characteristic – 1 m<sup>2</sup> of sandiwch panle with MW core of 200 mm thickness

Environmental impacts: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	2.90E+01	8.26E-01	7.83E+00	1.57E-01	2.79E-01	5.64E-02	7.05E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	5.80E-07	0.00E+00	5.96E-07	1.73E-09	0.00E+00	7.53E-08	2.86E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	7.81E-02	2.02E-02	1.75E-02	1.38E-04	5.02E-03	4.70E-03	9.05E-04	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	2.20E-02	4.13E-04	1.03E-03	7.17E-04	1.02E-04	1.20E-05	1.52E-04	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	1.77E-02	1.04E-03	2.30E-03	5.77E-06	2.55E-04	7.53E-03	5.50E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	8.79E-02	0.00E+00	1.05E-02	1.17E-03	0.00E+00	5.75E-08	1.39E-02	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.33E+02	6.25E+00	7.54E+01	1.80E+00	1.53E+00	7.53E+00	3.20E+00	-5.56E+01
Environmental aspects: (FU) 1 m <sup>2</sup>									
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	6.65E+01	4.35E-01	3.95E+00	2.70E-01	1.06E-01	9.41E-02	3.12E+00	-3.37E+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	3.53E+02	6.07E+00	7.85E+01	1.98E+00	#ARG!	8.00E+00	3.33E+00	-5.74E+00
Use of secondary material	kg	1.19E+00	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	2.02E-01	4.18E-01	0.00E+00	0.00E+00	1.03E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	1.91E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	4.42E-01	2.37E-05	3.47E-03	5.69E-04	4.15E-06	0.00E+00	2.31E-03	-5.91E-03
Other environmental information describing waste categories: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	4.44E-03	9.05E-05	6.49E-03	2.40E-06	1.62E-05	1.41E-06	4.48E-06	-6.12E-04
Non-hazardous waste disposed	kg	9.70E-01	9.65E-02	6.55E-02	2.17E-02	1.65E-02	6.13E-04	1.18E+01	-9.96E-02
Radioactive waste disposed	kg	1.20E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	1.69E-05	0.00E+00
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	2.23E-02	0.00E+00	4.65E+00	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

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**Table 10.** Environmental product characteristic – 1 m<sup>2</sup> of sandiwch panle with MW core of 250 mm thickness

Environmental impacts: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global warming potential	kg CO <sub>2</sub> eq.	3.12E+01	8.32E-01	9.78E+00	1.57E-01	2.99E-01	5.64E-02	8.78E-01	-6.12E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	7.25E-07	0.00E+00	7.45E-07	1.73E-09	0.00E+00	7.53E-08	3.52E-08	-1.08E-10
Acidification potential of soil and water	kg SO <sub>2</sub> eq.	8.51E-02	2.03E-02	2.19E-02	1.38E-04	5.03E-03	4.70E-03	1.11E-03	-1.50E-02
Formation potential of tropospheric ozone	kg Ethene eq.	2.53E-02	4.16E-04	1.28E-03	7.17E-04	1.02E-04	1.20E-05	1.90E-04	-2.52E-03
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup> eq.	2.09E-02	1.05E-03	2.83E-03	5.77E-06	2.57E-04	7.53E-03	6.49E-04	-1.40E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.10E-01	0.00E+00	1.32E-02	1.17E-03	0.00E+00	5.75E-08	1.73E-02	-3.32E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.69E+02	6.34E+00	9.38E+01	1.80E+00	1.54E+00	7.53E+00	3.95E+00	-5.56E+01
Environmental aspects: (FU) 1 m <sup>2</sup>									
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	8.03E+01	4.41E-01	4.93E+00	2.70E-01	1.07E-01	9.41E-02	3.90E+00	-3.37E+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	3.94E+02	6.16E+00	9.76E+01	1.98E+00	#ARG!	8.00E+00	4.12E+00	-5.74E+00
Use of secondary material	kg	1.32E+00	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	2.47E-01	4.23E-01	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	-5.34E-03
Use of non-renewable secondary fuels	MJ	2.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.50E-05
Net use of fresh water	m <sup>3</sup>	5.47E-01	2.90E-05	4.25E-03	5.69E-04	5.02E-06	0.00E+00	2.89E-03	-5.91E-03
Other environmental information describing waste categories: (FU) 1 m <sup>2</sup>									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	5.05E-03	1.09E-04	8.12E-03	2.40E-06	1.93E-05	1.41E-06	5.58E-06	-6.12E-04
Non-hazardous waste disposed	kg	1.13E+00	1.19E-01	8.06E-02	2.17E-02	2.02E-02	6.13E-04	1.47E+01	-9.96E-02
Radioactive waste disposed	kg	1.50E-04	0.00E+00	0.00E+00	2.40E-06	0.00E+00	3.60E-06	2.11E-05	0.00E+00
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	2.49E-02	0.00E+00	5.82E+00	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 with MW core is mainly dependent on the energy-intensive production of steel claddings (80% of impact) on which the manufacturer has only a limited influence. The amount of carbon dioxide necessary to produce raw materials for production is almost 31 kg CO<sub>2</sub>/ m<sup>2</sup> for a 100mm panel and the primary energy input is 334 MJ / m<sup>2</sup> (where steel itself gives highest impact). These values (A1 – resource production) are about several dozen times higher than the production process impact A3 itself (manufacturing plant). The search for improvement of the environmental quality of the products may take place through the purchase of eco steel or, to a lesser extent, the purchase of an ecological insulation core. The impact of the mineral wool insulation impact increases with the thickness of the panel. The production process A3 itself is not significantly emissive. The transport of raw materials from considerable distances is also not significant to overall values.

## 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.) <input checked="" type="checkbox"/> external <input type="checkbox"/> internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA, LCI audit and input data verification: Ph.D. 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
- 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<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, 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





Instytut Techniki Budowlanej

00-611 Warsaw, Filtrów 1

Thermal Physics, Acoustics and Environment Department  
02-656 Warsaw, Ksawerów 21

## CERTIFICATE № 248/2021 of TYPE III ENVIRONMENTAL DECLARATION

Products:

**Górstal sandwich panels with Mineral Wool 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 1<sup>st</sup> 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



Deputy Director  
for Research and Innovation

  
Krzysztof Kućzyński, PhD

Warsaw, September 2021