Type III Environmental Product Declaration No. 453/2023

Issuance date: 12.05.2023
Validity date: 12.05.2028

PETRALANA - mineral wool products

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 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 and their aspects verified by the independent party according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2. The intended use of an EPD is to communicate scientifically based environmental information for product, for the purpose of assessing the environmental performance of buildings.

Life cycle analysis (LCA): A1-A5, C1-C4 and D modules in accordance with EN 15804
(Cradle-to-Gate with options and module D)
The year of preparing the EPD: 2023
Product standard: EN 13162
Service Life: Reference service life of 50 years
PCR: ITB-PCR A v1.6, EN 16783
Declared unit: 1 m^2 of stone wool product with R_D=1 m^2 K/W
Reasons for performing LCA: B2B
Representativeness: Polish, 2021

MANUFACTURER

Petralana S.A. with almost 250 employees produces 44,000 tons of mineral stone wool annually, half of which goes to foreign markets. Instead of a metallurgical furnace, a new ecological basalt smelting furnace on the premises of the former Huta Bobrek, has started operating since 2015. It is one of the most modern plants in Europe, using innovative technologies in the production of insulation materials. Rock wool products from Bytom production plant (in Poland) are sold in the countries of the Visegrad Group (Czech Republic, Slovakia, Hungary), on highly developed Scandinavian markets (Denmark, Iceland, Norway, Sweden), on the Balkans (Croatia, Romania, Slovenia) and on western markets (Austria France, Netherlands, Italy). The production process of PETRALANA mineral stone wool ensures environmentally friendly business operation and obtaining products that meet increasingly growing requirements. PETRALANA stone wool insulation is a fire-safe material for insulation against heat, cold, fire, vibrations and noise. It is traditionally made from volcanic rocks, an increasing proportion of secondary material, and a few percent resin binder.

PRODUCTS DESCRIPTION AND APPLICATION

Stone wool is a widely used material commonly used to thermally insulate buildings. PETRALANA insulation products contribute to the creation of energy-efficient and fire-safe buildings with good acoustics and a comfortable indoor climate. Stone wool is available in various forms with different characteristics and properties to suit a wide range of applications, ranging from the insulation of roofs, lofts, walls, floors and HVAC systems in buildings to, fire-protection and noise reducing solutions and use in process industry. The PETRALANA products considered in this EPD are boards or rolls used to provide thermal insulation in general building applications, attics, facades, ETICS ceilings, partition walls and flat roofs (Figure 1). The necessary technical data can be found in the product catalogue.

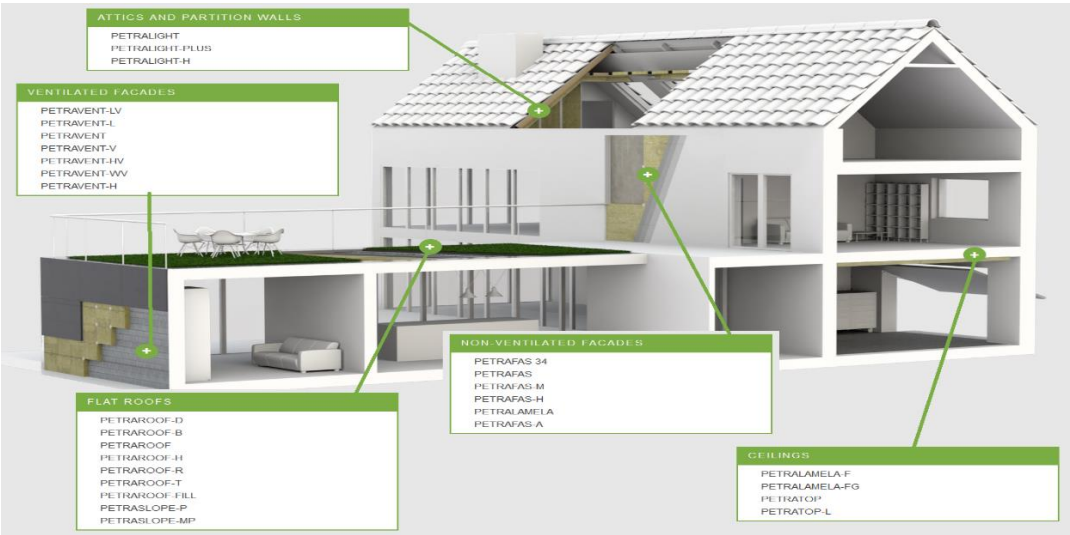

Figure 1. MW Petralana Products covered by EPD

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The environmental impacts and indicators given in the section “Life Cycle Assessment: Results” of this EPD are for 1 m^2 of product, providing a thermal resistance of R_D=1 m^2 K/W (the declared unit). The reference product is 39 mm thick PETRALANA stone wool with a density of 30 kg/m^3. For other PETRALA specific MW products, the environmental impacts and indicators are determined by applying the appropriate scaling factors.

System boundary

This EPD is based on a cradle-to-gate with options and covers the life cycle modules A1-A3, A4-A5, C1-C4, and D, in which 100 weight-% of the product has been accounted in accordance with EN 15804+A2 and ITB PCR A. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculation based on LCI provided by manufacturer. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA. The boundaries of the system are shown in Figure 2. The packaging, such as PE film for packaging and palletizing, the pallet out of wood and the labels, are included in the assessment. Any facings, such as glass fleece, aluminium foil or other laminations, are excluded in this EPD. If relevant for a product, their environmental parameter values may be added.

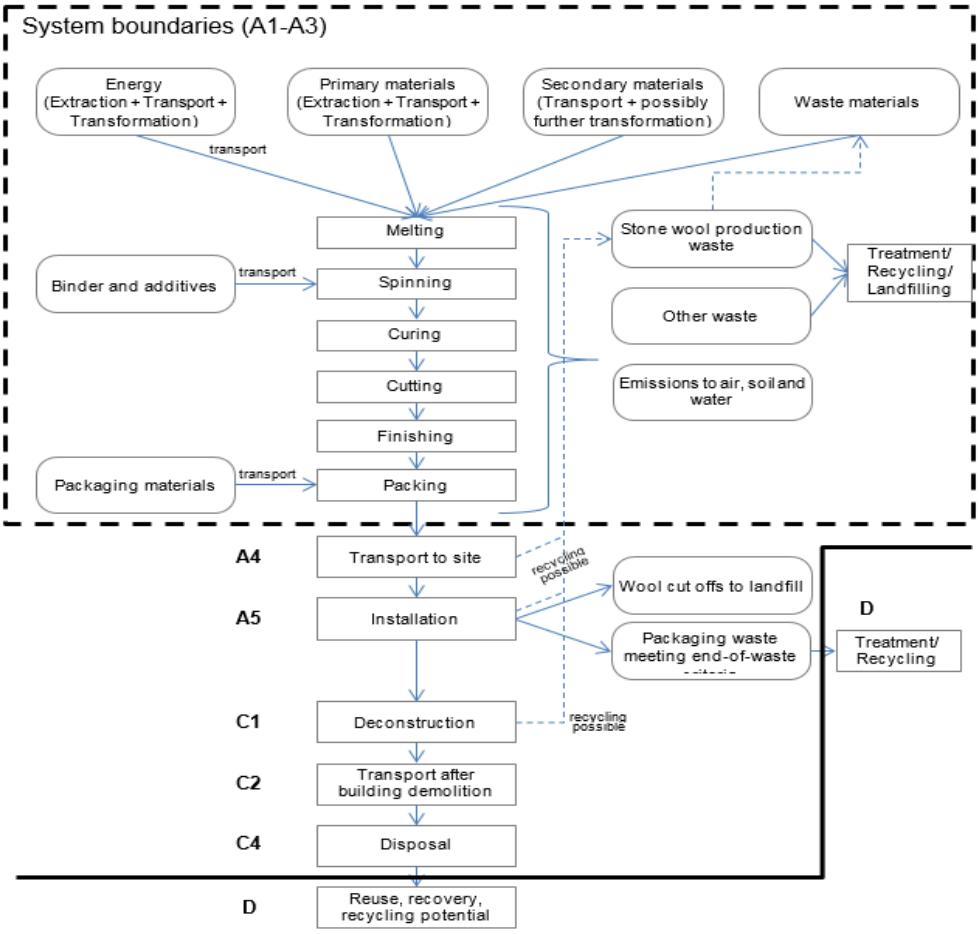

Figure 2. The boundaries of the system used in LCA for PETRALANA made products

Allocation

The allocation rules used for this EPD are based on general ITB's document PCR A. In the modules A1-A3, material losses in the assembly of the products in the factory are defined on the averaged specific values for the site. Input and output data from the production is inventoried and allocated to the production on the mass basis. The declaration covers a wide range of products (averaged). Their production resources and processing stages are basically similar, so it is possible to average the production by product volume (see scaling procedures). The slag is considered to be a co-product of steel production as a co-product and is allocated by economic value.

System limits

All data (including supply system) obtained from the LCI survey were taken into consideration, all available data from production have been considered, i.e. all raw materials/elements used as per assembly process, utilized thermal energy (coke and coke gas), and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 5 % of energy usage and mass per module A, C or D. Machines and facilities required during production are neglected. The production of etiquettes, tape and glue was not considered.

Modules A1 and A2: *Raw materials supply and transport*

The modules A1 and A2 represent the extraction and processing of raw materials and components and transport to the production site. It is traditionally made from volcanic rocks, and proportion of secondary material (slag), and a few percent resin binder. The binder is a water-based phenol-formaldehyde resin which is later (see production A3) polymerized into solid resin during production of the final stone wool product. The mass dominant input material is basalt, gabbro and dolomite (local producers). For A2 module (transport) European averages for fuel data are applied and specific transport data (verified) is provided by the manufacturer in LCI questionnaire.

Module A3: *Production*

Stone wool is produced as presented on Figure 3. The main raw material for production of rock mineral wool panels is basalt and gabbro, these alkaline extrusive rocks turn into hot lava after being melted down in a shaft furnace where temperature reaches 1500 degrees. The lava in a liquid form is fed on the so called discs rotating at a speed of several thousand revolutions where it turns into natural fibers that form a liquid carpet in a forming box. The formed material is treated with a binder and hydrophobic agents to ensure excellent resistance of subsequent panels to absorption of moisture from the air and, in consequence, the highest quality of the panels. The process also ensures excellent adhesion of the product to the adhesive and other mixtures used for possible future installation. A conveyor feeds fibers laid in layers to a device where the fibers are undulated according to the type of the product manufactured. In the next step, the formed "carpet" of wool goes to a polymerization chamber where the binder is cured and a panel with the required thickness is formed. The process also takes place at a raised temperature, however not as high as that of the melting process. After leaving the chamber, the product is cooled down to the ambient temperature and then cut to appropriate length and width. The cut panels go to a stacking machine where single panels are packed into omnibus packings and foiled. A bulk pallet is wrapped in a foil sleeve, which allows for storing the product outdoors. The product is wrapped with PE-foil and placed on wooden or stone wool pallets for further distribution.

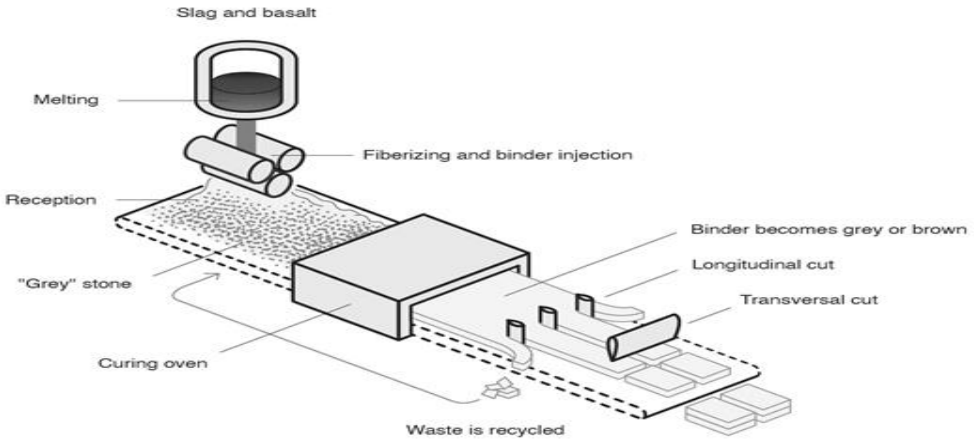

Fig. 3. A basic scheme of the MW manufacturing process

Module A4-A5 : Transport and installation

The transportation distance between production plant (Poland) and the building site is assumed as 500 km (lorry 10t, Euro 5). It should be recognized that the installation process (a potential losses may vary depending on the specific site. It was assumed a certain amount of electricity necessary for power tools during installation A5.

Modules *C1-C4 and D: End-of-life (EOL)*

The deconstruction of the products covered by this study is assumed to be done manually with electric tools. In the adapted end-of-life scenario, the de-constructed products are transported to recycling plant on the distance 200 km with > 10t lorry, EURO 5. The recycling potential of recovered materials (20%) is presented in Table 1. The materials used in the production have potential benefits and load beyond the system boundary. The benefits from recycling of MW (e.g. agricultural applications) are calculated based on formula from EN 15804:2012+A2:2019.

Table 1. End-of-life scenario for the product components

Material	Recycling/Reuse %	Landfilling %	Energy recovery %
Mineral Wool	20	80	0

Electricity at end-of-life (module C) has been modelled using an average Polish electricity mix as the location where the product reaches end-of-life is unknown.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2021 – 31.12.2021 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by PETRALANA. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good. The database, Ecoinvent 3.9 is utilized for the background system (rocks, binder, energy, chemical additives, packaging) . The slag is considered to be a co-product of steel production as a co-product and is allocated by economic value (impacts of slag are calculated based on steel production). As a result, both upstream- and downstream activities are based on average supply mixes for the Polish region depending on the given dataset and national KOBiZE data is used (Polish electricity mix and

combustion factors for fuels). Specific (LCI) data quality analysis was a part of the input data verification. The time related quality of the data used is valid (5 years).

Assumptions and estimates

The impacts of the representative products were aggregated using weighted average. Amounts of energy and material flows used at the manufacturing of the declared product were allocated by dividing the annual amounts with the specific production volume (mass based).

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with the CML-IA baseline method

Additional information

Polish electricity emission factor is 0.698 kg CO_2/kWh (KOBiZE 2021). European electricity mix used is 0.430kg CO_2/kWh (Ecoinvent v3.9, RER). The stone wool does not contain substances from the Candidate List of Substances of Very High Concern. Mineral wool fibres produced by PETRALANA are classified as non-hazardous under REACH (Regulation (EC) No 1272/2008 of the European parliament and of the council of 16 December 2008 on classification, labelling and packaging of substances and mixtures). The International Agency for Research on Cancer (IARC), part of the World Health Organization, revised its classification of mineral wool fibres in October 2001, including them in Group 3 as an agent “not classifiable” as to its carcinogenicity to humans. The stone wool products made by PETRALANA fulfill the national demands with regard to VOC emission to indoor environment.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – for 1 m^2 of product, providing a thermal resistance of RD=1 m^2 K/W The following life cycle modules (Table 2) were included in the analysis.

Table 2. System boundaries for the environmental characteristic of the MW made by PETRALANA

Environmental assessment information (MD – Module Declared, MND – Module Not 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**	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

The method of converting the environmental impact for a specific MW product - scaling

The results presented in the impacts Tables 3-6 are presented for a specific DU = 1 m^2 of representative product, providing a thermal resistance of RD=1 m^2 K/W, 39 mm thick with a density of 30 kg/m^3. To convert the impacts to any other specific PETRALANA wool products the scaling factor is needed. The scaling factor is proportional to the specific product density (in relation to DU) and is “2” for products with a density of 60 kg/m^3, “3” for products with a density of 90 kg/m^3, “4” for products with a density of 120 kg m^3 and “5” for products with a density of 150 kg/m^3. For intermediate product densities, a linear approximation shall be used.

Table 3. Life cycle assessment (LCA)– environmental impacts (DU: 1 m^2 stone wool product with a thermal resistance of R_D=1 m^2 K/W, thickness of 39 mm; density of 30 kg/m^3)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	8.05E-01	9.75E-02	8.17E-03	8.17E-03	3.90E-02	1.52E-02	9.96E-03	-1.03E-02
Greenhouse potential - fossil	eq. kg CO_2	7.74E-01	9.72E-02	8.01E-03	8.01E-03	3.89E-02	1.52E-02	9.85E-03	-1.03E-02
Greenhouse potential - biogenic	eq. kg CO_2	3.63E-02	2.57E-04	2.34E-04	2.34E-04	1.33E-04	3.18E-06	9.94E-05	-1.08E-03
Global warming potential - land use and land use change	eq. kg CO_2	4.33E-04	3.82E-05	2.81E-06	2.81E-06	1.53E-05	2.41E-06	9.98E-06	-2.59E-05
Stratospheric ozone depletion potential	eq. kg CFC 11	4.03E-08	2.25E-08	1.64E-10	1.64E-10	9.00E-09	1.86E-01	3.00E-09	-2.69E-10
Soil and water acidification potential	eq. mol H+	6.08E-03	3.95E-04	8.89E-05	8.89E-05	1.58E-04	1.27E-04	8.31E-05	-9.48E-05
Eutrophication potential - freshwater	eq. kg P	1.77E-01	6.26E-06	1.52E-05	1.52E-05	2.61E-06	1.03E-07	2.86E-06	-9.56E-06
Eutrophication potential - seawater	eq. kg N	9.21E-04	1.19E-04	1.29E-05	1.29E-05	4.77E-05	4.32E-04	2.87E-05	-2.06E-05
Eutrophication potential - terrestrial	eq. mol N	9.68E-03	1.30E-03	1.09E-04	1.09E-04	5.20E-04	8.17E-04	3.12E-04	-2.64E-04
Potential for photochemical ozone synthesis	eq. kg NMVOC	3.88E-03	3.98E-04	3.04E-05	3.04E-05	1.59E-04	1.78E-04	9.02E-05	-6.13E-05
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	5.01E-06	3.46E-07	3.91E-08	3.91E-08	1.38E-07	3.45E-09	3.34E-08	-2.56E-06
Abiotic depletion potential - fossil fuels	MJ	1.48E+01	1.44E+00	1.36E-01	1.36E-01	5.77E-01	1.45E-02	2.28E-01	-2.30E-01
Water deprivation potential	eq. m^3	4.56E-01	6.62E-03	2.81E-03	2.81E-03	2.67E-03	3.39E-04	1.32E-03	-5.58E-03

Table 4. Life cycle assessment (LCA) results– additional impacts indicators (DU: 1 m^2 stone wool product with R_D=1 m^2 K/W , thickness of 39 mm; density of 30 kg/m^3)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA

Table 5. Life cycle assessment (LCA) results - the resource use (DU: 1 m^2 stone wool product with R_D=1 m2 K/W, thickness of 39 mm; density of 30 kg/m^3)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw ,aterials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	6.20E-01	2.08E-02	1.01E-02	1.01E-02	8.28E-03	#ARG!	4.00E-03	-1.31E-02
Consumption of non-renewable primary energy - excluding renewable primary energy used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	1.49E+01	1.56E+00	1.36E-01	1.36E-01	5.77E-01	1.45E-02	2.46E-01	-2.31E-01
Consumption of secondary materials	kg	2.84E-03	0.00E+00	1.24E-05	1.24E-05	1.94E-04	6.54E-06	0.00E+00	-5.27E-05
Consumption of renew. secondary fuels	MJ	1.63E-05	0.00E+00	6.91E-08	6.91E-08	2.13E-06	8.88E-08	0.00E+00	-3.51E-07
Consumption of non-renewable secondary fuels	MJ	4.08E-03	0.00E+00	1.10E-04	1.10E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net consumption of freshwater	m^3	1.17E-02	7.18E-05	3.69E-05	3.69E-05	7.26E-05	1.28E-05	3.55E-05	-1.06E-03

Table 6. Life cycle assessment (LCA) results– waste categories ((DU: 1 m^2 stone wool product with R_D=1 m^2 K/W , thickness of 39 mm; density of 30 kg/m^3)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	2.24E-02	3.84E-06	1.40E-06	1.40E-06	6.48E-04	1.04E-09	3.58E-07	-4.32E-04
Non-hazardous waste	kg	7.99E-01	7.56E-02	7.30E-05	7.30E-05	1.15E-02	2.71E-03	9.38E-01	-4.40E-02
Radioactive waste	kg	7.39E-06	9.94E-06	1.02E-07	1.02E-07	4.31E-08	7.72E-08	1.38E-06	-2.00E-08
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	8.66E-04	0.00E+00	1.40E-07	1.40E-07	1.79E-06	9.66E-08	0.00E+00	-2.00E-05
Materials for energy recovery	kg	3.38E-07	0.00E+00	1.23E-09	1.23E-09	1.45E-08	1.20E-09	0.00E+00	-5.22E-09
Exported Energy	MJ	3.23E-02	0.00E+00	4.05E-04	4.05E-04	0.00E+00	1.47E-02	0.00E+00	-7.68E-04

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 (sub clause 8.1.3.) [x] external [ ] internal
External verification of EPD: Halina Prejzner, PhD. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note: The declaration owner has the sole ownership, liability, and responsibility for the declaration. Declarations within the same product category but from different programmes may not be comparable. Declarations of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025

Normative references

- ITB PCR A v 1.6. (2023) General Product Category Rules for Construction Products
- ECO PLATFORM EPD: http://www.eco-platform.org/
- Ecoinvent 3.9 data set, https://ecoinvent.org/
- EN 13162+A1:2015 – Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification.
- EURIMA: http://www.eurima.org/about-mineral-wool/health-safety.
- EN 16783:2017 Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations
- 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+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- 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. Grudzień 2021

Signature Not Verified
Dokument podpisany przez Michał Piasecki, ITB
Data: 2023.05.15 09:17:19 CEST

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Thermal Physics, Acoustics and Environment Department
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CERTIFICATE № 453/2023
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Mineral Wool

Manufacturer:

Petralana S.A.

ul. Konstytucji 74, 41-905 Bytom, Poland

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

EN 15804+A2

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

This certificate, issued on 12th May 2023 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, May 2023