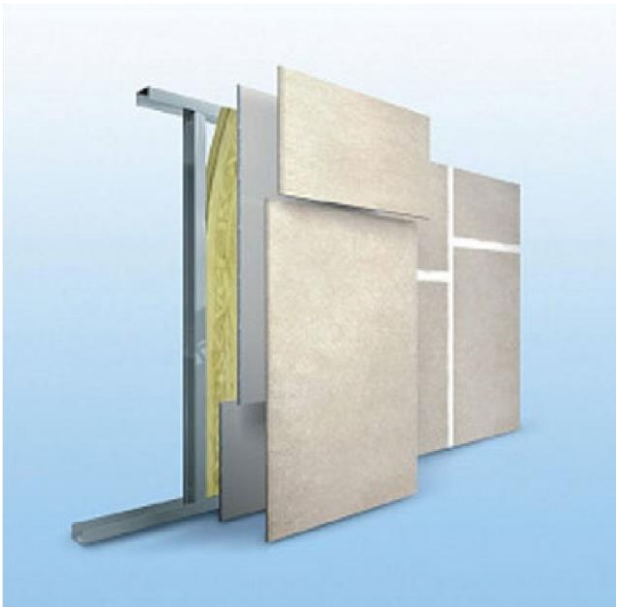
RIGIPS systems with gypsum plasterboards RIGIPS PRO and RIGIPS 4PRO™ lightweight wall partitions, shaft walls, walls lining, suspended ceilings, ceilings lining, attics lining

ENVIRONMENTAL PRODUCT DECLARATION No. 094/2019

In accordance with EN 15804 and ISO 14025

Date of issue:01/07/2019
Validity: 5 years
Valid until:01/07/2024
Scope of the EPD®: POLAND



General information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by external auditor. It contains the information on the impacts of declared construction materials on environment and their aspects 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 (see point 5.3 of the standard).
Life cycle: A1-D modules in accordance with PN-EN 15804+A1:2014-04 (Cradle to grave)
Declared durability: Under normal conditions, wall system products are expected to last the service life of a building (50 years)
PCR: ITB - GENERAL PCR v1.4 and PN-EN 15804+A1:2014-04 based
European Standard: EN 520:2004 +A1:2009 Gypsum plasterboards - Definitions, requirements and test methods
Declared unit: The declared unit is 1 m^2 of wall or another building elements such as: shaft walls, walls lining, suspended ceilings, ceilings lining, attics lining
Reasons for performing LCA: B2B
Representativeness: Polish product
EPD Prepared by: Central Team, Saint Gobain Gypsum. **Contact:** Yves.coquelet@saint-gobain.com

EPD program operator:
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EPD Owner:
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Manufacture Site Address: Rigips - Stawiany Szarbków 73, 28-400 Pińczów
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ITB is the verified member of The European Platform for EPD program operators and LCA practicioners. www.eco-platform.org

All Rigips products have been assessed down to 100 ppm (0,01%) of product weight, and do not contain any substances listed:

- Authorization list – REACH Annex XIV
- Restriction list – REACH Annex XVII
- Candidate List of Substances of Very High Concern (SVHC) for authorization

The candidate list is updated regularly and we are required to update the information if necessary.
The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

Manufacturer and product Information

RIGIPS (SAINT GOBAIN group) exists on the Polish market since 1994 and is engaged in manufacturing gypsum products (from own natural stone mined). RIGIPS offers a full range of building elements such as: lightweight partition walls, walls lining, shaft walls, suspended ceilings, ceilings linings, attics lining. Standard systems are non-loadbearing and constructed using drylining techniques. All systems can be used in all types of buildings including private housing, flats and apartments, commercial, institutional, recreational and industrial properties. They cover all applications, from simple space division through to high performance systems designed to meet the most demanding fire resistance, sound insulation, impact and height requirements. The impact of wide range of RIGIPS products is assessed, verified and presented in international ITB EPDs (www.zb.itb.pl/epd).

RIGIPS systems are constructed using lightweight Saint-Gobain group materials (covered by EPDs), which can give rise to significant savings in structural design compared to masonry alternatives. Big benefits also include the speed of installation and reduction to overall build costs. A full range of solutions is available to meet specific performance specifications (see http://www.rigips.pl/).

The subject of this EPD is based on the actual technical documents for all Rigips systems such as National Technical Assessments and Fire Classifications. All actual technical documents are always available on website www.rigips. pl. Set of products for the Rigips partition system walls that is actual for the date of edition of this document is National Technical Assessment ITB-KOT-2018/0176. System of wall partition includes wall frame construction of cold-formed steel sections (CW and UW) with linings of plasterboard. The space between the sheets of plasterboards can be filled with plates or mats of glass wool or rock wool. All Rigips systems must consist of three main elements: cold formed steel sections, Rigips plasterboards and glass or rock wool.

The set of products which this EPD includes consist of:

- Cold formed steel sections
  ULTRASTIL CW 50, CW 75, CW 100; ULTRASTIL AKU CW 50, CW 75, CW 100;
  ULTRASTIL UW 50, UW 75, UW 100;
  UA 50, UA 75, UA 100;
  UD 30 ULTRASTIL; C RIGISTIL, U RIGISTIL; Brackets: elastic bracket, hat profile, ES, ES acoustic, GL2, GL9;

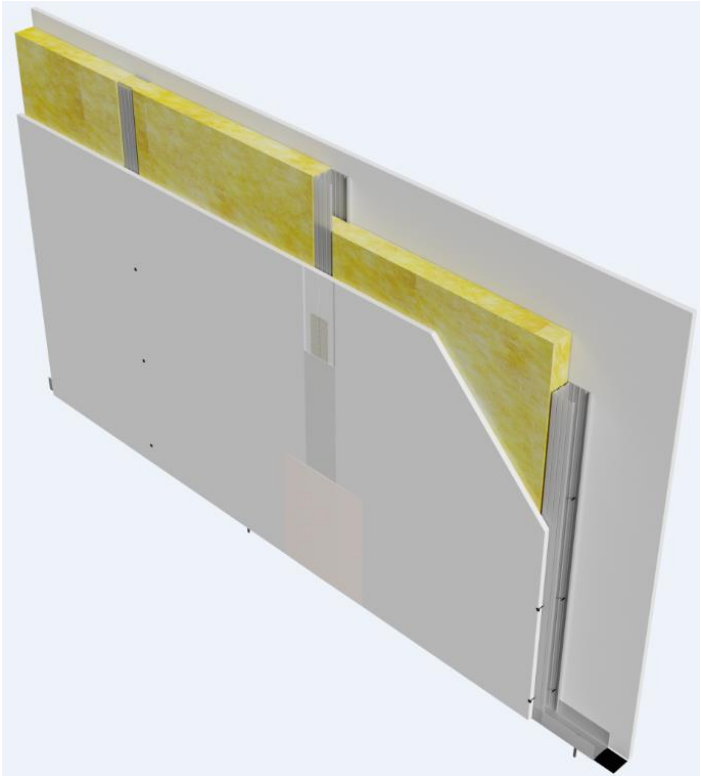
- and another Rigips cold frame steel components which are part of substructure of Rigips systems

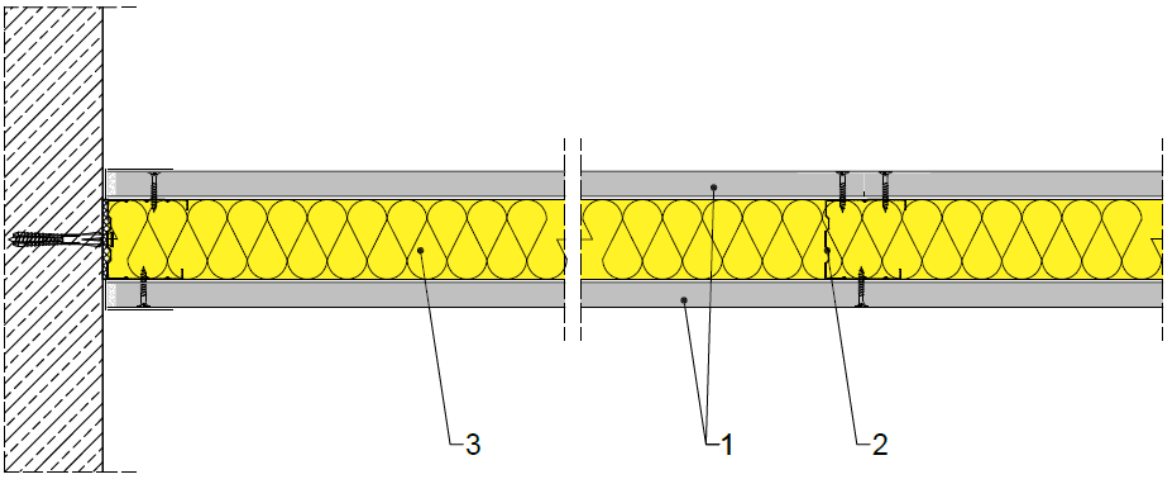
- RIGIPS plasterboards PRO or 4PRO™ types: A, F, D, H1, H2, H3, R, E, I, P and combinations thereof filling a plate or mat of noncombustible glass mineral wool or rock mineral wool

SYSTEM PARTS

The basic solution of lightweight partition wall presented below is a high-performance wall system consisting of mineral wool thickness 50 mm, a steel metal studs RIGIPS CW 50 ULTRASTIL and cover with RIGIPS PRO (4PRO) gypsum plasterboards on either side.

(see basic system scheme).



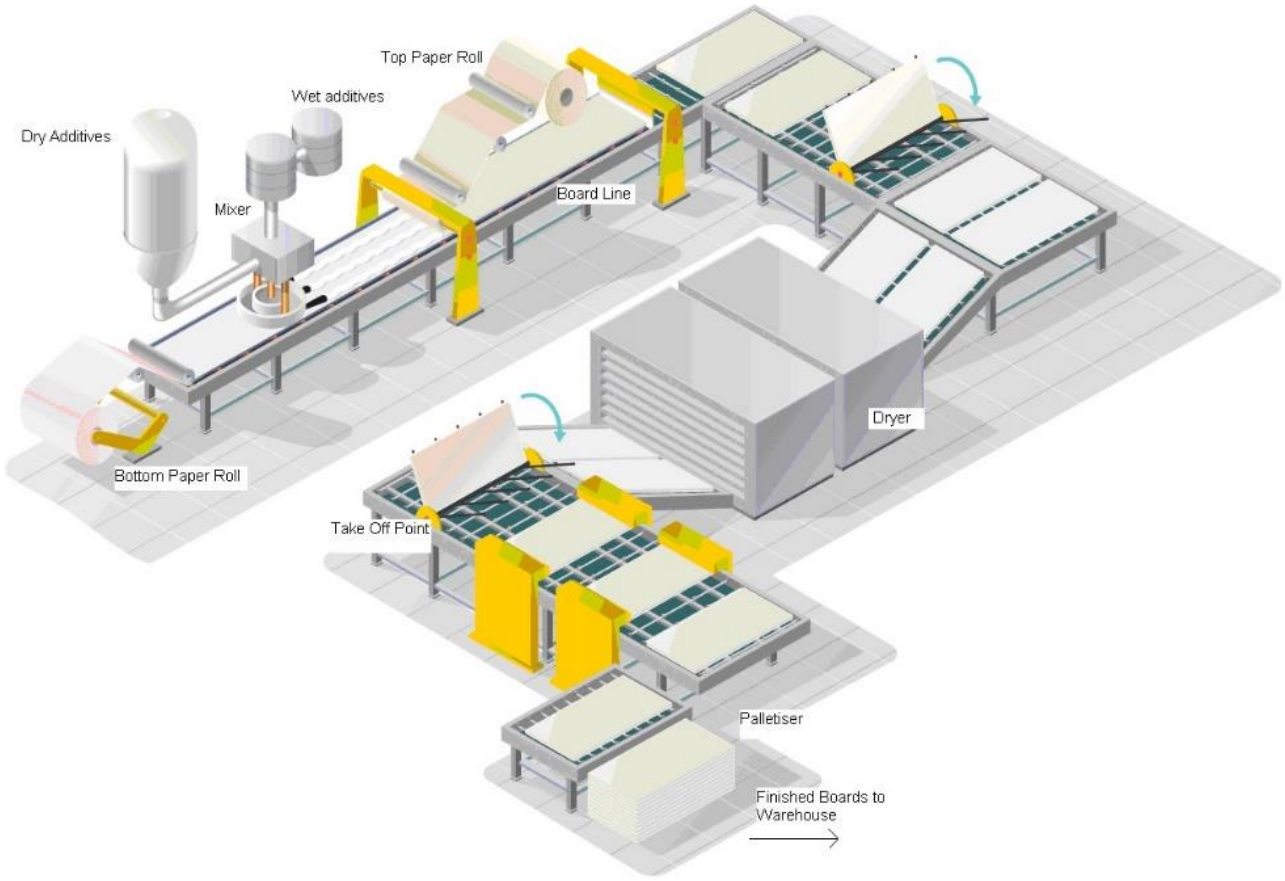


1. RIGIPS PRO (4PRO) gypsum plasterboard 12,5 mm
2. Metal stud CW 50 RIGIPS ULTRASTIL
3. Mineral wool thickness 50 mm

RIGIPS gypsum plasterboards

Manufacturing in detail:

To produce RIGIPS plasterboard, gypsum is milled and calcined to produce calcium sulfate hemihydrates ($CaSO_4$, ½H_2O), commonly called Stucco. Calcination occurs at approximately 120 to 150°C and 0,908 Megagrams (Mg) (1 ton) of gypsum calcines to about 0,77 Mg (0,85 ton) of stucco. In calciner, the gypsum is heated by hot combustion gas passed through flues in the kettle, and the stucco product is separated in the bug filter and finally stored in the silo. Ready for use stucco is transferred from one process to next (gypsum board and blocks production) by means of screw conveyors. Later in the manufacture of plasterboard, stucco from calcinator is first mixed with dry additives such as starch, fiberglass and others. This dry mix is combined with water, foam, accelerators and pulpwood in a pin mixer at the head of a board forming line. The slurry is then spread on the moving belt conveyor between 2 paper sheets. The edges of the paper are scored to allow precise folding of the paper to form the edges of the board. As the wet board travels the length of a conveying line, the calcium sulfate hemihydrate combines with the water in the slurry to form solid calcium sulfate dihydrate, resulting in rigid board. The board is rough-cut to length, and it enters a multideck dryer, where it is dried by direct contact with hot combustion gases The dried plasterboard is conveyed to the board end sawing area and it is trimmed and bundled for shipment.



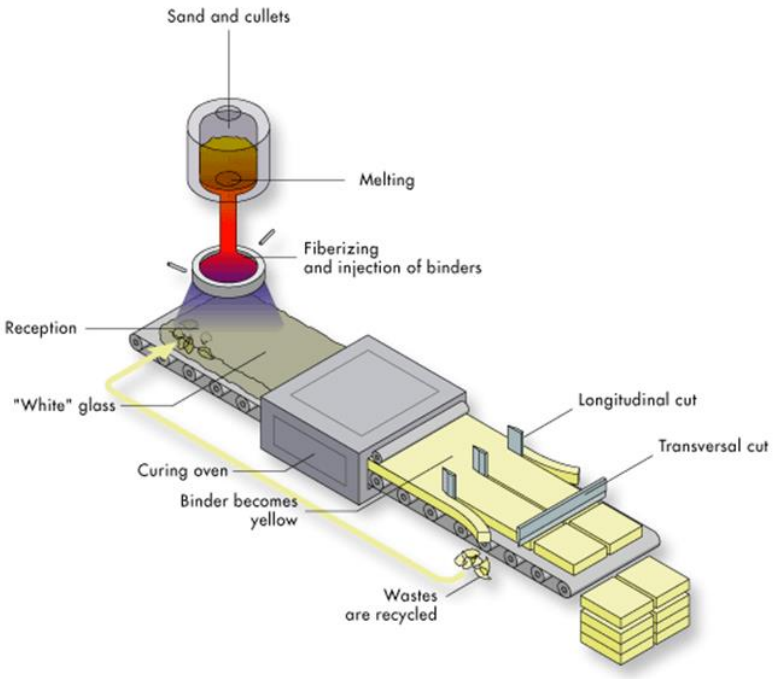
ISOVER mineral wool

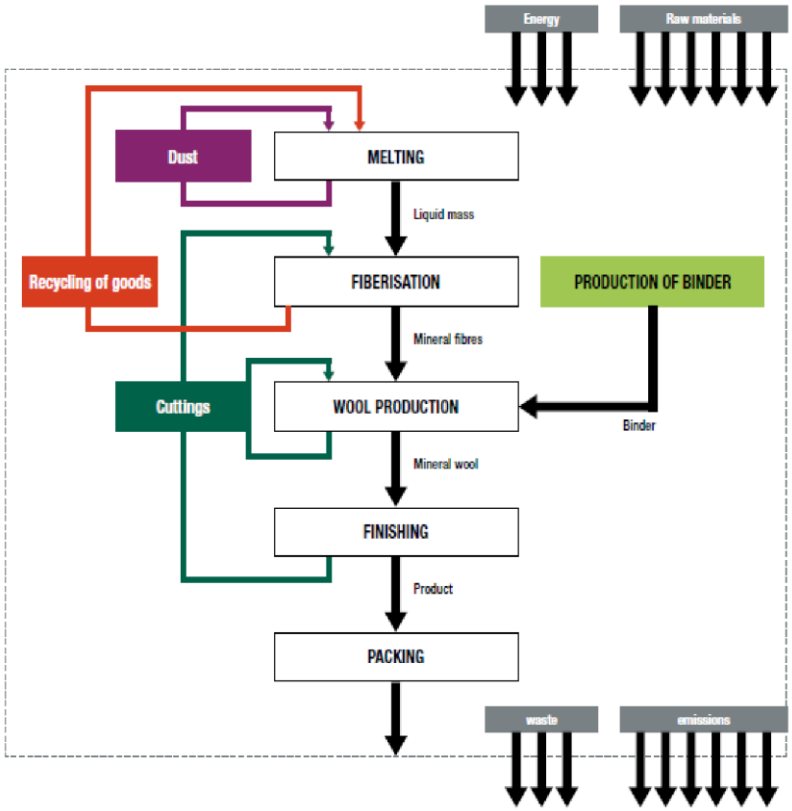
ISOVER wool products are made in Gliwice (Poland) from volcanic rock – stone wool or from sand and glass - glass wool. The raw materials for a stone wool are 97% natural, and include basalt, diabase and similar igneous rocks, which are melted in a furnace with fueling and fluxing agents. Up to 30% recycled stone wool waste is added to the mix. ISOVER stone wool products combine mechanical resistance with good insulation performance, high temperature suitability and cost-efficiency and come in a range of thicknesses specially tailored for individual applications. Environmental characteristic of Isover Mineral Wool can be found in ITB-EPD 052/2016 and Isover Glass Wool in ITB EPD 051/2016.

A1 and A2 Modules: Raw material supply and transport

The raw material supply covers production of all binder components and sourcing of raw materials for fiber production basalt and diabase for a stone wool. The main product components are inorganic minerals (stone) and a low percentage of organic binder. Mineral wool is free from substances of very high concern (SVHC). No additives like fire retardants are needed to ensure or improve the fire safety of mineral wool, as the mineral composition provides a non-combustible product. Neither is there a need to add substances to keep the insulation free from mould and insects. Data on transport of the different raw materials to the manufacturing plant are collected and modelled for Gliwice plant by ITB. Means of transport include truck, train and ship, and for Polish and European fuel averages are applied.

Figure 1: Glass wool production





A3: Production

Manufacture covers all processes linked to production, which comprises various related operations besides onsite activities, including melting, fiberisation, wool production, finishing, packaging and internal transportation. The manufacturing process also yields data on the combustion of refinery products, such as diesel and gasoline, related to the production process. Use of electricity, fuels and auxiliary materials in the production of stone wool products is taken into account using national data. The environmental profile of these energy carriers is modelled for average Polish conditions. Packaging-related flows in the production process and all upstream packaging are included in the manufacturing module, i.e. wooden pallets and PE-LD film (cradle-to-gate). Apart from production of packaging material, the supply and transport of packaging material are also considered in the LCA model. Data on packaging waste created during this step are then generated. It is assumed that packaging waste generated in the course of production and up-stream processes is 100% collected

and recycled or incinerated based on a multi-input and multi-output process specific to the elementary composition of the waste. Energy (e.g. steam, electricity) are credited using national production averages.

Cold formed steel RIGIPS CW and UW ULTRASTIL profiles
(as a representation of Rigips cold formed steel profiles)

CW&UW profiles are prefabricated in RIGIPS BUDMAT Factory in Płock. Products are the thin-walled profiles made of hot-dip coated slit strip. The CW 75 profile with length of 300 cm was selected as a representative product for all CW profiles as it is an average product in terms of geometry and also displays the most popular shape and average values for all RIGIPS. Use of this profile can be regarded as a worst-case scenario as it is heavier at 0,7 kg/m than the average weight of all profiles. RIGIPS CW and UW profiles are used as substructures for non-bearing single or dual-layer RIGIPS partition walls and wall linings in accordance with ITB-KOT-2018/0176. The constructions are suitable for use in normal air-conditioned interior rooms. Corrosion protection complies with EN 14195. Placing on the market is governed by Directive (EU) No. 305/2011. The Declaration of Performance number is DoP ULTRASTIL/2018/1 consideration of EN 14195 and CE marking.

All actual Declarations of Performance of all cold formed steel profiles are available on Rigips website http://www.rigips.pl

A3 Module Profiles Production (as a representation of Rigips cold formed steel profiles)

RIGIPS CW and UW profiles are manufactured from hot-dip coated steel sheet as DX 51+Z, d= 0.6 mm (nominal) slit strip in accordance with EN 10346 and EN 10143 with Z 100 hot-dip galvanizing. The slit strip is manufactured with an average of 40% steel recycling share and delivered wound on coils (diameter 800-1800 mm). Acetone ink is used for marking the profiles. Volume, converted to 1 running meter of profile: 0,02 mg. During the profile manufacturing process lubricant and cleaning agent is also used: water-based emulsion. RIGIPS profiles are manufactured from hot-dip coated steel slit strip in a cutting and forming process. The slit strip is added continuously in a conveyor process. The first step involves cutting and stamping the central section followed by continuous splaying by a suitable device. The folded area of the strip is rolled smooth and then the modified slit strip is roll-formed. This step is followed by marking by ink jet lettering before the profiles are cut to length in a shearing process and packed in bundles of 8. The material is processed without waste.
“Cradle to gate” average assessment for RIGIPS profiles was done by Saint-Gobain LCA central TEAM using Gabi software and Thinkstep database.

Product type

Table 1: RIGIPS wall system 3.40.01 as a representative of Rigips systems

Partition Wall 3.40.01 (example)					
Filling				Mineral stone or glass wool	
Commercial name of filling (example)				Isover Aku-Płyta	Isover POLTERM UNI
Thickness, mm				50	50
Acoustic insulation of wall with the filling of stone wool 14 ÷ 60 kg/m³, with claddings of RIGIPS gypsum, dB		1 x 12,5 mm	R_W	44	44
			RA1	38	38
			RA2	30	30
Fire resistant class with wool with density i ≥ 10kg/m³ PN-EN 13501-2	Claddings by g-k Rigips	1 x 12,5 mm: type A or H2 Board weight ≥ 8,50 kg/m²	EI	15 [1)]	15 [1)]
		1 x 12,5 mm: type F, type DF or DFH2 Board weight ≥ 9,00 kg/m²	EI	30	30
		1 x 12,5 mm: type DF or DFH2 Board weight ≥ 10,00 kg/m²	EI	30	60 2)
		1 x 15 mm: type F or type DF or DFH2 Board weight ≥ 11,00 kg/m²	EI	60	60
Use category –impact resistance According to ETAG 003		Wall with board g-c 12,5 mm	-	II	
		Wall with board g-c 15 mm		II	
Wall thickness, mm		Wall with board g-c12,5 mm	G	75	
		Wall with board g-c 15 mm		80	
Maximum wall height 3) , mm		1	HMAX	3250	
Wall weight, kg/m²		With board g-c 12,5 mm	M	26	
		With board g-c 15 mm		30	

[1)] concerns wall without filling or with any non-flammable mineral wool
[2)] concerns walls with the mineral stone wool with density ≥ 30 kg/m³
[3)] concerns scope of use 1) i 2) in accordance to National Technical Assessment

Table 2: Gypsum plasterboard according to PN-EN 520+A1: 2012 standard

Standard designation	Type of application	Commercial name
Gypsum plasterboard	light systems used for wall coverings, partitions, walls, shafts, suspended ceilings and attics recommended for large intensely lit surfaces with crosswise edge joints	RIGIPS PRO and 4PRO™ Type A, F, D, H1, H2, H3, R, E, I, P – and combinations thereof

Table 3: Gypsum plasterboard technical parameters according to PN-EN 520+A1:2010 standard

Technical parameters	
Description	Gypsum plasterboard RIGIPS PRO and RIGIPS 4PRO™
Standard designation	PN-EN 520 + A1:2012
Thickness	From 6,5 to 18 mm
Weight	From 5,5 to 18 kg/m^2
Width	1200 mm
Length	2000mm, 2500 mm, 2600 mm, 3000 mm (other on request)
Reaction to fire	Nonflammable, Class A2-s1,d0 compliant as regards reaction to fire of construction materials (according to PN-EN 13501-1)
Colour	Assigned to the type of plasterboard
Product reference document	Declaration of Performance (DoP)
Manufacturing site	Szarbków 73, Poland

LCA calculation information for 1m² of wall

PARAMETERS	VALUE
EPD TYPE DECLARED	Cradle to grave
DECLARED UNIT	1 m² of wall.
SYSTEM BOUNDARIES	Cradle to grave: stages A1 – 3, A4, A5, B1 – 7, C1 – 4, D
REFERENCE SERVICE LIFE (RSL)	50 years by default, it corresponds to standard building design life
CUT-OFF RULES	Life Cycle Inventory data for a minimum of 99% of total inflows to the upstream and core module shall be included
ALLOCATIONS	Production data. Recycling, energy and waste data have been calculated on a mass basis.
GEOGRAPHICAL COVERAGE AND TIME PERIOD	Scope includes: Data included is collected from one production site, Pińczów. Data collected for the year 2018 Background data: Ecoinvent (2015) and Gabi (2013 - 2016)
PRODUCT CPC CODE	37530 (Articles of plaster or of compositions based on plaster)

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard.
According to ISO 21930, EPDs might not be comparable if they are from different programmes.

Product stage, A1-A3

Description of the stage: the product stage of plasterboard products is subdivided into 3 modules A1, A2 and A3 respectively “Raw material supply”, “transport to manufacturer” and “manufacturing”.

A1, raw material supply
This includes the extraction and processing of all raw materials and energy which occur upstream from the manufacturing process.

A2, transport to the manufacturer
The raw materials are transported to the manufacturing site. The modelling includes road transportation of each raw material.

A3, manufacturing
This module includes the manufacture of products and the manufacture of packaging. The production of packaging material is taken into account at this stage. The processing of any waste arising from this stage is also included.

The PN-EN 15804 standard allow the aggregation of the three stage, this option has been applied in this EPD

Construction process stage, A4-A5

Description of the stage: the construction process is divided into 2 modules: A4, transport to the building site and A5, installation in the building

A4, Transport to the building site: this stage includes transport from the production gate to the building site. Transport is calculated on the basis of a scenario with the parameters described in the following table theses parameter are considered equal for all materials included in the wall.

PARAMETERS	VALUE (expressed per functional / declared unit)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat, etc.	0.38 liters per km
Distance	797 km
Capacity utilisation (including empty returns)	58.7 %
Volume capacity utilisation factor	1

A5, installation into the building The accompanying table quantifies the parameters for installing the product at the building site. All installation materials and their waste processing are included.

PARAMETERS	VALUE (expressed per functional/declared unit)
Ancillary materials for installation (specified by materials)	Jointing compound 0.66kg/m^2 board, tape 2.46m /m^2 wall, screws 20 /m^2 wall
Water use	0.33 liters/m^2 wall
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Board: 0.862 kg Screws: 0 kg Jointing Compound: 0.070 kg Jointing Tape: 0.000126 kg Glass wool: 0.069 kg Metal frame : 0.085 kg
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovering, disposal (specified by route)	Board: 0.86 kg to landfill 95% to recycling 5% Jointing Compound: 0.070 kg to landfill Jointing Tape: 0.000126 kg to landfill Glass wool: 0.069 kg to landfill Metal frame : 0.085 kg to recycling
Direct emissions to ambient air, soil and water	None

Use stage (excluding potential savings), B1-B7

Description of the stage:

The use stage, related to the building fabric includes:
B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment,
B6, Operational energy use
B7, Operational water use

Description of scenarios and additional technical information:

Once installed correctly according to the RIGIPS ceiling tiles manufacture technical documents needs no further maintenance, repair, replacement or refurbishment during the full life span of the product.
The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Therefore, it has no impact at this stage.

End-of-life stage C1-C4

Description of the stage: The end-of-life stage includes:
C1, de-construction, demolition;
C2, transport to waste processing;
C3, waste processing for reuse, recovery and/or recycling: the entire product is assumed here to be sent to landfill
C4, disposal, including provision and all transport, provision of all materials, products and related energy and water use.

End-of-life:

PARAMETER	VALUE (expressed per functional/declared unit)
Collection process specified by type	20.1 kg collected with mixed construction waste
Recovery system specified by type	4.46 kg for recycling
Disposal specified by type	15.64 kg to municipal landfill
Assumptions for scenario development (e.g. transportation)	On average, wastes are transported 50 km by road from construction / demolition sites to end of life treatment, disposal or recycling.

Reuse/recovery/recycling potential, D

Description of the stage: Module D includes:

Metal frame has a high end of life recycling potential and therefore modelling includes recycling of 95% of the product at end of life, and a subsequent material credit for the potential avoided impacts of steel manufacture.
Plaster product are considered recycled at 16% and a subsequent material credit for the potential avoided impacts of gypsum extraction.

LCA results

Description of the system boundary (MD = Module Declared in LCA, MND = Module Not Declared)

Description of studied system

Wall system thickness [mm]	Gypsum Board thickness [mm]	Board Weight [kg/m² of wall]	Metal Profiles	Profiles Weight [kg/m² of wall]	Wool Thickness [mm]	Wool [kg/m³]	Wool [kg/m² of wall]
70	12,5	16,2	CW 50	1,7	40	30	1,2

Environmental assessment information (MND – Module not declared, MD – Module Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Rawmaterialsupply	Transport	Manufacturing	Transportto constructionsite	Construction-installationprocess	Use	Maintenance	Repair	Replacement	Refurbishment	Operationalenergy use	Operationalwater use	Deconstruction demolition	Transport	Wasteprocessing	Disposal	Reuse-recovery-recyclingpotential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD

Environmental characteristic of 1kg of RIGIPS gypsum plasterboards

Environmental Impact (1kg)															
Indicator	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global warming potential	[kg CO2 eq.]	2,32E-01	3,74E-02	1,69E-02	0	0	0	0	0	0	0	4,67E-03	2,15E-03	1,83E-03	1,40E-02	-1,65E-03
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	3,41E-09	5,72E-18	1,70E-10	0	0	0	0	0	0	0	6,36E-19	5,89E-14	2,06E-11	7,80E-17	-2,63E-14
Acidification potential of soil and water	[kg SO2 eq.]	5,68E-04	1,49E-04	4,40E-05	0	0	0	0	0	0	0	1,64E-05	8,79E-06	1,20E-05	7,96E-05	5,75E-06
Eutrophication potential	[kg (PO4)3- eq.]	5,51E-04	3,64E-05	2,95E-05	0	0	0	0	0	0	0	9,53E-07	2,23E-06	7,65E-06	9,02E-06	1,43E-06
Formation potential of tropospheric ozone	[kg Ethene eq.]	1,68E-05	5,47E-06	3,69E-06	0	0	0	0	0	0	0	1,10E-06	3,59E-07	1,14E-07	6,56E-06	1,15E-06
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	2,23E-07	4,98E-10	2,44E-07	0	0	0	0	0	0	0	1,16E-10	1,85E-10	1,94E-10	4,75E-09	6,09E-10
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	3,65E+00	5,21E-01	2,37E-01	0	0	0	0	0	0	0	5,81E-02	2,90E-02	2,65E-02	1,86E-01	-2,54E-02

Environmental aspects on resource use: 1 kg																
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	3,69E+00	5,22E-01	2,43E-01	0	0	0	0	0	0	0	5,83E-02	2,91E-02	2,68E-02	1,93E-01	-2,28E-02
Use of renewable primary energy resources used as raw materials	[MJ]	1,01E-01	0	4,79E-03	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	3,79E+00	5,22E-01	2,48E-01	0	0	0	0	0	0	0	5,83E-02	2,91E-02	2,68E-02	1,93E-01	-2,28E-02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1,26E+00	1,20E-02	9,38E-02	0	0	0	0	0	0	0	1,89E-04	1,73E-03	2,20E-03	2,44E-02	8,14E-02
Use of non-renewable primary energy resources used as raw materials	[MJ]	3,68E-01	0	1,75E-02	0	0	0	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	1,63E+00	1,20E-02	1,11E-01	0	0	0	0	0	0	0	1,89E-04	1,73E-03	2,20E-03	2,44E-02	8,14E-02
Use of secondary material	[kg]	8,83E-03	0	6,33E-04	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net use of fresh water	[dm3]	2,40E-03	3,99E-06	1,57E-04	0	0	0	0	0	0	0	3,47E-07	3,05E-06	5,19E-05	4,84E-05	-2,41E-05
Other environmental information describing waste categories: 1 kg																
Hazardous waste disposed	[kg]	7,21E-07	1,88E-09	3,65E-08	0	0	0	0	0	0	0	7,19E-12	1,60E-09	6,72E-13	3,28E-09	1,53E-10
Non-hazardous waste disposed	[kg]	1,32E-02	6,33E-06	4,54E-02	0	0	0	0	0	0	0	8,58E-06	2,44E-06	2,40E-07	8,94E-01	-7,49E-03
Radioactive waste disposed	[kg]	1,01E-05	6,09E-07	2,17E-06	0	0	0	0	0	0	0	7,19E-08	5,95E-08	3,22E-09	2,56E-06	1,08E-06
Components for re-use	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling	[kg]	9,73E-04	0	2,99E-02	0	0	0	0	0	0	0	0	0	1,70E-01	0	0
Materials for energy recovery	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Environmental characteristic of 1kg of ISOVER Glass Wool

Environmental Impact (1kg)																
Indicator	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global warming potential	[kg CO_2 eq.]	1,98E+00	5,33E-02	8,00E-02	0	0	0	0	0	0	0	0	3,89E-03	0	5,34E-03	0
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	5,18E-08	9,72E-09	4,06E-09	0	0	0	0	0	0	0	0	7,08E-10	0	1,79E-09	0
Acidification potential of soil and water	[kg SO_2 eq.]	1,99E-02	1,78E-04	5,49E-04	0	0	0	0	0	0	0	0	1,30E-05	0	4,02E-05	0
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	1,76E-03	3,06E-05	8,69E-05	0	0	0	0	0	0	0	0	2,23E-06	0	7,24E-06	0
Formation potential of tropospheric ozone	[kg Ethene eq.]	5,25E-03	5,10E-05	2,44E-04	0	0	0	0	0	0	0	0	3,72E-06	0	1,13E-05	0
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	1,10E-06	1,01E-07	6,01E-08	0	0	0	0	0	0	0	0	7,35E-09	0	4,64E-09	0
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	3,83E+01	8,04E-01	1,60E+00	0	0	0	0	0	0	0	0	5,86E-02	0	1,52E-01	0

Environmental aspects on resource use: 1 kg																
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	3,41E-01	0	1,71E-02	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable primary energy resources used as raw materials	[MJ]	3,02E+01	7,99E-01	1,47E+00	0	0	0	0	0	0	0	0	5,83E-02	0	1,51E-01	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	3,05E+01	7,99E-01	1,48E+00	0	0	0	0	0	0	0	0	5,83E-02	0	1,51E-01	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1,03E+00	0	5,17E-02	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable primary energy resources used as raw materials	[MJ]	2,13E+00	9,93E-03	1,21E-01	0	0	0	0	0	0	0	0	7,24E-04	0	3,92E-03	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	3,16E+00	9,93E-03	1,73E-01	0	0	0	0	0	0	0	0	7,24E-04	0	3,92E-03	0
Use of secondary material	[kg]	5,67E-01	0	2,84E-02	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net use of fresh water	[dm^3]	7,09E-03	1,54E-04	4,26E-04	0	0	0	0	0	0	0	0	1,13E-05	0	1,67E-04	0

Other environmental information describing waste categories: 1 kg																
Hazardous waste disposed	[kg]	7,72E-02	5,23E-04	2,73E-03	0	0	0	0	0	0	0	0	3,82E-05	0	7,81E-05	0
Non-hazardous waste disposed	[kg]	3,74E-01	4,20E-02	6,88E-02	0	0	0	0	0	0	0	0	3,06E-03	0	1,00E+00	0
Radioactive waste disposed	[kg]	2,43E-05	5,46E-06	2,35E-06	0	0	0	0	0	0	0	0	3,98E-07	0	1,01E-06	0
Components for re-use	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling	[kg]	1,24E-01	0	7,62E-02	0	0	0	0	0	0	0	0	0	0	0	0
Materials for energy recovery	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy	[MJ]	3,36E-06	0	9,23E-09	0	0	0	0	0	0	0	0	0	0	0	0

Environmental characteristic of 1kg of Metal Frame

Environmental Impact (1kg)																
Indicator	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global warming potential	[kg CO_2 eq.]	2,47E+00	3,49E-02	2,05E-01	0	0	0	0	0	0	0	4,39E-03	2,39E-03	0	0	-1,68E+00
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	-9,37E-09	5,34E-18	3,59E-09	0	0	0	0	0	0	0	5,98E-19	5,93E-19	0	0	9,42E-09
Acidification potential of soil and water	[kg SO_2 eq.]	5,87E-03	1,39E-04	8,50E-04	0	0	0	0	0	0	0	1,54E-05	9,69E-06	0	0	-3,31E-03
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	5,47E-04	3,40E-05	1,16E-04	0	0	0	0	0	0	0	8,97E-07	2,46E-06	0	0	-2,48E-04
Formation potential of tropospheric ozone	[kg Ethene eq.]	9,08E-04	5,10E-06	4,57E-05	0	0	0	0	0	0	0	1,04E-06	3,96E-07	0	0	-7,80E-04
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	9,94E-06	4,69E-10	4,37E-07	0	0	0	0	0	0	0	1,11E-10	2,09E-10	0	0	-4,88E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	2,55E+01	4,86E-01	-3,02E-01	0	0	0	0	0	0	0	5,47E-02	3,23E-02	0	0	-1,64E+01

Environmental aspect on resource use (1 kg)																
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	8,16E-01	1,12E-02	3,41E-01	0	0	0	0	0	0	0	1,78E-04	1,93E-03	0	0	1,09E+00
Use of renewable primary energy resources used as raw materials	[MJ]	1,21E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	1,06E+00	1,12E-02	3,41E-01	0	0	0	0	0	0	0	1,78E-04	1,93E-03	0	0	1,09E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	2,47E+01	4,88E-01	4,29E+00	0	0	0	0	0	0	0	5,48E-02	3,25E-02	0	0	-1,58E+01
Use of non-renewable primary energy resources used as raw materials	[MJ]	1,47E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	2,61E+01	4,88E-01	4,29E+00	0	0	0	0	0	0	0	5,48E-02	3,25E-02	0	0	-1,58E+01
Use of secondary material	[kg]	0	0	2,84E-02	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net use of fresh water	[dm^3]	1,86E-03	3,72E-06	9,40E-05	0	0	0	0	0	0	0	3,27E-07	3,25E-06	0	0	2,26E-03

Other environmental information describing waste categories and output flows 1 kg																
Hazardous waste disposed	[kg]	2,46E-06	1,75E-09	2,73E-03	0	0	0	0	0	0	0	6,76E-12	1,80E-09	0	0	-1,10E-06
Non-hazardous waste disposed	[kg]	1,12E-01	5,91E-06	7,44E-02	0	0	0	0	0	0	0	8,07E-06	2,73E-06	0	0	1,81E-01
Radioactive waste disposed	[kg]	2,89E-07	5,69E-07	2,40E-06	0	0	0	0	0	0	0	6,76E-08	6,65E-08	0	0	5,43E-07
Components for re-use	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling	[kg]	7,88E-03	0	2,42E-01	0	0	0	0	0	0	0	0	0	1,38E+00	0	0
Materials for energy recovery	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Environmental characteristic of 1m² of wall

Environmental Impact (1m²)															
Indicator	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global warming potential	[kg CO_2 eq.]	9,35E+00	6,66E-01	3,28E-01	0	0	0	0	0	0	0	8,83E-02	4,79E-02	1,34E-02	2,45E-01	-2,88E+00
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	1,14E-07	1,02E-16	3,26E-09	0	0	0	0	0	0	0	1,20E-17	1,20E-17	2,60E-16	1,37E-15	1,61E-08
Acidification potential of soil and water	[kg SO_2 eq.]	2,25E-02	2,66E-03	1,14E-03	0	0	0	0	0	0	0	3,10E-04	1,95E-04	4,27E-05	1,40E-03	-5,70E-03
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	6,93E-03	6,49E-04	1,44E-04	0	0	0	0	0	0	0	1,81E-05	4,91E-05	3,73E-06	1,58E-04	-4,29E-04
Formation potential of tropospheric ozone	[kg Ethene eq.]	2,20E-03	9,75E-05	8,73E-05	0	0	0	0	0	0	0	2,08E-05	7,88E-06	2,56E-06	1,15E-04	-1,34E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	4,10E-04	8,96E-09	2,67E-06	0	0	0	0	0	0	0	2,24E-09	3,72E-09	2,87E-09	8,59E-08	-8,34E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	7,57E+01	9,28E+00	9,32E-01	0	0	0	0	0	0	0	1,10E+00	6,50E-01	1,65E-01	3,26E+00	-2,81E+01

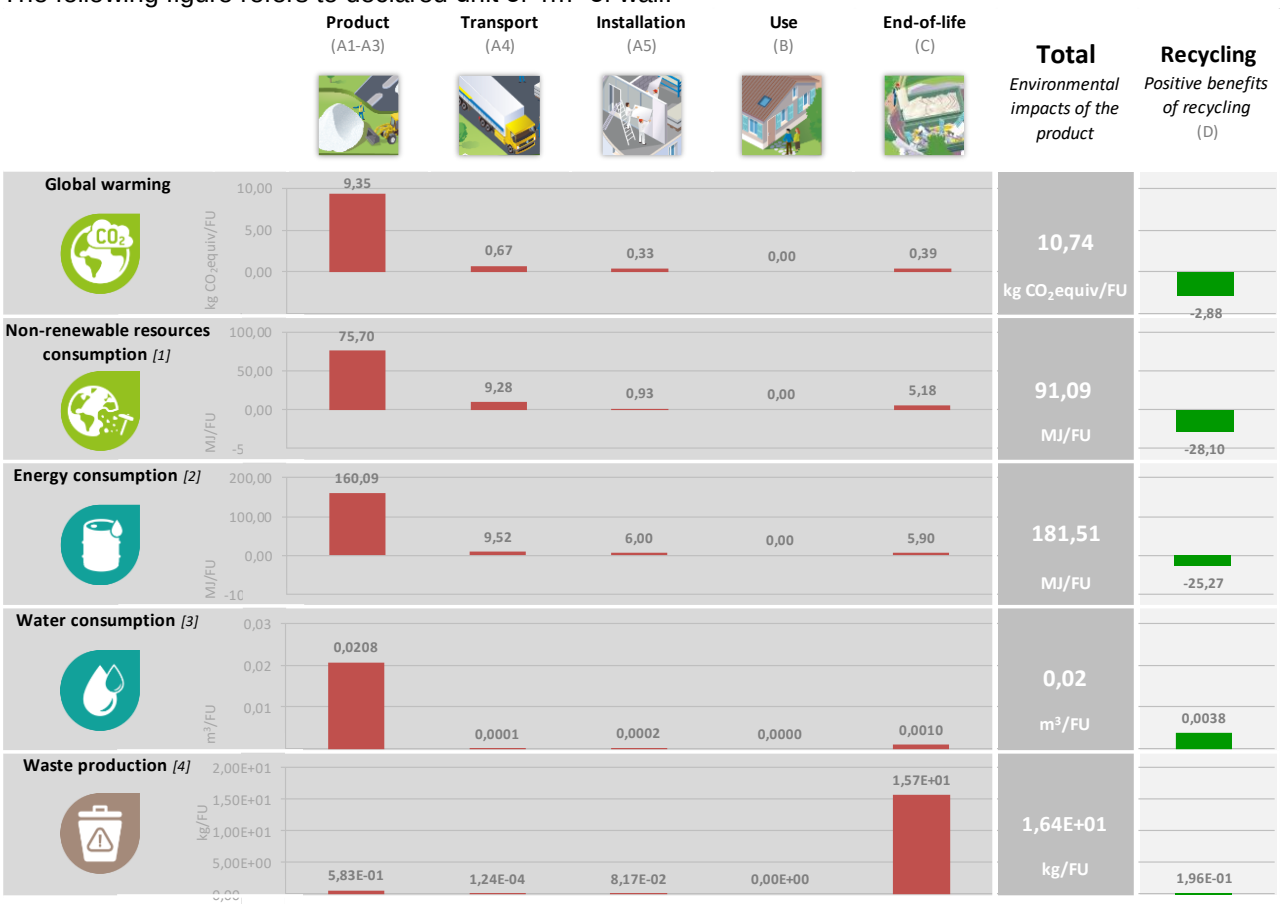
Environmental aspect on resource use (1m²)																
Indicator	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	2,65E+01	2,13E-01	4,27E-01	0	0	0	0	0	0	0	3,58E-03	3,57E-02	6,66E-02	4,29E-01	1,83E+00
Use of renewable primary energy resources used as raw materials	[MJ]	5,79E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	3,81E+01	2,13E-01	4,27E-01	0	0	0	0	0	0	0	3,58E-03	3,57E-02	6,66E-02	4,29E-01	1,83E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1,19E+02	9,31E+00	5,57E+00	0	0	0	0	0	0	0	1,10E+00	6,53E-01	2,32E-01	3,38E+00	-2,71E+01
Use of non-renewable primary energy resources used as raw materials	[MJ]	3,04E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	1,22E+02	9,31E+00	5,57E+00	0	0	0	0	0	0	0	1,10E+00	6,53E-01	2,32E-01	3,38E+00	-2,71E+01
Use of secondary material	[kg]	1,43E-01	0	2,84E-02	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net use of fresh water	[dm³]	2,08E-02	7,11E-05	2,05E-04	0	0	0	0	0	0	0	6,58E-06	5,73E-05	6,17E-05	8,49E-04	3,84E-03

Other environmental information describing waste categories and output flows 1m²																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	[kg]	7,52E-05	3,34E-08	2,73E-03	0	0	0	0	0	0	0	1,36E-10	3,16E-08	9,08E-11	5,76E-08	-1,89E-06
Non-hazardous waste disposed	[kg]	5,82E-01	1,13E-04	7,90E-02	0	0	0	0	0	0	0	1,62E-04	4,91E-05	1,94E-04	1,57E+01	1,96E-01
Radioactive waste disposed	[kg]	9,21E-04	1,09E-05	1,22E-05	0	0	0	0	0	0	0	1,36E-06	1,34E-06	2,75E-05	4,48E-05	-5,67E-06
Components for re-use	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling	[kg]	7,88E-03	0	2,42E-01	0	0	0	0	0	0	0	0	0	1,38E+00	0	0
Materials for energy recovery	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LCA results interpretation

The following figure refers to declared unit of 1m² of wall.



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the total use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the sum of hazardous, non-hazardous and radioactive waste disposed.

Global Warming Potential (Climate Change) (GWP)
When analyzing the above figure for GWP, it can clearly be seen that the majority of contribution to this environmental impact is from the production modules (A1 – A3). This is primarily because the sources of greenhouse gas emissions are predominant in this part of the life cycle. CO_2 is generated upstream from the production of electricity and is also released on site by the combustion of natural gas. We can see that other sections of the life cycle also contribute to the GWP; however, the production modules contribute to over 80% of the contribution. Combustion of fuel in transport vehicles will generate the second highest percentage of greenhouse gas emissions.

Non-renewable resources consumptions
We can see that the consumption of non – renewable resources is once more found to have the highest value in the production modules. This is because a large quantity of natural gas is consumed within the factory, and non – renewable fuels such as natural gas and coal are used to generate the large amount of electricity we use. The contribution to this impact from the other modules is very small and primarily due to the non – renewable resources consumed during transportation.

Energy Consumptions
As we can see, modules A1 – A3 have the highest contribution to total energy consumption. Energy in the form of electricity and natural gas is consumed in a vast quantity during the manufacture of product so we would expect the production modules to contribute the most to this impact category.

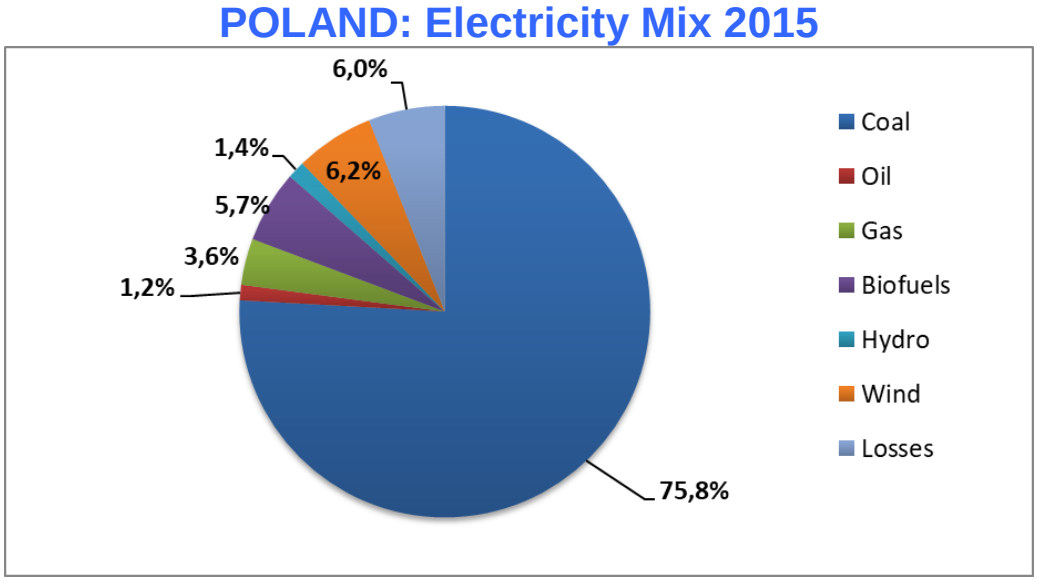
Water Consumption
We can see that water consumption is mainly during the production phase. For the production phase, water is used within the manufacturing facility and therefore we see the highest contribution here. However, we recycle a lot of the water on site so the contribution is still relatively low.

Waste Production
Waste production does not follow the same trend as the above environmental impacts. The largest contributor is the end of life module. This is because the entire product is sent to landfill and recycling treatment once it reaches the end of life state. However, there is a still an impact associated with the production module since we do generate waste on site. The very small impact associated with installation is due to the loss rate of product during implementation.

Additional information

Electricity description

TYPE OF INFORMATION	DESCRIPTION
Location	Representative of average production in Poland
Geographical representativeness description	**Split of energy sources in POLAND** Coal 75,8% Oil 1,2% Gas 3,6% Biofuels 5,7% Hydro 1,4% Wind 6,2% Losses 6,0%
Reference year	2015
Type of data set	Cradle to gate from ECOINVENT 3.5
Source	International Energy Agency -2015
Global Warming potential (excluding biogenic carbon)	1,02 kg eq CO_2 / kWh



Verification

The process of verification of this EPD is in accordance with EN 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 and EN 16783
Independent verification corresponding to ISO 14025 (subclause 8.1.3) ☒ external ☐ internal
External verification of EPD: PhD. Eng. Halina Prejzner LCA, LCI audit and input data verification: M.Sc. Eng. Dominik Bekierski, d.bekierski@itb.pl Verification of LCA: PhD Eng. Michał Piasecki, m.piasecki@itb.pl

References:

- ITB PCR A- General Product Category Rules for Construction Products
- EN 16783:2017 Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations
  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
- PN-EN 15804+A1:2014-04 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- EN 15942:2011 Sustainability of construction works - Environmental product declarations - Communication format business-to-business
- http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

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CERTIFICATE № 094/2019
of TYPE III ENVIRONMENTAL DECLARATION

Product:

RIGIPS systems with gypsum plasterboards RIGIPS PRO and RIGIPS 4PRO™ lightweight wall partitions, shaft walls, walls lining, suspended ceilings, ceilings lining, attics lining

Manufacturer:

Saint Gobain Construction Products Polska Sp. z o.o.
Cybernetyki 9, 02-677 Warsaw, 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+A1:2014-04

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 July 2019 is valid for 5 years or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Barbara Pietruszka, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, July 2019