



THE INTERNATIONAL EPD® SYSTEM

# ENVIRONMENTAL PRODUCT DECLARATION

*In accordance with EN 15804+A1 and ISO 14025*

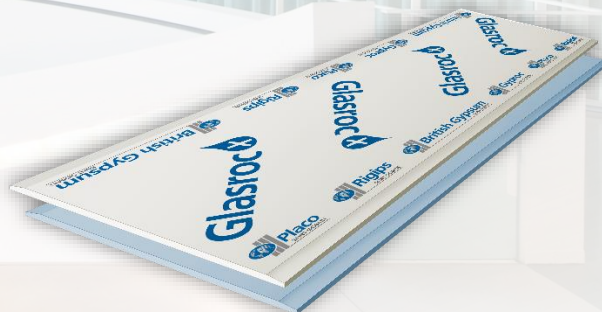
## Gyproc Glasroc X/H Board

Date of issue: 2021-10-19

Validity: 5 years

Valid until: 2026-10-20

Scope of the EPD®: Southeast Asia



The **environmental impacts** of this product have been assessed over its **whole life cycle**. Its Environmental Product Declaration has been verified by an **independent third party**.

Registration number

The International EPD® System:

S-P-04694



## General information

**Manufacturer:** Saint-Gobain Gyproc Thailand

**Programme used:** International EPD System <http://www.environdec.com/>

**EPD registration number/declaration number:** S-P-04694

**PCR identification:** EN 15804 Sustainability of construction works – Environmental product declaration - core rules for the product category of construction product and The International EPD® System PCR 2012:01 version 2.33 for Construction products and Construction services.

**Site of manufacture:** LAEM CHABANG

**Owner of the declaration:** Saint-Gobain Gyproc Thailand

**Product / product family name and manufacturer represented:** Gyproc Glasroc X and H Board plasterboard

**UN CPC code:** 37530 Articles of plaster or of composition based on plaster

**Declaration issued:** 2021-10-19

**Valid until:** 2026-10-20

**Demonstration of verification:** an independent verification of the declaration was made, according to ISO 14025:2010. This verification was external and conducted by the following third party: Andrew Norton, Renuables, based on the PCR mentioned above.

**EPD Prepared by:** Kanphirom Phaiboon (Saint-Gobain Gyproc Thailand) and Patricia Jimenez Diaz (Saint-Gobain)

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The declared unit is 1 m<sup>2</sup> of installed building plasterboard with a weight of 10,70 kg/m<sup>2</sup>, a specified function and an expected average service life of 50 years.

**Declaration of Hazardous substances: (Candidate list of Substances of Very High Concern):** none

**Environmental management systems in place at site:** ISO 14001 - TH 12/6459

**Health and safety management systems in place at site:** DS/OHSAS 18001:2008 – TH 15/8324

**Quality management systems in place at site:** ISO 9001:2015 – TH 12/6458

**Geographical scope of the EPD®:** Southeast Asia

CEN standard EN 15804 serves as the core PCR <sup>a</sup>	
PCR:	PCR 2012:01 Construction products and Construction services, Version 2.33
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via <a href="mailto:info@environdec.com">info@environdec.com</a>
Independent verification of the declaration, according to EN ISO 14025:2010 Internal <input type="checkbox"/> External <input checked="" type="checkbox"/>	
Third party verifier:	Andrew Norton , Renuables <a href="http://renuables.co.uk">http://renuables.co.uk</a>
Accredited or approved by	The International EPD System

# Product description

## Product description and use:

This Environmental Product Declaration (EPD®) describes the environmental impacts of 1 m<sup>2</sup> installed building plasterboard with a weight of 10,70 kg/m<sup>2</sup>, a specified function and an expected average service life of 50 years.

Glasroc X and Glasroc H is a high performance board with a gypsum core containing special additives for moisture and mould resistance. Glasroc® X is reinforced board with a glass-mat on both surfaces and finished with a UV resistant coating, providing outstanding performance in humid environments. This non-paper faced board, free from cellulose content and therefore has a strong inherent resistance to mould growth, which is perfect for wet areas and high-humidity environments including exterior applications. Glass-mats have a physical anchorage in with the gypsum core ensuring a strong bond with the gypsum core that creates a monolithic board of high strength, solidity and exceptional integrity.

Glasroc® X is an ideal substrate for ETICS (External Thermal Insulation Systems) or Direct Render application (also known as Direct Apply Systems). This high performance board can be used for areas requiring high protection against water and it has been designed especially for exterior applications. This board is a perfect solution for exterior ceilings, external walls systems and façade cladding systems.

Gyproc Glasroc X and Glasroc H Board is available in sizes 12,5 mm.

## Technical data/physical characteristics:

REACTION TO FIRE	Non-Combustible Class A1
WATER VAPOUR RESISTANCE	18,2
THERMAL CONDUCTIVITY	0,1865 W/mK

## Description of the main components and/or materials for 1 m<sup>2</sup> of product for the calculation of the EPD®:

PARAMETER	VALUE (expressed per functional/declared unit)
Quantity of plaster for 1 m <sup>2</sup> of product	10,70 Kg
Thickness	12,5 mm
Surfacing	Glass mat: 640 g/m <sup>2</sup>
Packaging for the transportation and distribution	Polyethylene film: 0,002 kg/m <sup>2</sup> Gypsum culls: 0,37 kg/m <sup>2</sup> Wooden culls: 0,004 kg/m <sup>2</sup> Metal strips and angle: 0,026 kg/m <sup>2</sup>
Product used for the Installation	Jointing compound 0,33kg/m <sup>2</sup> board, tape 1,23m /m <sup>2</sup> board, screws 8 /m <sup>2</sup> board

During the life cycle of the product any hazardous substance listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorization" has not been used in a percentage higher than 0,1% of the weight of the product.

The verifier and the programme operator do not make any claim nor have any responsibility of the legality of the product.

## LCA calculation information

<b>EPD TYPE DECLARED</b>	Cradle to Gate with options
<b>DECLARED UNIT</b>	1 m <sup>2</sup> of installed board with a weight of 10,7 kg/m <sup>2</sup>
<b>SYSTEM BOUNDARIES</b>	Cradle to Gate with options: stages A1 – 3, A4 – A5, B1 – 7 and C1 – 4
<b>REFERENCE SERVICE LIFE (RSL)</b>	50 years By default, it corresponds to Standards building design life and value is included in Appendix III of Saint-Gobain Environmental Product Declaration Methodological Guide for Construction Products.
<b>CUT-OFF RULES</b>	Life Cycle Inventory data for a minimum of 99% of total inflows to the upstream and core module shall be included
<b>ALLOCATIONS</b>	Production data. Recycling, energy and waste data have been calculated on a mass basis
<b>GEOGRAPHICAL COVERAGE AND TIME PERIOD</b>	Scope includes: Southeast Asia Data included is collected from one production site in LAEM CHABANG, Thailand, Thai Gypsum Products Pcl. Data collected for the year 2020. Background data: Ecoinvent (v3.1 2013 and 3.5 2015) and GaBi (SP37 2019)
<b>PRODUCT CPC CODE</b>	37530 Articles of plaster or of composition based on plaster

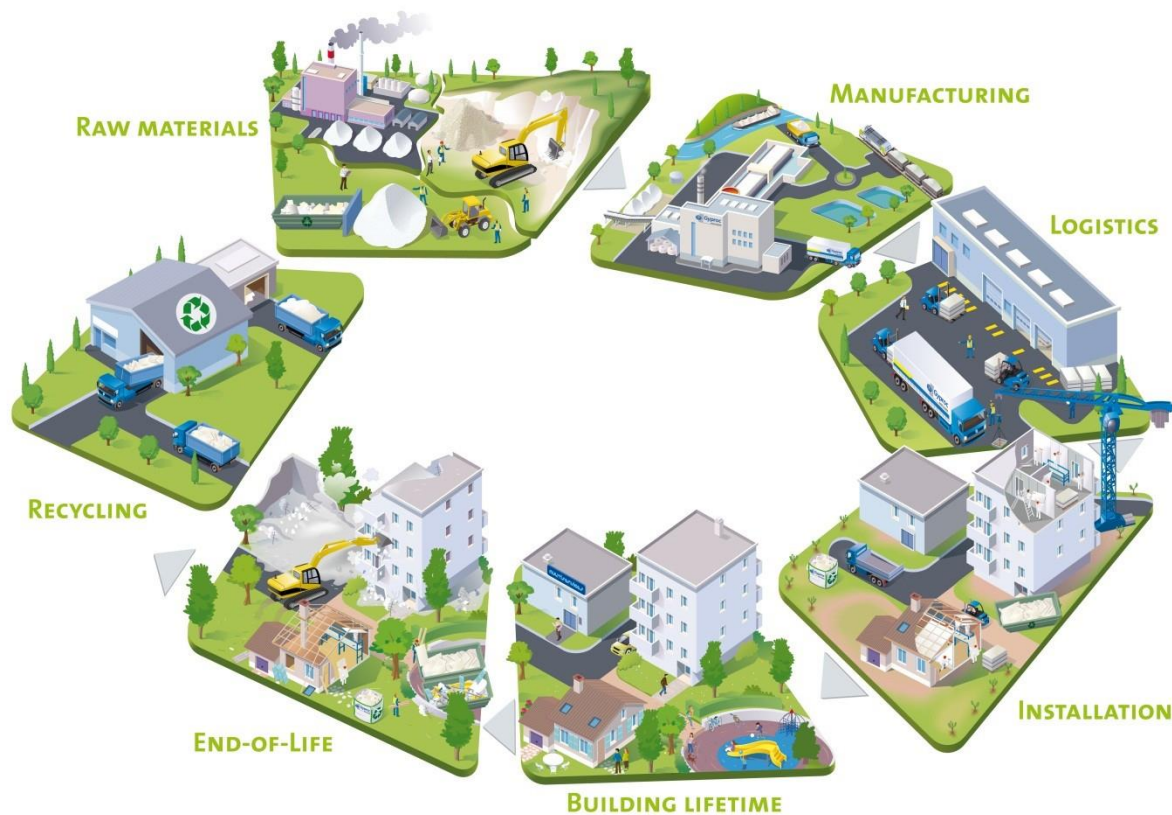
According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard.

According to ISO 21930, EPDs might not be comparable if they are from different programmes.



# Life cycle stages

## Flow diagram of the Life Cycle



### Product stage, A1-A3

Description of the stage: the product stage of plaster 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.

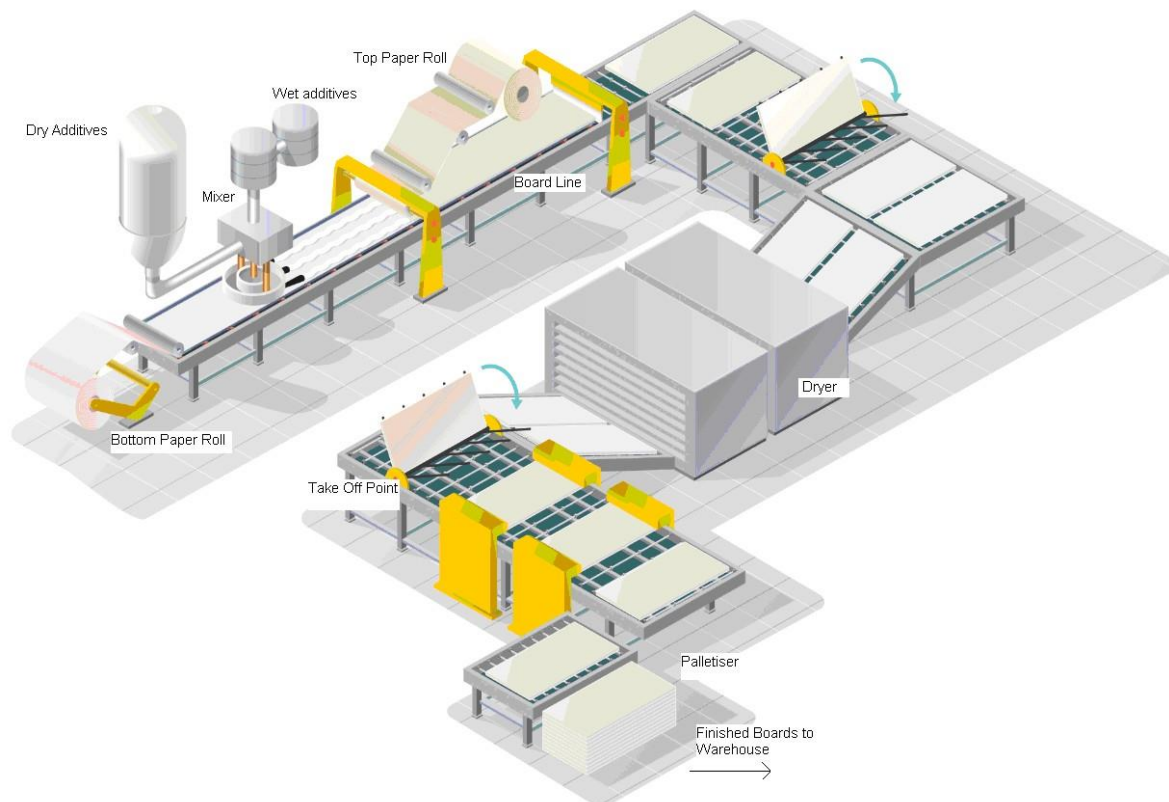
#### **A2, transport to the manufacturer.**

The raw materials are transported to the manufacturing site. The modelling includes road, boat and/or train transportations 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.

## Manufacturing process flow diagram



### Manufacturing in detail:

The initial materials are homogenously mixed to form a gypsum slurry that is spread via multiple hose outlets onto a paper liner on a moving conveyor belt. A second paper liner is fed onto the production line from above to form the plasterboard. The plasterboard continues along the production line where it is finished, dried, and cut to size.

Recycled Gypsum waste is reintegrated back into the manufacturing process wherever possible.

## 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 module 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.

PARAMETER	VALUE (expressed per functional/declared unit)
<b>Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat, etc.</b>	Truck, maximum load weight of 27 t and consumption of 0.38 liters per km Container ship ocean with 27500 t, and consumption of 109 liters per km
<b>Distance</b>	Truck: 800 km Container ship: 2000 km
<b>Capacity utilisation (including empty returns)</b>	85% for truck and 48% for container ship
<b>Bulk density of transported products</b>	856 kg/m <sup>3</sup>
<b>Volume capacity utilisation factor</b>	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.

PARAMETER	VALUE (expressed per functional/declared unit)
<b>Ancillary materials for installation (specified by materials)</b>	Jointing compound 0,33kg/m <sup>2</sup> board, tape 1,23m /m <sup>2</sup> board, screws 8 /m <sup>2</sup> board
<b>Water use</b>	0,165 litres/m <sup>2</sup> board
<b>Other resource use</b>	None
<b>Quantitative description of energy type (regional mix) and consumption during the installation process</b>	None
<b>Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)</b>	Plasterboard: 0,575 kg (5%) Screws: 0 kg Jointing Compound: 0,0165 kg Jointing Tape: 0,00021 kg Polyethylene film: 0,002 kg/m <sup>2</sup> Gypsum culls: 0,37 kg/m <sup>2</sup> Wooden culls: 0,004 kg/m <sup>2</sup> Metal strips and angle: 0,026 kg/m <sup>2</sup>
<b>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)</b>	Plasterboard: 0,575 kg to landfill Screws: 0 kg Jointing Compound: 0,0165 kg to landfill Jointing Tape: 0,00021 kg to landfill Polyethylene film: 0,002 kg to landfill Gypsum culls: 0,37 to landfill Wooden culls: 0,004 to recycling Metal strips and angle: 0,026 to landfill
<b>Direct emissions to ambient air, soil and water</b>	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:**

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.

**Maintenance:**

PARAMETER	VALUE (expressed per functional/declared unit)
Maintenance process	None required during product lifetime
Maintenance cycle	None required during product lifetime
Ancillary materials for maintenance (e.g. cleaning agent, specify materials)	None required during product lifetime
Wastage material during maintenance (specify materials)	None required during product lifetime
Net fresh water consumption during maintenance	None required during product lifetime
Energy input during maintenance (e.g. vacuum cleaning), energy carrier type, (e.g. electricity) and amount, if applicable and relevant	None required during product lifetime

**Repair:**

PARAMETER	VALUE (expressed per functional/declared unit)
Repair process	None required during product lifetime
Inspection process	None required during product lifetime
Repair cycle	None required during product lifetime
Ancillary materials (e.g. lubricant, specify materials)	None required during product lifetime
Wastage material during repair (specify materials)	None required during product lifetime
Net fresh water consumption during repair	None required during product lifetime
Energy input during repair (e.g. crane activity), energy carrier type, (e.g. electricity) and amount if applicable and relevant	None required during product lifetime

**Replacement:**

PARAMETER	VALUE (expressed per functional/declared unit)
Replacement cycle	None required during product lifetime
Energy input during replacement (e.g. crane activity), energy carrier type, (e.g. electricity) and amount if applicable and relevant	None required during product lifetime
Exchange of worn parts during the product's life cycle (e.g. zinc galvanized steel sheet), specify materials	None required during product lifetime



#### Refurbishment:

PARAMETER	VALUE (expressed per functional/declared unit)
<b>Refurbishment process</b>	None required during product lifetime
<b>Refurbishment cycle</b>	None required during product lifetime
<b>Material input for refurbishment (e.g. bricks), including ancillary materials for the refurbishment process (e.g. lubricant, specify materials)</b>	None required during product lifetime
<b>Wastage material during refurbishment (specify materials)</b>	None required during product lifetime
<b>Energy input during refurbishment (e.g. crane activity), energy carrier type, (e.g. electricity) and amount</b>	None required during product lifetime
<b>Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants)</b>	None required during product lifetime

#### Use of energy and water:

PARAMETER	VALUE (expressed per functional/declared unit)
Ancillary materials specified by material	None required during product lifetime
<b>Net fresh water consumption</b>	None required during product lifetime
<b>Type of energy carrier (e.g. electricity, natural gas, district heating)</b>	None required during product lifetime
<b>Power output of equipment</b>	None required during product lifetime
<b>Characteristic performance (e.g. energy efficiency, emissions, variation of performance with capacity utilisation etc.)</b>	None required during product lifetime
<b>Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants)</b>	None required during product lifetime

## End-of-life stage C1-C4

Description of the stage: This stage includes the next modules:

**C1**, de-construction, demolition;

**C2**, transport to waste processing;

**C3**, waste processing for reuse, recovery and/or recycling;

**C4**, disposal, including provision and all transport, provision of all materials, products and related energy and water use.

### Description of the scenarios and additional technical information for the end-of-life:

PARAMETER	VALUE (expressed per functional/declared unit)
Collection process specified by type	100% collected with mixed construction waste
Recovery system specified by type	None
Disposal specified by type	100% landfilled
Assumptions for scenario development (e.g. transportation)	On average, gypsum waste is transported 50 km to the landfill facility.

## Reuse/recovery/recycling potential, D

Description of the stage: module D has not been taken into account.

## LCA results








Description of the system boundary (X = Included in LCA, MNA = Module Not Assessed)









CML 2001 has been used as the impact model. Specific data has been supplied by the plant, and generic data come from GABI and Ecoinvent databases.

All emissions to air, water, and soil, and all materials and energy used have been included.




All figures refer to a declared unit of 1 m<sup>2</sup> installed building plasterboard with a weight 10.7 kg/m<sup>2</sup>, a specified function and an expected average service life of 50 years.





PRODUCT STAGE			CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-recovery
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MNA

ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 Global Warming Potential (GWP 100) - <i>kg CO<sub>2</sub> equiv/FU</i>	4,1E+00	1,3E+00	3,0E-01	0	0	0	0	0	0	0	5,1E-02	2,8E-02	0	1,8E-01	MNA
The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.															
 Ozone Depletion (ODP) <i>kg CFC 11 equiv/FU</i>	4,1E-08	1,9E-16	2,0E-09	0	0	0	0	0	0	0	6,9E-18	6,9E-18	0	1,0E-15	MNA
Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life, This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules,															
 Acidification potential (AP) <i>kg SO<sub>2</sub> equiv/FU</i>	1,4E-02	1,4E-02	9,9E-04	0	0	0	0	0	0	0	1,8E-04	1,1E-04	0	1,0E-03	MNA
Acid depositions have negative impacts on natural ecosystems and the man-made environment incl, buildings, The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport,															
 Eutrophication potential (EP) <i>kg (PO<sub>4</sub>)<sup>3-</sup> equiv/FU</i>	1,7E-03	2,0E-03	1,3E-04	0	0	0	0	0	0	0	1,0E-05	2,9E-05	0	1,2E-04	MNA
Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects,															
 Photochemical ozone creation (POPC) <i>kg Ethylene equiv/FU</i>	3,2E-04	6,6E-04	8,9E-05	0	0	0	0	0	0	0	1,2E-05	4,6E-06	0	8,5E-05	MNA
Chemical reactions brought about by the light energy of the sun, The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.															
 Abiotic depletion potential for non-fossil resources (ADP-elements) - <i>kg Sb equiv/FU</i>	6,6E-05	1,5E-08	6,9E-06	0	0	0	0	0	0	0	1,3E-09	2,4E-09	0	6,2E-08	MNA
 Abiotic depletion potential for fossil resources (ADP-fossil fuels) - <i>MJ/FU</i>	6,3E+01	1,7E+01	4,1E+00	0	0	0	0	0	0	0	6,4E-01	3,8E-01	0	2,4E+00	MNA
Consumption of non-renewable resources, thereby lowering their availability for future generations.															

RESOURCE USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 Use of renewable primary energy excluding renewable primary energy resources used as raw materials <i>MJ/FU</i>	4,98E+00	3,1E-01	1,4E+00	0	0	0	0	0	0	0	2,1E-03	2,2E-02	0	3,2E-01	MNA
 Use of renewable primary energy used as raw materials <i>MJ/FU</i>	3,11E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) <i>MJ/FU</i>	8,09E+00	3,1E-01	1,4E+00	0	0	0	0	0	0	0	2,1E-03	2,2E-02	0	3,2E-01	MNA
 Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - <i>MJ/FU</i>	6,51E+01	1,7E+01	4,3E+00	0	0	0	0	0	0	0	6,4E-01	3,8E-01	0	2,5E+00	MNA
 Use of non-renewable primary energy used as raw materials <i>MJ/FU</i>	1,21E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - <i>MJ/FU</i>	6,63E+01	1,7E+01	4,3E+00	0	0	0	0	0	0	0	6,4E-01	3,8E-01	0	2,5E+00	MNA
 Use of secondary material <i>kg/FU</i>	3,99E-01	0	2,8E-02	0	0	0	0	0	0	0	0	0	0	0	MNA
 Use of renewable secondary fuels - <i>MJ/FU</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
 Use of non-renewable secondary fuels - <i>MJ/FU</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
 Use of net fresh water - <i>m³/FU</i>	1,67E-02	1,2E-04	1,1E-03	0	0	0	0	0	0	0	3,8E-06	3,8E-05	0	6,3E-04	MNA



WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 Hazardous waste disposed <i>kg/FU</i>	5,9E-08	4,8E-08	1,9E-08	0	0	0	0	0	0	0	7,8E-11	2,1E-08	0	4,3E-08	5,9E-08
 Non-hazardous (excluding inert) waste disposed <i>kg/FU</i>	1,9E-01	1,9E-04	1,3E+00	0	0	0	0	0	0	0	9,4E-05	3,2E-05	0	1,2E+01	1,9E-01
 Radioactive waste disposed <i>kg/FU</i>	6,7E-04	2,0E-05	6,7E-05	0	0	0	0	0	0	0	7,9E-07	7,7E-07	0	3,3E-05	6,7E-04

OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
 Components for re-use <i>kg/FU</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
 Materials for recycling <i>kg/FU</i>	1,5E-02	0	5,0E-03	0	0	0	0	0	0	0	0	0	0	0	MNA
 Materials for energy recovery <i>kg/FU</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA
 Exported energy, detailed by energy carrier <i>MJ/FU</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MNA

## LCA results interpretation

The following figure refers to a declared unit of 1 m<sup>2</sup> installed building plasterboard with a weight 10,7 kg/m<sup>2</sup>, a specified function and an expected average service life of 50 years.



[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<sub>2</sub> 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 70% 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 plasterboard so we would expect the production modules to contribute the most to this impact category.

### **Water Consumption**

Water is used within the manufacturing facility and therefore we see the highest contribution in the production phase. However, we recycle a lot of the water on site so the contribution is still relatively low. The second highest contribution occurs in the installation site due to the water used on the joint components.

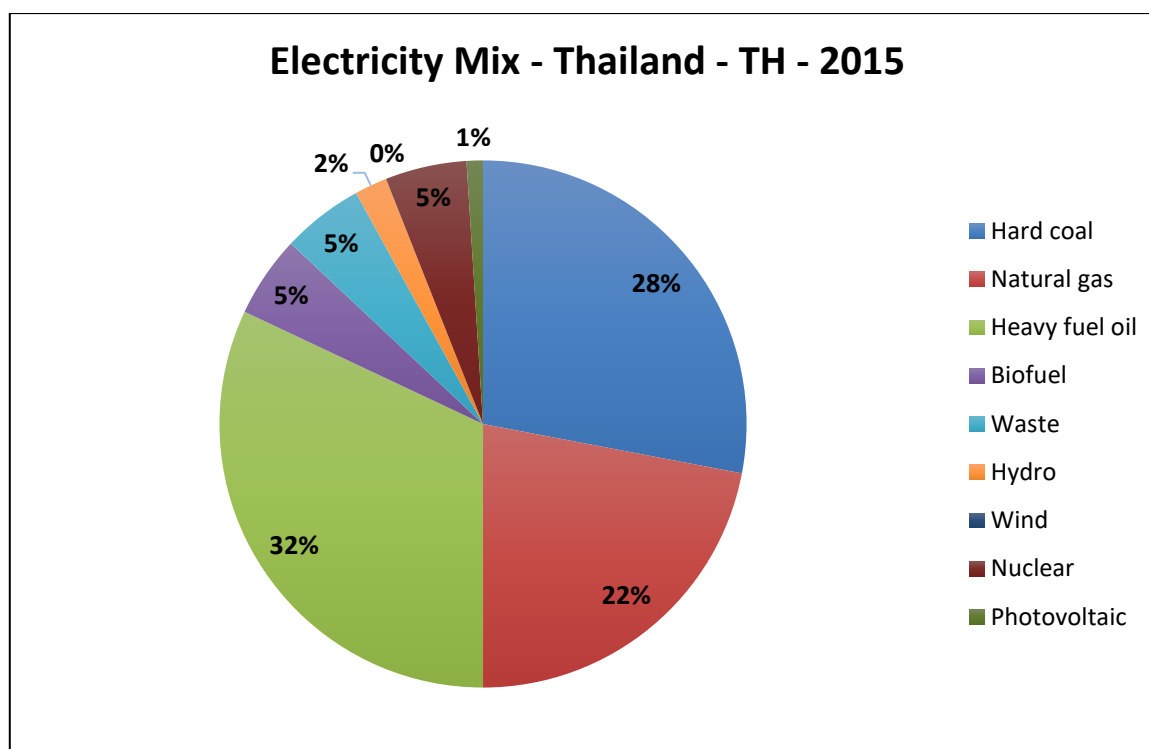
### **Waste Production**

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 100% of the product is assumed here to be sent to landfill once it reaches the end of life state. 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 Thailand (2015)
Geographical representativeness description	<b>Split of energy sources in Thailand</b> <ul style="list-style-type: none"> <li>- Hard coal: 28%</li> <li>- Natural gas: 22%</li> <li>- Heavy fuel oil: 32%</li> <li>- Biofuel: 5%</li> <li>- Waste: 5%</li> <li>- Hydro: 2%</li> <li>- Wind: 0%</li> <li>- Nuclear: 5%</li> <li>- Photovoltaic: 1%</li> </ul>
Reference year	2015
Type of data set	Cradle to gate
Source	Source: IEA World Energy Balances 2017 – <a href="https://webstore.iea.org/world-energy-balances-2017">https://webstore.iea.org/world-energy-balances-2017</a>



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