BAUMIT Pro

External Thermal Insulation Composite System (ETICS)
by BAUMIT Bulgaria EOOD

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1. General Information

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This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025. It contains information about the impact of declared construction materials on environment and their aspects verified by the independent Advisory Board 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.

Life Cycle analysis (LCA): Modules A1-A3, C1-C4 and Module D in accordance with EN 15804 (Cradle to Gate with options)

Declared durability: 50 years under normal conditions of use

Product standard: ETAG 004

PCR: ITB-EPD General PCR v1.4/2014

Representativeness: BG, RER, GLO

Declared unit: 1 m^2 External thermal insulation composite system (ETICS)

LCA scope: Product stage (modules A1-A3), End-of-life stage (C1-C4) and Benefits and loads beyond the system boundary (module D)

Year of preparing the characteristic: 2021

2. Product Description

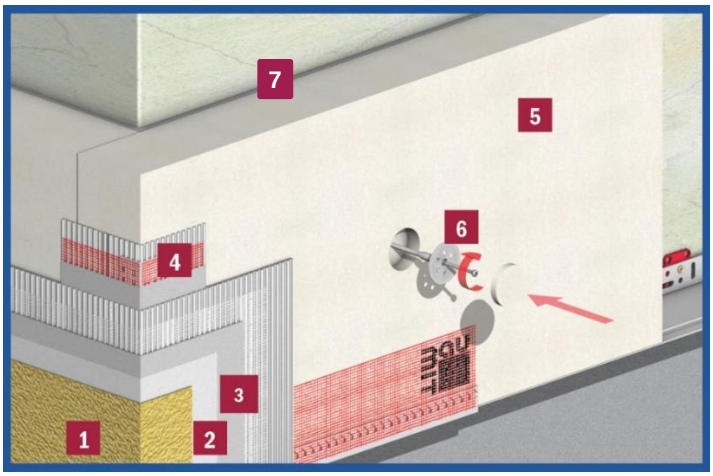
Baumit Pro is a trade name for an EPS-based External Thermal Insulation Composite System (ETICS) put on the market by BAUMIT Bulgaria EOOD. Baumit Pro system is intended for façade protection and design solution both in new buildings and in renovation projects. The following components are included in the ETICS (Table 1).

The ETICS is declared with three options for the render differing by the active binder compound: GranoporTop, SilikonTop and SilikatTop.

Table 1: Components of ETICS Baumit Pro

Component	Functionality	Quantity per 1 m²	
		kg per 1 m²	%
Bonding (adhesive) mortar:	Baumit ProContact – for bonding the insulation with the substrate	5.00	39.86%
Insulation layer:	Expanded polystyrene (EPS) boards with thickness of 10 cm	1.50	11.96%
Coating (base coat render):	Baumit ProContact – coating of the insulation	3.00	23.91%
Reinforcing layer:	Glass fibre mesh Baumit StarTex 145 – reinforcement of the coating	0.145	1.16%
Mechanical fixings:	Dowels for fixing of ETICS to concrete substrate	0.20	1.98%
Primer:	Priming layer Baumit UniPrimer for preparation of cementitious coating before laying the Render	0.20	1.59%
Render:	GranoporTop / SilikonTop / SilikatTop	2.50	19.93%
	Total mass of the ETICS per 1 m²:	12.545	

Figure 1 presents a scheme of the layers/components of the hereby certified external thermal insulation composite system.



1 – Render (GranoporTop/ SiliconTop/SilicatTop);

2 – Primer: Baumit UniPrimer;

3 – Base coat render: Baumit ProContact;

4 – Reinforcing layer Baumit StarTex 145;

5 – Insulation layer: EPS;

6 – Fixings (with plastic or steel nails)

7 – Bonding (adhesive) mortar: Baumit ProContact

Figure 1: Product scheme of Baumit Pro ETICS (*Source:* https://baumit.bg/statii/etics/izolacia-pro)

3. Description of Components

3.1 Bonding (adhesive) mortar and base coat render – BAUMIT ProContact

BAUMIT ProContact is a factory-made cement-based dry mix adhesive mortar for manual and machine application, for integration in thermal insulation systems complying with ETAG 004. It is flexible, weather-resistant, suitable for use outdoors and indoors. It consists of Portland cement, organic binders, sand and additives. BAUMIT ProContact mixed with water provides a paste with appropriate consistency that is applied in two layers: on the substrate as a bonding mortar and as a base coat render under the finishing render of the ETICS. The dry mix mortar is packed in paper bags with mass 25 kg. Table 2 describes the essential characteristics of BAUMIT ProContact.

Table 2: Technical characteristics of Baumacol ProContact

Characteristics	Value/Class	Units	Technical specification
Grain size	< 0.6	mm	ETAG 004
Density (dry)	1540	kg/m^3	ETAG 004
Thermal conductivity λ_n	0.8	W/mK	ETAG 004
Water vapour resistance, μ	≈ 30	-	ETAG 004
S_d-value	≈ 0.09	m (for 3 mm layer)	ETAG 004
Minimal layer thickness	≥ 2	mm	ETAG 004
Water demand	≈ 4.5-6	litres per bag	ETAG 004
Consumption rate	≈ 4.0-5.0 ≈ 3.5-4.5	kg/m^2 (as bonding mortar) kg/m^2 (as plastering mortar)	ETAG 004

3.2 Thermal insulation – BAUMIT ProTherm

BAUMIT ProTherm are factory-made white EPS slabs of type EPS-F, resistant to ageing, non-shrinkable, difficult to burn. The product consists of expanded polystyrene. ProTherm is classified as EPS-F, in compliance with ÖNORM B 6000. BAIMIT ProTherm slabs are packed in packs of 5 slabs with unit area 0.5 m2 (100x50 cm) and a total area per pack – 2.5 m^2. A referent thickness of 10 cm is assumed for EPS in the the ETICS system under study. Table 3 lists the essential characteristics of the thermal insulation material.

Table 3: Technical characteristics of BAUMIT ProTherm

Characteristics	Value/Class	Units	Technical specification
Density	15-18	kg/m^3	EN 13163, EN13162/NA
Tensile strength perpendicular to slab	≥ 150	kPa	EN 13163, EN13162/NA
Thermal conductivity, $\lambda_{10,dry}$	≤0.035	W/mK	EN 13163, EN13162/NA
Water vapour resistance, μ	30-70	-	EN 13163, EN13162/NA
Flammability	Class E		EN 13501-1

3.3 Primer – BAUMIT UniPrimer

BAUMIT UniPrimer is a factory-made universal primer. It represents a suspension of water, organic binders containing silicon resins, mineral filler and other additives to achieve the required cohesion, consistence, flexibility and other properties. BAIMIT UniPrimer is packed as a liquid mix in buckets with unit mass 25 kg. The essential characteristics of the primer are described in Table 4.

Table 4: Technical characteristics of BAUMIT UniPrimer

Characteristics	Value/Class	Units	Technical specification
Density	≈ 1.65	kg/dm^3	–
Grain size	0.5	mm	–
Colour	White		–
Consumption rate	≈ 0.2-0.25 ≈ 0.4	kg/m^2 (on renderings) kg/m^2 (on plasterings)	–

Render

The ETICS under study can be constructed using three render types: GranoporTop, SilikonTop or SilikatTop. All renders are factory-made, ready-to-use, paste-like thin-layer renders that form the finishing layer with scratched and dragged texture. All renders are resistant to atmospheric conditions, highly water-repellent, vapour permeable and washable render. GranoporTop consists of organic binders, two fractions of fine crushed sand, pigments, additives and water. SilikonTop consists of silicone resin and organic binders, two fractions of fine crushed sand, pigments, additives and water. SilikatTop consists of mineral binders on the basis of potassium water glass (silicate), two fractions of fine crushed sand, pigments, additives and water.

All products are manufactured in compliance with EN 15824:2009. The renders are packed as pasty substances in plastic buckets of unit mass 25 kg. Below are listed the essential characteristics of the renders - Table 5.

Table 5: Technical characteristics of BAUMIT renders GranoporTop, SilikonTop and SilikatTop

Characteristics	Value/Class			Units	Technical specification
	GranoporTop	SilikonTop	SilikatTop		
Grain size	≤ 3,0	≤ 3,0	≤ 3,0	mm	EN 15284
Density	≈ 1.8	≈ 1.8	≈ 1.8	kg/dm^3	EN 15284
Thermal conductivity, λ_n	≈ 0.7	≈ 0.7	≈ 0.7	W/mK	EN 15284
Water vapour resistance, μ	≈ 110-140	≈ 60-80	≈ 30-50		EN 15284
S_D value	0.22-0.28	0.12-0.16	0.06-0.10	m (for thickness of 1 mm)	EN 15284
Water absorption, w	< 0.1	< 0.1	< 0.1	$kg/m^2.h^{0.5}$	EN 15284
Consumption rate	≈ 2.5-3.9	≈ 2.5-3.9	≈ 2.5-3.9	kg/m^2	EN 15284

3.4 Reinforcing layer – BAUMIT StarTex 145

BAUMIT StarTex 145 is alkali-resistant, glass-fibre textile mesh for use in ETICS systems. BAUMIT StarTex 145 is manufactured in compliance with ETAG 004. The product is packed in rolls with a length of 50 linear meters. Table 6 provides data on the essential characteristics of the mesh.

Table 6: Technical characteristics of BAUMIT StarTex 145 glassfibre mesh

Characteristics	Value/Class	Units	Technical specification
Mesh size	4 x 4	mm	ETAG 004
Mass per unit	≈ 145	g/m^2	ETAG 004
Tensile strength	≥ 2000	N/50 mm	ETAG 004
Tensile strength after aging	≥ 1000	N/50 mm	ETAG 004
Consumption rate	≈ 1.1	m/m^2	ETAG 004

3.5 Mechanical fixings (dowels)

The dowels are used to fix the thermal insulation of EPS slabs to the substrate. The fixings are suitable for use on concrete, dense masonry units, masonry units with vertical holes and aerated concrete. BAUMIT offers several types of dowels:

- Baumit Dübel HA –dowel casing of high-density polyethylene and polyamide needle;
- Baumit Dübel FIF-PN8 – dowel casing of polypropylene and polyamide needle;
- Baumit Dübel CN – dowel casing of polypropylene and steel needle
- Baumit Dübel SD X8 – dowel casing of polypropylene and polyethylene needle;
- Baumit STR U – dowel casing of polyethylene and steel needle.

Bamit Dübel HA is the most used (with a share of about 80%) type and it is used as a reference dowel in the LCA model. The dowels are packed in paper boxes of 200 items.

4. LCA Information

FUNCTIONAL UNIT	1 m^2 of ETICS
SYSTEM BOUNDARIES	Cradle to Gate + options: Modules A1-A3, C1-C4 and Module D
DECLARED DURABILITY	50 years under normal conditions of use
CUT-OFF CRITERIA	As per EN 15804, in the case that there is not enough information, the process energy and materials representing less than 1% of the energy and mass used per module can be excluded (if they do not cause significant impacts). The addition of all the inputs and outputs excluded is less than 5% of the whole mass and energy used, as well of the emissions to environment occurred. Flows related to human activities such as employee transport are excluded. In accordance with EN 15804 the construction of plants, production of machines and transportation systems are excluded. Environmental burden of the administrative building is partly considered. Some additives in very small amounts are excluded due to lack of enough data and negligible potential environmental impacts. The total sum of omitted processes does not exceed 1% of the whole mass of inputs and outputs.
ASSUMPTIONS AND LIMITATIONS	Generic data from ecoinvent v.3.6 database is used to model the ETICS components that are delivered by external suppliers and the manufacturer does not have influence on their production processes. Packaging materials and packaging waste are considered in the assessment of all components of the ETICS.
GEOGRAPHICAL COVERAGE AND TIME PERIOD	All data related to the bonding and coating mortar, primer and renders is collected from BAUMIT Bulgaria EOOD and represents the manufacturing process in 2018.

Assessment of transport of all components covers all used transport types, external and internal transport activities.

DATA QUALITY The information on the production process of the bonding and coating mortar, primer and renders is collected from BAUMIT Bulgaria EOOD.

Information on the transport and composition of components is provided by BAUMIT Bulgaria EOOD.

Information on the production process of additives and other relevant pre-products is accounted as presented in ecoinvent v.3.6 database.

ALLOCATION The factory of BAUMIT Bulgaria EOOD in Elin Pelin produces various construction products for external and internal finishing layers of buildings. The manufacturing processes for the renders and the primer are equivalent with slight variance in terms of working regime of mixing stations. The bonding and coating mortar is produced on a separate production line.

Allocation is done regarding energy and fuel use, and generated waste. Environmental impacts, resource use and waste generation are calculated based on yearly data about the inputs/outputs and the yearly production of lime-cement plasters for 2018.

5. Manufacturing process

5.1. Manufacturing of bonding and coating mortar Baumit ProContact

The received fraction of crushed stone is 20/60 mm and it is dried in an oven, if necessary. This fraction is then crushed in a coarse crusher and subsequently sieved into seven smaller fractions. The smaller fractions are fed into pipelines and then carried to silos. The other ingredients - cement, hydrated lime and additives, are delivered as dry substances. Cement, hydrated lime and expanded perlite in KlimaWhite are delivered in mobile (transportable silos) and are discharged into the factory silos (in the factory tower) through pneumatic compressed air pipe system. Expanded perlite is delivered in ready-to-use status and no additional processing is done.

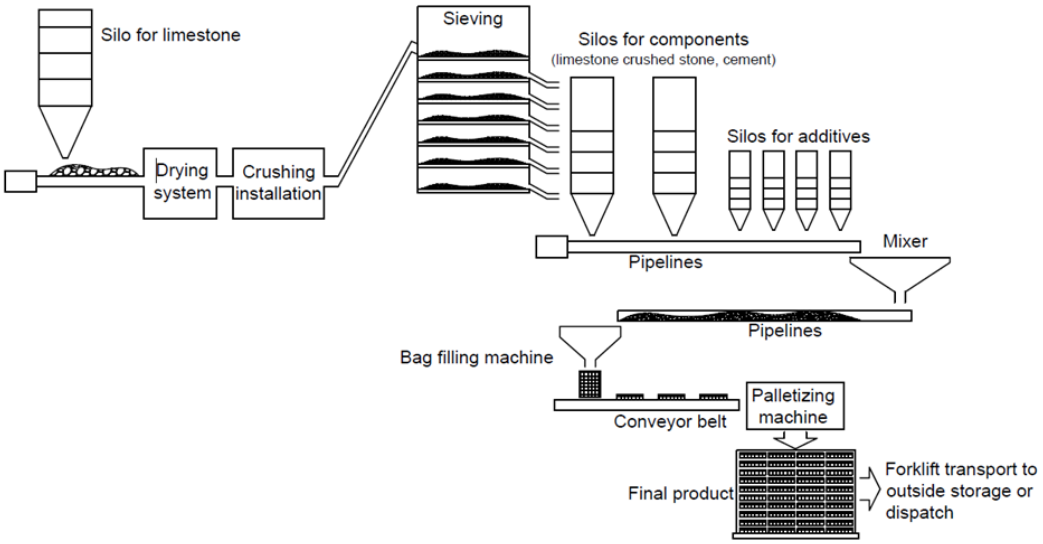


Figure 2: Production process of Baumit ProContant (bonding and coating mortar)

The additives are delivered in paper bags or big bags and are also discharged into smaller silos in the factory tower.

After the predefined quantity of each material is set, the materials are dosed and released on gravity pipelines that take them to a mixing facility. The ready mix is then transported to a machine for bag-filling. All products are packed in paper bags with mass 25 kg. The sealed bags are transported to the palletizing station through conveying belt. The bags are arranged on the pallets and covered by elastic polyethylene film. The pallets are transported by forklifts to an outside storage space.

5.2. Manufacturing of primer Baumit UniPrimer

The primer (UniPrimer) consists of fine quartz sand (grain size <0.5 mm), binder, water and additional substances (additives) to control the behaviour and improve the properties.

The production process of Baumit UniPrimer includes the processes of delivery, unloading and storing of the components, received as pre-products, their dozing and mixing, packaging (in buckets), palletizing and storage in conditioned area. Baumit UniPrimer is packed as a liquid mixture in buckets with unit mass 25kg.

The water, binder and most additives of the UniPrimer are dosed directly in a mixing drum. Some additives which are in a very small amount are dosed on scales with a greater precision, before being placed in the mixture. The drum then is placed under an electrical propeller mixer where the sandy fractions are added. When the mixing is done, the drum is lifted over a roller conveyor belt to allow discharging of the primer into buckets of 25 kg each. The buckets are closed by plastic covers and then transported to the palletizing station through conveying belt. The buckets are arranged on the pallets and covered by elastic polyethylene film. The pallets with renders are transported by forklifts to a tempered storage area where the temperature during the winter period is maintained by a gas heating to at least +5°C. Figure 3 illustrates this process.

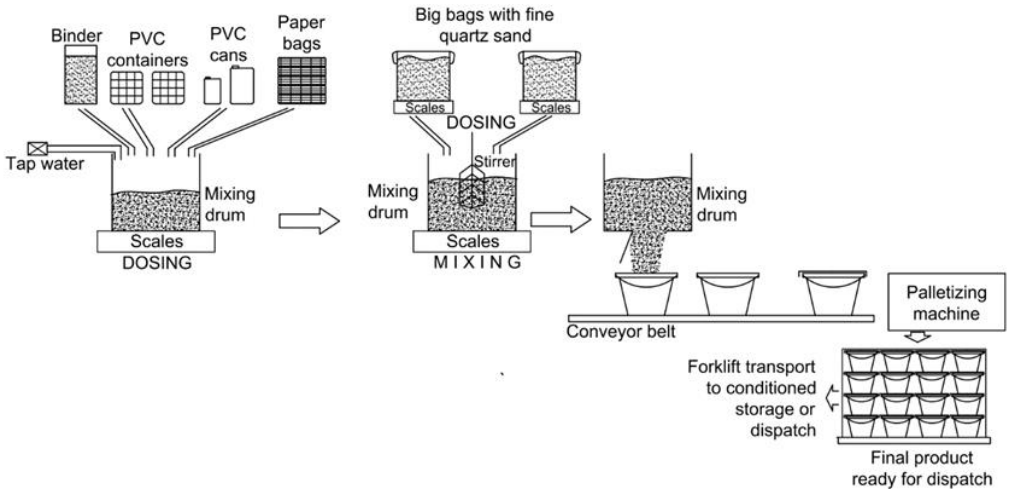


Figure 3: Typical production process of Baumit UniPrimer

5.3. Manufacturing of render GranoporTop, SilikonTop, SilikatTop

The Baumit renders - GranoporTop, SiliconTop and SilikatTop are dense suspensions of a complex mixture, called compound, whose base differs as a chemistry (acrylic for GranoporTop, silicone for SiliconTop and silicate for SilikatTop), two types of crushed stone fine sand, water, de-foaming agent and vary small amount of pigments. The production process is the same for all renders and includes the processes of

delivery, unloading and storing of the components, received as pre-products, their dozing and mixing, packaging (in buckets), palletizing and storage in conditioned area. Baumit renders are packed as liquid mixtures in buckets with unit mass 25 kg.

The compound is dosed by a balance, directly in the mixing drum. Then the de-foaming agent and mixing water are dosed and added. Figure 4 illustrates the typical process of Baumit Renders (GranoporTop, SiliconTop, SilikatTop) manufacturing.

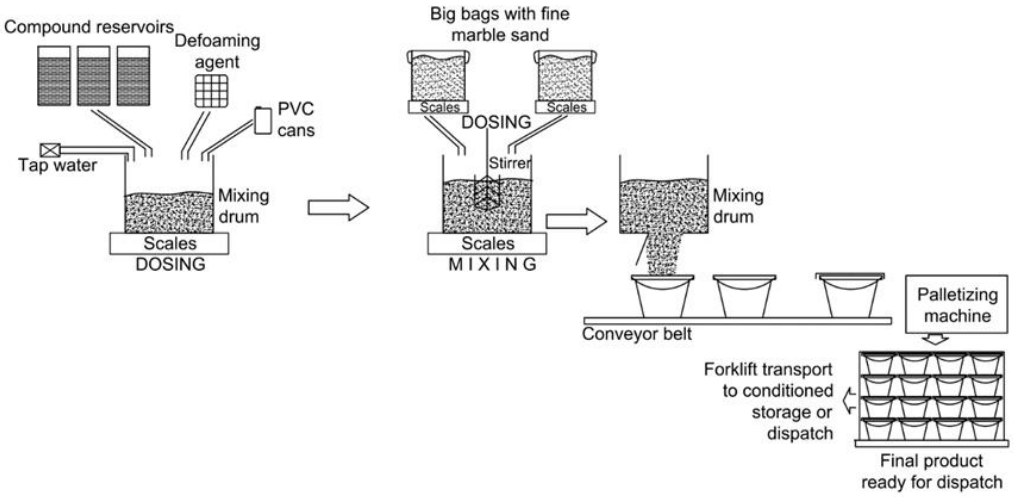


Figure 4: Typical production process of the renders (GranoporTop/SilikonTop/SilikatTop)

The drum is placed under an electrical propeller mixer where the sandy fractions are added. When the mixing is done, the drum is lifted over a roller conveyor belt to allow discharging of the render into buckets of 25 kg each. The buckets are closed by plastic covers. The closed buckets are transported to the palletizing station through conveying belt. The buckets are arranged on the pallets and covered by elastic polyethylene film. The pallets with renders are transported by forklifts to a tempered storage area where the temperature during the winter period is maintained by a gaz heating to at least +5°C.

6. System boundaries

Module A1: Raw materials supply and transport
Module A1 describes the acquisition of raw materials and manufacturing of pre-products. The production processes of the limestone crushed stone, Portland cement, hydrated lime, expanded perlite and additives are considered using referent data for the ecoinvent database. Production of packaging materials is also considered using referent data from the ecoinvent database.

Module A2: Transport of raw materials to the production site
The transport to the factory of all ingredients, components and packaging materials is considered using real data from the manufacturer.

Module A3: Manufacturing
This module includes the actual production process: This includes the process of crushing, drying, sieving, dosing, packaging and palletizing. Energy, water and fuel consumption are considered in full based on 1-year consumption data provided by the manufacturer.

Module C1: Deconstruction/Demolition of the building
Module C1 describes processing of ETICS during the deconstruction/demolition as part of the deconstruction/demolition process of the entire building.

Data is assembled based on the developed scenario, considering the processing of removal/demolition of ETICS in the context of the whole demolition of the building. The following scenario is developed, based on existing practices in Bulgaria in regards with the construction and demolition waste (C&DW) management and the requirements of the national legislation (WMA, 2012 and Ordinance on C&DW management, 2012 and 2017) for selective demolition, separate collection of C&DW and material recovery degree for some C&DW, such as concrete and bricks. Thus, the ETICS shall be removed prior to the demolition of the substrate walls.

In Bulgaria there are no energy recovery operations, no chemical recycling of EPS, either, so the ETICS are not disassembled and are removed as a whole, forming C&DW of code 17 09 04 as per the European waste catalogue (EWC). The removal is done by a long boom excavator equipped by a suitable bucket for peeling off/scratching the ETICS from the substrate wall.

Module C2: Transport to waste treatment facility
Module C2 refers to the transport of the ETICS C&DW to a landfill for waste disposal. Data is assembled based on developed scenario.

The following assumptions are made to calculate the impacts of this module:

Table 7: Information on assumed processing for module C2

Parameter	Data
Waste code	170904
Bulk density of waste	80 kg/m^3
Treatment type	Disposal operation D01
Collection of waste by	Loader with bucket capacity 3,6 m3, tipping load 13.7 tons, operating weight 18.4 tons, Euro IV emissions class, rated power 165 кW / 224HP.
Transport of waste by	Lorry of the size class 7.5-16 tons, Euro IV emissions class.
Distance of transportation	25 km

Module C3: Waste processing
Module C3 accounts for the environmental impacts during the processing of ETICS C&DW. No recovery or further treatment of that waste is foreseen. The impact of this module is assumed as zero.

Module C4: Disposal
Module C4 should consider the effects from ETICS containing C&DW that is disposed.

At the landfill, the waste is unloaded from the lorry (module C2) at a dedicated place. No additional treatment is applied.

Module D: Benefits and loads beyond the system boundary
Module D regards the effects and impact of the secondary material derived from recycling of C&DW.

Since the ETICS waste is not a subject of any recovery operations, the impacts of this module are assumed as zero.

7. LCA Results

Declared unit

The declaration refers to 1 m^2 of ETICS BAUMIT Pro.

Table 8: Description of the system boundary

Environmental assessment information (☒ – Included in LCA, MNA – Module not assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction – assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse- Recovery- Recycling potential
☒	☒	☒	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	☒	☒	☒	☒	☒

The following tables provide the LCA results on the evaluated environmental categories. A list of the used abbreviations is given below:

GWP-total	Global warming potential total (sum of GWP-fossil, GWP-biogenic and GWP-luluc)
GWP-fossil	Global warming potential fossil fuels
GWP-biogenic	Global warming potential biogenic
GWP-luluc	Global warming potential land use and land use change
ODP	Ozone depletion potential
AP	Acidification potential
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
EP-marine	Eutrophication potential, fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential, Accumulated Exceedance
POCP	Photochemical ozone creation potential
ADP-minerals & metals	Abiotic depletion potential for non-fossil resources
ADP-fossil fuels	Abiotic depletion potential of fossil resources
RPER	Renewable primary energy resources
NRPER	Non-renewable primary energy resources
ETP-fw	Eco-toxilcity freshwater (Potential Comparative Toxic Unit for ecosystems)
HTP-c	Human toxicity, cancer effects (Potential Comparative Toxic Unit for humans)
HTP-nc	Human toxicity, non-cancer effects (Potential Comparative Toxic Unit for humans)
IRP	Ionizing radiation, human health (Potential Human exposure efficiency relative to U-235)
SQP	Soil quality (Potential soil quality index)
PM	Particulate Matter emissions (Potential incidence of disease due to PM emissions)

Table 9: Environmental information about 1m^2 ETICS Baumit Pro with GranoporTop render, EPS - 10 cm

Environmental impacts for 1m² ETICS Baumit Pro (GranoporTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO_2–eq.	1.01E+01	4.85E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-fossil	kg CO_2–eq.	1.01E+01	4.85E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-biogenic	kg CO_2–eq.	6.31E-02	0.00E+00	2.31E-04	1.64E-06	0.00E+00	0.00E+00	4.09E-07	0.00E+00
GWP-luluc	kg CO_2–eq.	3.80E-05	4.02E-06	2.95E-05	5.64E-08	2.36E-06	0.00E+00	1.41E-08	0.00E+00
ODP	kg CFC 11–eq.	3.26E-07	1.10E-07	1.81E-06	5.19E-09	4.41E-08	0.00E+00	1.30E-09	0.00E+00
AP	mol H^+–eq.	3.82E-02	1.33E-03	2.17E-03	4.11E-05	5.10E-04	0.00E+00	1.03E-05	0.00E+00
EP-freshwater	kg PO_4–eq.	1.43E-03	3.74E-05	8.57E-02	8.72E-07	2.14E-05	0.00E+00	2.18E-07	0.00E+00
EP-marine	kg N–eq.	6.52E-03	2.60E-04	3.98E-02	5.52E-06	7.05E-05	0.00E+00	1.38E-06	0.00E+00
EP-terrestrial	mol N–eq.	6.93E-02	2.79E-03	2.39E-01	5.91E-05	7.40E-04	0.00E+00	1.48E-05	0.00E+00
POCP	kg NMVOC–eq.	4.36E-02	1.09E-03	7.06E-02	4.22E-05	3.50E-04	0.00E+00	1.05E-05	0.00E+00
ADP-minerals&metals	kg Sb–eq.	9.60E-05	1.32E-05	1.10E-04	3.67E-08	9.85E-06	0.00E+00	9.18E-09	0.00E+00
ADP-fossil	MJ	1.99E+02	7.28E+00	5.98E+02	3.27E-01	3.01E+00	0.00E+00	8.16E-02	0.00E+00
WDP	m^3	2.74E+02	6.21E+00	8.39E+03	7.01E-02	4.62E+00	0.00E+00	1.75E-02	0.00E+00

Additional environmental impacts for 1m² ETICS Baumit Pro (GranoporTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	1.02E+00	2.44E-01	1.96E+00	2.20E-03	7.10E-02	0.00E+00	5.50E-04	0.00E+00
HTP-c	CTUh	2.28E-09	1.52E-10	1.18E-08	3.04E-11	9.35E-11	0.00E+00	7.59E-12	0.00E+00
HTP-nc	CTUh	1.45E-07	9.61E-09	2.26E-06	1.70E-10	5.01E-09	0.00E+00	4.25E-11	0.00E+00
IRP	kBq U-235-eq.	5.41E-01	3.72E-02	1.86E+01	1.50E-03	1.68E-02	0.00E+00	3.80E-04	0.00E+00
SQP	-	3.70E+01	7.63E+00	3.87E+01	1.69E-02	2.04E+00	0.00E+00	4.22E-03	0.00E+00
PM	Disease incidence	3.22E-07	3.28E-08	4.33E-07	2.40E-09	1.05E-08	0.00E+00	5.99E-10	0.00E+00

Resource use for 1m² ETICS Baumit Pro (GranoporTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	5.19E+00	1.01E-01	4.59E+01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
RPER used as raw materials	MJ	8.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	6.03E+00	1.01E-01	4.59E+01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	2.14E+02	7.42E+00	9.25E+02	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
NRPER used as raw materials	MJ	6.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.15E+02	7.42E+00	9.25E+02	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
Use of secondary material	kg	3.00E-02	2.98E-03	6.64E-02	1.60E-04	1.89E-03	0.00E+00	4.06E-05	0.00E+00
Use of renewable secondary fuels	MJ	2.62E-01	3.35E-03	1.87E+00	4.40E-05	2.32E-03	0.00E+00	1.10E-05	0.00E+00
Use of non-renewable secondary fuels	MJ	6.63E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.60E-04	0.00E+00
Net use of fresh water	m^3	1.43E-01	5.07E-04	3.75E-01	9.09E-06	3.20E-04	0.00E+00	2.27E-06	0.00E+00

Output flows and waste categories for 1m² ETICS Baumit Pro (GranoporTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.39E-01	7.93E-03	4.93E-01	3.60E-04	4.33E-03	0.00E+00	8.90E-05	0.00E+00
Non-hazardous waste disposed	kg	6.15E+00	5.35E-01	5.90E-03	3.80E-03	1.86E-01	0.00E+00	9.50E-04	0.00E+00
Radioactive waste disposed	kg	1.92E-04	5.02E-05	4.62E-03	2.32E-06	2.04E-05	0.00E+00	5.80E-07	0.00E+00
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	2.01E-02	2.47E-03	2.06E-01	1.60E-04	1.53E-03	0.00E+00	3.99E-05	0.00E+00
Materials for energy recovery	kg	2.67E-03	3.78E-05	1.84E-02	4.94E-07	2.58E-05	0.00E+00	1.24E-07	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	5.00E-03
Biogenic carbon content in accompanying packaging	kg C	1.10E+00

Table 10: Environmental information about 1m^2 ETICS Baumit Pro with SilikonTop render, EPS - 10 cm

Environmental impacts for 1m² ETICS Baumit Pro (SilikonTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO_2–eq.	1.06E+01	4.85E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-fossil	kg CO_2–eq.	1.05E+01	4.85E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-biogenic	kg CO_2–eq.	3.57E-02	0.00E+00	2.31E-04	1.64E-06	0.00E+00	0.00E+00	4.09E-07	0.00E+00
GWP-luluc	kg CO_2–eq.	5.78E-05	4.02E-06	2.35E-07	5.64E-08	2.36E-06	0.00E+00	1.41E-08	0.00E+00
ODP	kg CFC 11–eq.	7.21E-07	1.10E-07	1.45E-08	5.19E-09	4.41E-08	0.00E+00	1.30E-09	0.00E+00
AP	mol H^+–eq.	4.05E-02	1.33E-03	2.17E-03	4.11E-05	5.10E-04	0.00E+00	1.03E-05	0.00E+00
EP-freshwater	kg PO_4–eq.	1.56E-03	3.74E-05	6.88E-04	8.72E-07	2.14E-05	0.00E+00	2.18E-07	0.00E+00
EP-marine	kg N–eq.	7.05E-03	2.60E-04	3.20E-04	5.52E-06	7.05E-05	0.00E+00	1.38E-06	0.00E+00
EP-terrestrial	mol N–eq.	7.39E-02	2.79E-03	1.91E-03	5.91E-05	7.40E-04	0.00E+00	1.48E-05	0.00E+00
POCP	kg NMVOC–eq.	4.49E-02	1.09E-03	5.66E-04	4.22E-05	3.50E-04	0.00E+00	1.05E-05	0.00E+00
ADP-minerals&metals	kg Sb–eq.	9.59E-05	1.32E-05	8.51E-07	3.67E-08	9.85E-06	0.00E+00	9.18E-09	0.00E+00
ADP-fossil	MJ	2.05E+02	7.27E+00	4.80E+00	3.27E-01	3.01E+00	0.00E+00	8.16E-02	0.00E+00
WDP	m^3	3.13E+02	6.21E+00	6.73E+01	7.01E-02	4.62E+00	0.00E+00	1.75E-02	0.00E+00

Additional environmental impacts for 1m² ETICS Baumit Pro (SilikonTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	1.03E+00	2.43E-01	1.57E-02	2.20E-03	7.10E-02	0.00E+00	5.50E-04	0.00E+00
HTP-c	CTUh	2.80E-09	1.52E-10	9.44E-11	3.04E-11	9.35E-11	0.00E+00	7.59E-12	0.00E+00
HTP-nc	CTUh	1.55E-07	9.60E-09	1.81E-08	1.70E-10	5.01E-09	0.00E+00	4.25E-11	0.00E+00
IRP	kBq U-235-eq.	5.85E-01	3.72E-02	1.50E-01	1.50E-03	1.68E-02	0.00E+00	3.80E-04	0.00E+00
SQP	-	4.20E+01	7.62E+00	3.09E-01	1.69E-02	2.04E+00	0.00E+00	4.22E-03	0.00E+00
PM	Disease incidence	3.43E-07	3.28E-08	3.47E-09	2.40E-09	1.05E-08	0.00E+00	5.99E-10	0.00E+00

Resource use for 1m² ETICS Baumit Pro (SilikonTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	6.20E+00	1.01E-01	3.68E-01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
RPER used as raw materials	MJ	8.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	7.05E+00	1.01E-01	3.68E-01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	2.21E+02	7.41E+00	7.42E+00	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
NRPER used as raw materials	MJ	6.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.21E+02	7.41E+00	7.42E+00	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
Use of secondary material	kg	3.05E-02	2.97E-03	5.22E-04	1.60E-04	1.89E-03	0.00E+00	4.06E-05	0.00E+00
Use of renewable secondary fuels	MJ	2.98E-01	3.35E-03	1.50E-02	4.40E-05	2.32E-03	0.00E+00	1.10E-05	0.00E+00
Use of non-renewable secondary fuels	MJ	7.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.60E-04	0.00E+00
Net use of fresh water	m^3	1.68E-01	5.07E-04	2.42E-03	9.09E-06	3.20E-04	0.00E+00	2.27E-06	0.00E+00

Output flows and waste categories for 1m² ETICS Baumit Pro (SilikonTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.68E-01	7.93E-03	3.94E-03	3.60E-04	4.33E-03	0.00E+00	8.90E-05	0.00E+00
Non-hazardous waste disposed	kg	6.84E+00	5.35E-01	5.90E-03	3.80E-03	1.86E-01	0.00E+00	9.50E-04	0.00E+00
Radioactive waste disposed	kg	2.05E-04	5.01E-05	3.71E-05	2.32E-06	2.04E-05	0.00E+00	5.80E-07	0.00E+00
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	1.99E-02	2.47E-03	2.06E-01	1.60E-04	1.53E-03	0.00E+00	3.99E-05	0.00E+00
Materials for energy recovery	kg	3.02E-03	3.78E-05	1.48E-04	4.94E-07	2.58E-05	0.00E+00	1.24E-07	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	5.00E-03
Biogenic carbon content in accompanying packaging	kg C	1.10E+00

Table 11: Environmental information about 1m^2 ETICS Baumit Pro with SilikatTop render, EPS - 10 cm

Environmental impacts for 1m² ETICS Baumit Pro (SilikatTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO_2–eq.	1.02E+01	4.95E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-fossil	kg CO_2–eq.	1.01E+01	4.95E-01	3.06E-01	2.42E-02	2.06E-01	0.00E+00	6.06E-03	0.00E+00
GWP-biogenic	kg CO_2–eq.	6.19E-02	0.00E+00	2.31E-04	1.64E-06	0.00E+00	0.00E+00	4.09E-07	0.00E+00
GWP-luluc	kg CO_2–eq.	3.80E-05	4.12E-06	2.35E-07	5.64E-08	2.36E-06	0.00E+00	1.41E-08	0.00E+00
ODP	kg CFC 11–eq.	4.68E-07	1.12E-07	1.45E-08	5.19E-09	4.41E-08	0.00E+00	1.30E-09	0.00E+00
AP	mol H^+–eq.	3.85E-02	1.35E-03	2.17E-03	4.11E-05	5.10E-04	0.00E+00	1.03E-05	0.00E+00
EP-freshwater	kg PO_4–eq.	1.50E-03	3.81E-05	6.88E-04	8.72E-07	2.14E-05	0.00E+00	2.18E-07	0.00E+00
EP-marine	kg N–eq.	6.61E-03	2.63E-04	3.20E-04	5.52E-06	7.05E-05	0.00E+00	1.38E-06	0.00E+00
EP-terrestrial	mol N–eq.	7.00E-02	2.82E-03	1.91E-03	5.91E-05	7.40E-04	0.00E+00	1.48E-05	0.00E+00
POCP	kg NMVOC–eq.	4.34E-02	1.11E-03	5.66E-04	4.22E-05	3.50E-04	0.00E+00	1.05E-05	0.00E+00
ADP-minerals&metals	kg Sb–eq.	1.05E-04	1.34E-05	8.51E-07	3.67E-08	9.85E-06	0.00E+00	9.18E-09	0.00E+00
ADP-fossil	MJ	1.96E+02	7.42E+00	4.80E+00	3.27E-01	3.01E+00	0.00E+00	8.16E-02	0.00E+00
WDP	m^3	2.80E+02	6.35E+00	6.73E+01	7.01E-02	4.62E+00	0.00E+00	1.75E-02	0.00E+00

Additional environmental impacts for 1m² ETICS Baumit Pro (SilikatTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	9.74E-01	2.48E-01	1.57E-02	2.20E-03	7.10E-02	0.00E+00	5.50E-04	0.00E+00
HTP-c	CTUh	2.38E-09	1.55E-10	9.44E-11	3.04E-11	9.35E-11	0.00E+00	7.59E-12	0.00E+00
HTP-nc	CTUh	1.55E-07	9.79E-09	1.81E-08	1.70E-10	5.01E-09	0.00E+00	4.25E-11	0.00E+00
IRP	kBq U-235-eq.	5.49E-01	3.80E-02	1.50E-01	1.50E-03	1.68E-02	0.00E+00	3.80E-04	0.00E+00
SQP	-	3.78E+01	7.77E+00	3.09E-01	1.69E-02	2.04E+00	0.00E+00	4.22E-03	0.00E+00
PM	Disease incidence	7.75E-07	3.35E-08	3.47E-09	2.40E-09	1.05E-08	0.00E+00	5.99E-10	0.00E+00

Resource use for 1m² ETICS Baumit Pro (SilikatTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	5.31E+00	1.03E-01	3.68E-01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
RPER used as raw materials	MJ	8.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	6.16E+00	1.03E-01	3.68E-01	1.79E-03	6.40E-02	0.00E+00	4.50E-04	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	2.11E+02	7.56E+00	7.42E+00	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
NRPER used as raw materials	MJ	6.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.11E+02	7.56E+00	7.42E+00	3.29E-01	3.10E+00	0.00E+00	8.22E-02	0.00E+00
Use of secondary material	kg	3.13E-02	3.03E-03	5.22E-04	1.60E-04	1.89E-03	0.00E+00	4.06E-05	0.00E+00
Use of renewable secondary fuels	MJ	2.70E-01	3.42E-03	1.50E-02	4.40E-05	2.32E-03	0.00E+00	1.10E-05	0.00E+00
Use of non-renewable secondary fuels	MJ	6.52E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.60E-04	0.00E+00
Net use of fresh water	m^3	1.40E-01	5.17E-04	2.42E-03	9.09E-06	3.20E-04	0.00E+00	2.27E-06	0.00E+00

Output flows and waste categories for 1m² ETICS Baumit Pro (SilikatTop)									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.60E-01	8.08E-03	3.94E-03	3.60E-04	4.33E-03	0.00E+00	8.90E-05	0.00E+00
Non-hazardous waste disposed	kg	6.62E+00	5.45E-01	5.90E-03	3.80E-03	1.86E-01	0.00E+00	9.50E-04	0.00E+00
Radioactive waste disposed	kg	1.95E-04	5.11E-05	3.71E-05	2.32E-06	2.04E-05	0.00E+00	5.80E-07	0.00E+00
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	2.09E-02	2.52E-03	2.06E-01	1.60E-04	1.53E-03	0.00E+00	3.99E-05	0.00E+00
Materials for energy recovery	kg	2.75E-03	3.86E-05	1.48E-04	4.94E-07	2.58E-05	0.00E+00	1.24E-07	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	5.00E-03
Biogenic carbon content in accompanying packaging	kg C	1.10E+00

8. Interpretation

Figure 5 below illustrates the shares of modules A1, A2, A3 and C1-C4 to certain environmental impacts

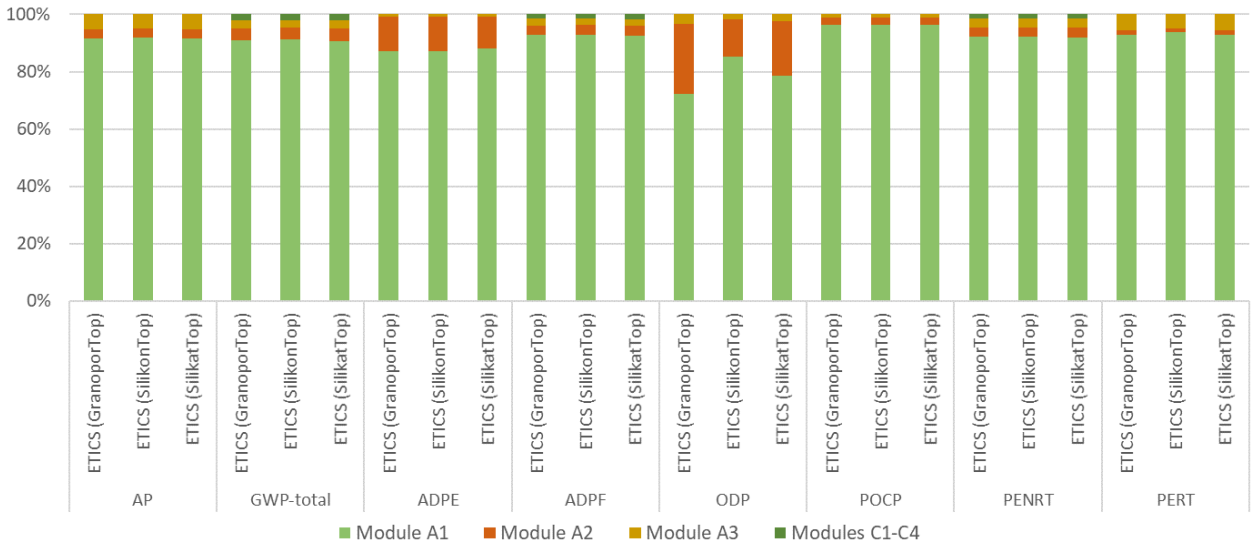


Figure 5: Contributions of modules A1, A2, A3 and C1-C4 to certain environmental impacts

The primary source of environmental impacts arise from the acquisition of raw materials and production of pre-products (module A1) for the ETICS components. These processes include various production activities, sometimes intensive energy and fuel consumption (e.g. for Portland cement production) which justify the high share of module A1. The transport to the factory site (module A2) forms distinctive contributions on

ADPE and ODP indicators, while for the rest impacts it not so relevant. The share of impacts from the actual production activities at the manufacturer's site (module A3) is very small (less than 5%) and their source is mostly from the used machinery powered by electrical energy and fuels.

The environmental impacts for the end-of-life stage arise from the operation of machines necessary for the processing of waste from ETICS. These operations include selective removal of ETICS, collecting and loading of waste, transport to disposal facility, etc. The impacts from machines operation arise mainly from the use of energy and fuels. The relevant indicators influenced by these activities are the abiotic depletion potential for fossil resources (ADPF) and the use of non-renewable resources (PENRT) and, to a smaller extent, the carbon footprint (GWP) and these impacts are mostly released during modules C2 and C4 when machine processing is done. It can be concluded that the environmental impact of modules C1-C4 is comparatively small (1-2%).

9. EPD verification

The process of verification of an EPD is in accordance with ISO 14025, clause 8.1.3 and ISO 21930, clause 9. After verification, this EPD is valid for a 5 years period. EPD does not have to be recalculated after 5 years if the underlying data has not changed significantly.

CEN standard EN 15804 serves as the core PCR along with ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3) ☒ external ☐ internal
Verification of EPD: PhD Eng. Halina Prejzner, PhD Eng. Justyna Tomaszewska LCI audit and input data verification: PhD Eng. Roumiana Zaharieva, PhD Eng. Yana Kancheva, PhD Eng. Justyna Tomaszewska LCA auditor: PhD Eng. Roumiana Zaharieva, PhD Eng. Yana Kancheva Verification of procedures and declaration: PhD Eng. Justyna Tomaszewska

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[29] Bulgarian Waste Management Act, State Gazette No 53 dated 13.07.2012 and further amendments (Закон за управление на отпадъците)
[30] Bulgarian Waters Act, State Gazette No 67 dated 91 dated 27.07.1999, and further amendments (Закон за водите)
[31] Bulgarian Ordinance No.6 for construction and use of landfills and other facilities for waste recovery and disposal, State Gazette No 80 dated 13 Sept 2013г., and further amendments (Наредба № 6 от 27 август 2013 г. за условията и изискванията за изграждане и експлоатация на депа и на други съоръжения и инсталации за оползотворяване и обезвреждане на отпадъци).
[32] Bulgarian Ordinance No 1 on the procedure and forms for providing information about the activities on waste and procedures for keeping the public registers, State Gazette No 51 dated 20 June 2014, and further amendments (Наредба № 1 от 04 юни 2014 г. за реда и образците, по които се предоставя информация за дейностите по отпадъците, както и реда за водене на публични регистри)
[33] Bulgarian Ordinance for C&D waste management and use of recycled building materials, State Gazette No 98 dated 8 December 2017 (Наредба за управление на строителните отпадъци и за влагане на рециклирани строителни материали, 2017)
[34] EAE, Life-cycle expectation & recycling of ETICS – experience and solutions, Third ETICS Forum on 12 October 2015 in Milan, https://www.ea-etics.eu/files/dokumente-eae/4_ETICS_Forum/05_2015-10-12_ETICS_Forum_2015_Life-cycle___recycling_01.pdf, last accessed 04.04.2021
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