Schleusner LEHMBAUSTOFFE

Dachverband Lehm e.V.

Environmental Product Declaration

in accordance with DIN EN ISO 14025:2025-05 and DIN EN 15804:2022-03

Schleusner & Söhne GmbH

Clay Panels according to DIN 18948

Declaration owner	Lehmbaustoffe Schleusner & Söhne GmbH, Elbchaussee 1, 39524 Schönhausen (Elbe), Germany
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Dachverband Lehm e.V.
Postfach 1172, 99409 Weimar, DE
www.dachverband-lehm.de

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Product Category Rule

Sustainability of buildings – Environmental Product Declarations: Basic rules for the building material category clay panels (PKR LP Version Ü5_2022_06)

Dataset creator

Dipl-Ök. Manfred Lemke

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Verification

The European standard DIN EN 15804:2022-03 serves as the core EPD. Independent verification of the declaration in accordance with DIN EN ISO 14025:2025 in conjunction with CEN ISO/TS 14071:2016.

☐ internal ☒ external

Declaration owner

Lehmbaustoffe Schleusner & Söhne GmbH,
Elbchaussee 1, 39524 Schönhausen (Elbe), DE
www.schleusner.de

Declared product / unit

This Environmental Product Declaration (EPD) is valid for clay panels according to DIN 18948 with the following specific designations:

- Hanf-Lehmbauplatte 22mm (Dry lining board)
- Hanf-Lehmbauplatte 14mm (Dry lining board)
- Hanf-Lehmbauplatte 10mm (Plaster base panel)

The functional unit is cubicmeter (m³) according to DIN 18948 Appendix A.3 for clay panels.

Scope

This EPD is based on data collected on energy and material flows at the company's production works in Schönhausen (Elbe). The reference year is 2025. The German Association for Building with Earth (Dachverband Lehm e.V.) accepts no liability for the manufacturer's information provided for this EPD.

Dipl.-Ing. Stephan Jörchel
Dachverband Lehm e.V. (Programme operator)

Prof. Dr. Klaus Pistol
Inspection committee

Dr.-Ing. Horst Schroeder
Independent verifier

Sustainability of buildings – Environmental Product Declarations

Environmental Product Declaration according to DIN EN 15804 for the product category

Clay Panels

Schleusner & Sons Clay Building Materials GmbH

December 2025

CONTENTS

1 GENERAL

1.1 Normative Foundations

This document was prepared on the basis of the following standards as well as the standards and rules mentioned in *section 2.4 :*

DIN EN 15804:2022-03, *Sustainability of construction works – Environmental product declarations – Basic rules for the product category of construction products,*

DIN EN 15942: 2022-04, *Sustainability of construction works – Environmental product declarations – Communication formats between companies,*

DIN EN ISO 14025:2025-05, *Environmental labelling and declarations – Type III environmental declarations, principles and procedures,*

DIN EN ISO 14040:2021-02, *Environmental management – Life cycle assessment – Principles and framework conditions,*

DIN EN ISO 14044:2021-02, *Environmental management – Life cycle assessment – Requirements and guidance.*

1.2 Version tracking

version	comment	Status
Exercise 1	Draft	Dec 2025
Ü2	Revision following factory visit	Dec 2025
Ü3	Verified Version	Feb 2026

Contact:

Lehmbaustoffe Schleusner & Söhne GmbH, Elbchaussee 1, 39524 Schönhausen (Elbe)

PCR Clay Panels acc. DIN 18948:
dvl@dachverband-lehm.de ; www.dachverband-lehm.de/wissen/PKR-UPD

Data Set Generator:

Dipl.-Ök. Manfred Lemke

1.3 Terms / Abbreviations

For the purposes of this document, in conjunction with the General Rules for the Preparation of Type III UPDs for Clay Building Materials (Part 2) [1], the following terms and abbreviations shall apply:

Product category rules (PCRs) according to DIN EN ISO 14025 contain a compilation of specific rules, requirements or guidelines for creating Type III Environmental Product Declarations for one or more product categories.

Type III Environmental Product Declarations (UPDs) according to DIN EN ISO 14025 are voluntary and provide quantitative, environmental data and, where applicable, environmental information based on defined parameters, which fully or partially depict the life cycle of a product.

Life cycle assessment (LCA): for building materials according to DIN EN 15804 includes a compilation and assessment of the input and output flows and the potential environmental impacts of a product system throughout its life cycle.

Life cycle inventory (LCI): a component of life cycle assessment that includes the compilation and *quantification* of inputs and outputs of a product system throughout its life cycle.

PKR Product Category Rules

UPD Environmental Product Declaration

IM Information module according to DIN EN 15804

LP Clay panel

LPM Clay plaster

LR Building codes for earth building materials [2]

DVL German Association for Building with Earth

AVV European Waste Catalogue Regulation [3]

2 PRODUCT DEFINITION

2.1 Scope

This Environmental Product Declaration (EPD) is a product declaration based on the model declaration and the product category rules of the German Association for Building with Earth (DVL) for clay panels [4][5]. The quantification of the life cycle assessment specifies three types of belt-coated clay panels produced on the same production plant (*Table 2.1*). It is based on an analysis of the energy and material flows submitted by the manufacturer to the DVL and a factory site audit.

Table 2.1 Manufacturer, process type and product name

No.	Manufacturer	Factory address	Procedure type n. *Chapter 4.1*	Product name
1	Schleusner & Sons GmbH clay building materials	Elbchaussee 1 39524 Schönhausen (Elbe)	machine coating (endless string)	24cm clay slab drywall panel
2	Schleusner & Sons GmbH clay building materials	Elbchaussee 1 39524 Schönhausen (Elbe)	band-painted	22cm clay slab drywall panel
3	Schleusner & Sons GmbH clay building materials	Elbchaussee 1 39524 Schönhausen (Elbe)	band-painted	10cm clay slab plasterboard

The declared products Nos. 1 – 3 are unfired "thin" (t ≤ 1/5 of the board width) LPs manufactured in the factory according to a process defined in *section 4.1* for various panel applications according to DIN EN 18948. Clay panels according to Nos. 1 and 2 in *Table 2.1* are intended as dry construction panels for planking stud structures or suspended constructions in the area of walls or ceilings. Clay panels according to No. 3 in *Table 2.1* are plasterboards for cladding by screwing or other fastening to flat substrates in interior areas.

The application is governed by the LR DVL [2], the technical data sheets TM 05 and TM 06 of the DVL [6][7] and the specific manufacturer's instructions for the various applications.

2.2 Product description

The products mentioned are unfired, flat panels made of earthen building material with additives and jute reinforcement for cladding and planking building components in interior and weather-protected exterior areas. Clay minerals are a fraction of the earthen building material from soil and form the sole binder in the material part of the mixture.

2.3 Intended Use

The declared LP are used for planking stud structures for partition walls and wall linings, as well as for cladding walls, ceilings, and sloping roofs in interior and weather-protected exterior areas. These LPs are not suitable for use in splash zones such as kitchens and bathrooms, or in rooms with permanently high humidity (swimming pools, commercial kitchens).

The declared products are assigned according to the type of application according to DIN 18948 *(Table 2.2)* .

Table 2.2 Types and application areas of clay boards according to DIN 18948

Product after Table 2.1	Type	Scope
1, 2	A	Planking of stud/suspension structures in the area of walls, ceilings and sloping roofs
3	B	Cladding of walls, ceilings and sloping roofs (plasterboards)

2.4 Product standard / Approval / Placing on the market / Application rules

- DIN 18942-1 Earth building materials – Terms,

- DIN 18942-100 Earth building materials – Certificate of conformity,

- DIN 18948 Clay panels (LP),

- Building codes for earth constructions of the German Association for Building with Earth (LR DVL) [2].

Furthermore, the DVL's model EPD for clay panels (LP) [4] apply, and in connection with this, the document "PCR Part 2" with the corresponding definitions and abbreviations [1] as well as the DVL's technical data sheets TM 05 and TM 06 [6] [7] . In addition, the AVV [3], the German Commercial Waste Ordinance (GewAbfV) [8] and the manufacturers' worksheets must be observed.

2.5 Quality Assurance

Quality assurance of the manufacturing process of all LPs is carried out in-house in accordance with DIN 18942-100. For the suitability testing of earthen building material, the LR DVL [2] and, on a voluntary basis, the TM 05 DVL [6] apply.

2.6 Delivery condition

The delivery formats of the declared LP are specified in terms of dimensions: length l x width w (ideally a multiple of 125 mm) and thickness t (t ≤ 1/5 of the width w) (*Table 2.3*). Permissible deviations from the nominal dimensions (perpendicularity, nominal length, nominal width, nominal thickness, flatness) correspond to dimensional accuracy class MHK I according to DIN 18948. The longitudinal and transverse edges of the declared LP form a rectangle. Their edges are blunt. The declared LPs are reinforced with jute fabric near the surface.

Table 2.3 Delivery formats of the declared LP

LP according to Table 2.1	**Max. formats lxw** [mm]	**Thickness t in** mm	**Dimensional accuracy class** MHK (according to DIN18948)	**Type of reinforcement**
LP 01	1250x1000	22	MHK I	Jute fabric both sides
LP 02	1000 x 625	14	MHK I	Jute fabric both sides
LP 03	2000 x 62.5	10	Not relevant	Jute fabric both sides

2.7 B structural engineering properties

2.7.1 Physical properties

Table 2.4 shows mechanical / technical properties according to the manufacturer's declaration of the LP.

Table 2.4 Mechanical / building physics properties of the declared LP according to DIN 18948

Characteristic	**LP 01**	**LP 02**	**LP 03**	**Units**
Dry bulk density		680		kg/ m³
Surface hardness	-	22	23	mm
Surface tensile strength	-	<0.10	<0.10	N/mm²
Flexural strength	-	>1.05	>1.49	N/mm²
Thermal conductivity λ	0.21	0.21	0.21	W/mK
Heat storage capacity c	1.4	1.4	1.4	kJ/kgK
Water vapor diffusion resistance factor μ	5-10	5-10	5-10	-
Water vapor sorption class	-	WS III	WS III	
Humidity tolerance class	-	FTK II	FTK II	

2.7.2 Sound insulation

The partition wall assembly tested according to DIN EN 10140-2 with LP 01 *(22 mm; Table 2.1)* achieves an airborne sound resistance of up to Rw = 49 dB. The partition wall assembly tested according to DIN EN 10140-2 with LP 02 *(14 mm; Table 2.1)* achieves an airborne sound resistance of up to Rw = 54 dB.

2.7.3 Air permeability

Constructions made of LP with full-surface clay plasters with a thickness of ≥ 2 mm are airtight.

2.8 Fire protection

All declared LPs are classified as class B, s1, d0 according to DIN EN 13501-1. The declared LP No. 1 *(22 mm, Table 2.1)* achieves a fire resistance of EI60 for the tested non-load-bearing, space-enclosing, thermally insulating wall construction in timber frame structure with single-layer symmetrical cladding/planking using LP No. 1 *(22 mm; Table 2.1)* under fire exposure on one side according to DIN EN 1364-1: 2015-09 in conjunction with DIN EN 1363-1: 2012-10.

3 MATERIALS

3.1 Selection / Suitability

The declared LPs consist of construction soil, mineral aggregate, hemp shives as a plant additive, and double-sided reinforcing fabric made of jute fibers. The substance prohibitions and restrictions of DIN 18948 and natureplus RL 1006 apply [9].

3.2 Explanation of the material

Construction soil according to LR DVL [2]: clayey soil, suitable for use as building material, consisting of a mixture of silty, sandy to gravelly aggregates and binding clay minerals. Construction soil is differentiated into pit clayed soil, dry clay/clay flour, and recycled clay. Pressed clay without surfactants can also be reused as construction clay [1, Figure 3.3].

Pit clayey soil is a naturally occurring primary raw material excavated from the geologically "natural" soil in a moist state [2] and has a varying granulometric and mineralogical composition (SiO_2, Al_2O_3, Fe_2O_3, $CaCO_3$). This can result in different plastic properties (lean/fat) and colors of the final product during preparation and processing, depending on the specific soil deposit. Different types are distinguished according to their intended use [1, Figure 3.3]:
Primary pit clayey soil is extracted specifically for the production of clay building materials.
Secondary pit clayey soil is generated during excavation work as soil (AVV No. 170504 [3]) and can be reused as a secondary raw material. It thus loses its waste status, enters a new product system and undergoes upcycling.

Dry clay is dried, possibly ground, pit clay. Clay flour is natural, dried, possibly ground clay that can be used to increase the binding strength of lean building clays.

Recycled clay is a clayey building material recovered from demolition components [2]. It is usually found as a component of mixed construction waste (construction rubble / site waste, AVV codes 170107 / 170904 [3]) and must be separated using suitable separation methods. It can be dry-crushed, replasticized by adding water, and further processed as earthen building products in the production process.

Primary recycled clay is specifically reused for earthen building products.
Secondary recycled clay is further processed for other purposes outside the declared system (e.g., separation of the sand fraction for concrete production) [1, Fig. 3.3].

Mineral aggregates: Sand grains (DIN EN 12620 / DIN EN 13139) with quartz as the main mineral, as well as natural minor and trace minerals. Natural sand grains are components of geologically "formed" structures and can be easily returned to geogenic cycles. Recycled aggregates are recovered and crushed demolition materials from masonry, which partially replace primary aggregates.

Mineral aggregates can influence the building physics (dry density, thermal conductivity, drying shrinkage) and structural mechanics (strength) properties of the final product, but especially the plastic properties of the building clay.

Organic additives / natural: Plant parts and fibers (e.g., hemp, flax, chopped straw, starch) without relevant herbicide residues, animal hair, shredded, chemically untreated wood (no wood-based materials). Organic additives can influence the building physics properties (dry density, drying shrinkage) of the final product. Fibrous additives counteract cracking of the LP during drying/hardening.

Jute fabric as reinforcement: Special fabric made of biodegradable natural jute yarn, warp/weft threads approx. 20/20 threads per 10 cm, open mesh size approx. 5 x 5 mm for surface or joint reinforcement of LP and at material transitions. The jute yarn is starch-treated and biodegradable.

Water: "Mixing water" is essential to achieve the appropriate consistency of the working compound for the molding process of the molded parts. Through evaporation of the mixing water, the molded parts harden and attain their intended product properties. Hardened molded parts based on clayed construction soil as solely binder can be replasticized or re-activated simply by adding water.

3.3 Provision

The identified construction soil categories are raw materials for the production of earthen building materials. Secondary recycled clay leaves the clay material cycle and becomes a raw material in another product system. Before being accounted for in IM A1, the construction soil categories are classified according to their method of provision as per *section 3.2*. IM A2 accounts for the transport routes of the material flows to the plant.

3.4 Availability

All mineral raw materials are generally limited in their availability as "geologically formed" natural resources. Therefore, instead of primary excavation from clay-rich pits, suitable excavated clayey soil from earthworks is preferably processed as a secondary raw material. Similarly, the declared LP contain 4 M.-% recycled mineral aggregate from crushed demolition material, mainly from the area surrounding the plant in Schönhausen/Elbe.

Due to the special hydraulic properties of the binding clay fraction in construction soil, replastizication by water immersion sets free the mineral resources of the LP for material reuse. This reversion effect is possible at any time. Dismantled LP are taken back by the manufacturer and, where possible, reused or recycled for new LP. Due to this closed loop there is no shortage of mineral raw materials.

The plant-based additives and jute fabric used are renewable raw materials.

4 PRODUCT MANUFACTURING

The raw materials – construction soil, mineral aggregates and organic additives – are stored loose under a roof at the factory. From the storage containers, the raw materials are gravimetrically dosed according to the respective recipe and thoroughly mixed. Adding water until the working mixture reaches the appropriate consistency allows for the application of the intended shaping process – "belt coating machine." The mixture is mechanically applied to a continuous conveyor belt spanning 3 meters, horizontally smoothed by a forming roller, and pressed down. During this process, surface reinforcements made of jute fabric are incorporated on both sides. After passing through a drying tunnel, the panels are cut to size.

4.1 Procedure diagram

Figure 4.1 shows the production scheme for all declared band-coated clay panels with the relevant process flows:

- Moist soil, mineral aggregate and hemp shives are dosed gravimetrically,
- The mixture is fed to the intensive mixer via conveyor belts and applied wet from an intermediate storage area onto the continuous strand.
- Jute reinforcing fabrics are embedded in the bottom and top of the LP,
- The damp string passes through a mesh belt dryer for drying by radiant heat and convection. The energy source are wood chips, supplemented by additional heat from a natural gas-fired combined heat and power (CHP) plant located within the factory.
- After the drying process, the LP can be cut to size.
- The cut LP are stacked on wooden pallets with cardboard interlayers and stored with a protective film to make them transportable and weatherproof.

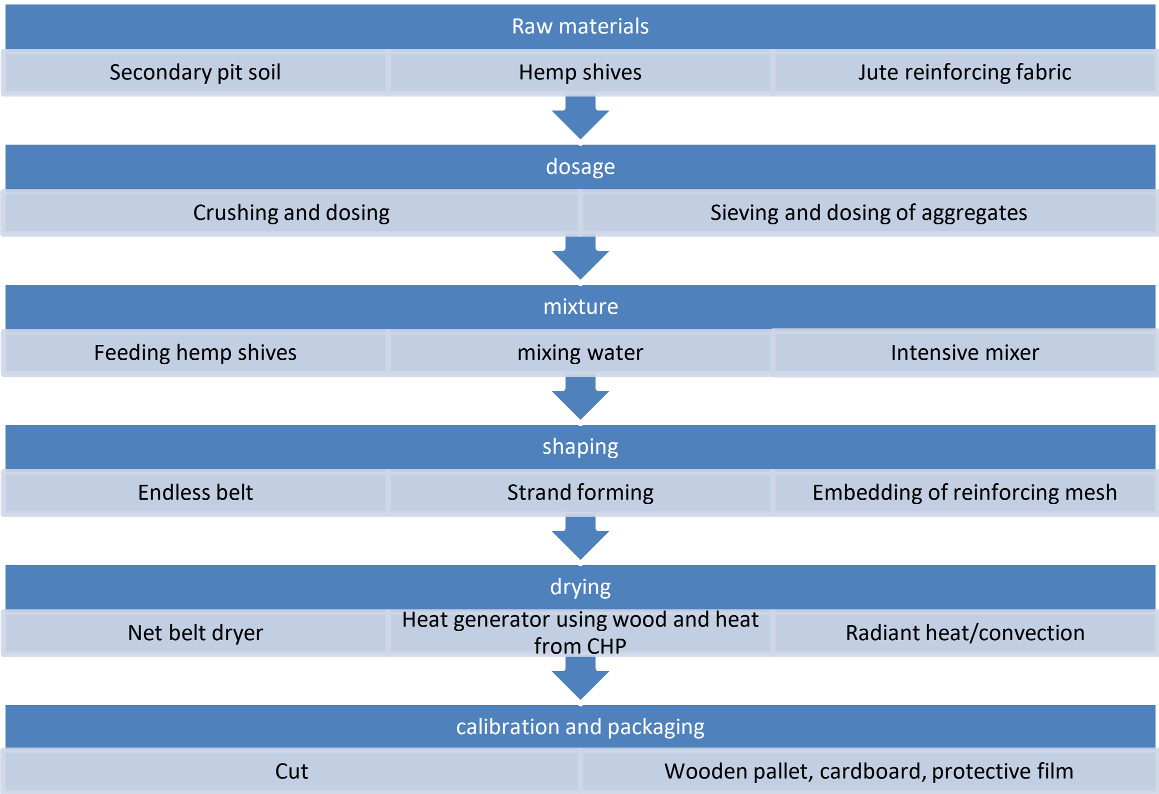

Figure 4.1 Production scheme "Clay panels 01-03 (Table 2.1), band-painted"

4.2 Health and Safety - Production

The limit values of the German TA Luft [11] are complied with. The manufacturing process is wastewater-free. Any remaining residual moisture from the mixing water is released as water vapor during the drying process.

4.3 Environmental protection - Production

4.3.1 Waste

Mineral waste from the production process *(Figure 4.1)* is recycled back into the ongoing manufacturing process.

4.3.2 Water / Soil

No water or soil contamination occurs. The recorded and described manufacturing process is wastewater-free.

4.3.3 Noise

The required limits are being met.

4.3.4 Air

Emissions from artificial drying of the LPs (net belt dryer) are within the limits set out in the German Technical Instructions on Air Quality Control (TA Luft) and the German Federal Immission Control Ordinance (BImSchV) [11] [12] . Environmental protection measures are aimed at minimizing energy consumption and producing low-emission exhaust air. Air emissions from the operation of the emergency power generator in the plant are recorded and evaluated within the framework of the life cycle assessment, taking into account the specific environmental factors of diesel consumption.

5 PRODUCT PROCESSING

5.1 Processing instructions

The processing of the LP is carried out according to DIN 18948, LR DVL [2] and product-specific manufacturer specifications.

Type A panels according to Table 2.2 are spot-nailed, screwed, or stapled to the substructure.

Type B panels are fully bonded to the substrate with clayey adhesive mortar according or spot-fastened by screwing or stapling.

LPs for cladding/planking building components are part of a building system. The properties of the system components must be coordinated and, as a whole, suitable for creating a functional building component. The system components are named and their properties described in the manufacturer's processing guidelines.

Non-load-bearing interior partition walls with LP planking must be constructed to allow for the direct attachment of light cantilever loads according to DIN 4103-1. The processing guidelines recommend attaching light additional loads such as lamps, detectors, or curtain tracks, ensuring the correct selection and use of anchors. Heavy loads (> 6 kg per fixing point) must always be attached directly to the load-bearing structural elements or, if necessary, to the substructure.
For timber frame constructions with LP type A, the manufacturer's specifications for the selection of fastening points must be followed in accordance with the specified system grid of the substructure.

Type A panels, used for cladding ceilings and pitched roofs, must have sufficient dimensional stability. The substructure grids specified by the manufacturer for panels LP 01 and LP 02 *(Table 2.2)* prevent deformation under continuous load. The panels are staggered and butted against the studs of the substructure (correspondingly for ceilings and pitched roofs).

For processing the LP standard drywall tools (e.g., jigsaw, circular saw, cutting disc) are typically used. For further processing, the manufacturer's instructions must be followed, particularly regarding the reinforcement of the panel joints and the reinforcement of subsequent clay plaster coatings.

LPs delivered to the construction site must be stored in a weatherproof manner.

5.2 Occupational safety / Environmental protection

The regulations of the employers' liability insurance associations and the respective safety data sheets for the construction products apply. No special environmental protection measures are required during the processing of LP. Dust emissions, e.g., during cutting and separating work, are below the dust emission limits specified in the TA Luft [11]. As a precaution, respiratory masks are worn.

5.3 Residual material

Dismantled, pure LPs are taken back by the manufacturing plant and reintroduced into the production process of new LP.

5.4 Packaging

Reusable wooden pallets are taken back by the manufacturer or building material suppliers (deposit system) and reused multiple times in the production process. Single-use wooden pallets are sorted and recycled for energy recovery through dual waste management systems (EWC 150103 Wooden packaging, [3]).

PE shrink films are sorted and fed into the recycling process within the German dual recycling systems (film manufacturers, AVV code 150102 Plastic packaging [3]).

6 USE CONDITION

6.1 Ingredients

In the production of LP, only the raw materials specified in section 3.1 are used. These ingredients, as well as any reinforcing fabrics used, are bound as solid substances within the component by the clay minerals within the clayed construction soil when in use. This bond is water-soluble and reversible.

6.2 Interrelationships between Environment and Health

The declared LPs contain no harmful substances such as volatile organic compounds (VOCs; TVOCs), formaldehyde, isocyanates, etc. Therefore, no harmful emissions are to be expected. The product emits no odors, or at least no foreign odors.

The microporous structure of the clay minerals in the clayey construction soil enables rapid and exceptionally high adsorption/desorption of excess water vapor in the interior. Therefore, building components made of LP contribute to a balanced indoor climate. The manufacturer's declared LPs possess water vapor adsorption class WS III according to DIN 18948, Table A.2.

The natural ionizing radiation emitted by the LP depends on the geological origin of the soil ("hot spots"). It is very low and poses no health risk. The average radon exhalation from the clayey construction soil used in the declared LP is < 2 Bq/m^2h.

6.3 Durability / Service life

Clay minerals are not hydraulic binders, meaning they only harden in air and become plastic again upon re-wetting. Therefore, the use of LP is limited to the area specified in *Table 2.2* . Building components with LP cladding/coverings must be protected from standing and flowing water as well as permanent dampness throughout their entire service life.

LPs are largely dimensionally stable under the usual fluctuations in ambient humidity, according to their application areas *(Table 2.2)* . Minor variations in dimensions and flatness of the LPs due to moisture exposure are permissible if these can be compensated for by the building system. Based on the determined deformations (changes in length, curvature/cupping), LPs are classified into moisture tolerance classes (FTK). The declared LPs of type A meet the requirements for FTK II according to DIN 18948 A.1.

7 EXTRAORDINARY INFLUENCES

7.1 Fire

No toxic gases or fumes will develop in the event of a fire. Small amounts of CO may be produced by LPs containing organic additives. Firefighting water used for extinguishing fires can damage components made of LPs. Washed-off LP material in the firefighting water does not pose any environmental risks.

7.2 Floods

When exposed to water (e.g., flooding), the binding agent, clay, in the LP (laminated concrete) can re-plasticize and be washed out. No water-polluting substances are released in this process. Areas affected by water may need to be tested for stability.

7.3 Water pipe damage

Damage to water pipes can cause water to leak into the building and soften installed LP (laminated plasterboard). Softened areas may need to be inspected for stability.

8 NOTES ON THE USAGE PHASE

The declared LPs do not emit any environmentally or health-hazardous volatile organic compounds (VOCs, TVOCs).

The dynamic moisture absorption of the LP during the usage phase affects the indoor climate positively and thus contributes to the energy optimization of necessary air exchange rates. Corresponding verifications according to DIN 18948, A.2 are documented in *Table 2.4* . The classification therein as sorption class WS III is verified as moisture absorption in g/m²/h. WS III achieves the following sorption values:

After 1 hour: ≥ 13 g/m²
After 6 hours: ≥ 61 g/m²
After 12 hours: ≥ 91 g/m².

The lifespan of processed LPs depends on the specific design, usage conditions, maintenance and other factors. Declared LPs are easy to repair. LPs are readily combinable with other building materials.

9 END-OF-LIFE PHASE

The end-of-life phase, if applicable, is declared in information modules C1-C4 and in module D (para. C).

Environmentally friendly building materials are characterized by the possibility of sorting by type and energy-efficient processing for recycling. A distinction must be made between [1, Figure 3.5]:
Product recycling means the reuse of building products in their original shape and, generally, for their original purpose. This requires selective dismantling to obtain pure/undamaged products followed by the sub-processes of temporary storage, cleaning, and, if necessary, repair.
Material recycling is the resource-use of building materials/components after they have been broken down. The resource-use can then take place in the original product system (primary recycled clay) or in a product system outside of clay construction (secondary recycled clay).

9.1 Recycling

The service life of LPs incorporated into building components generally exceeds the service life of the buildings they support. LPs can typically be easily dismantled. After removing any adhering, integrated components (e.g., joint reinforcement), LPs can be reused for the same purpose. Reinforcing mesh embedded near the surface of the LPs can be easily peeled off manually.

When reused, the dismantled LPs must not contain any traces of chemical / biological influences from previous use (building-damaging salts, mosses / algae, dry rot, mold, etc.).

From building demolition, clean, free-from-residue (e.g., old paint), and core-reinforced LPs can be re-plasticized by immersing in water without additional energy expenditure, or, when dry and crushed, re-used as a secondary raw material in a new shaping process. Their original composition generally meets the properties required for reuse as LPs.

If the aforementioned reuse options are not practical, sorted, unreinforced LP recovered from building demolition, containing natural mineral aggregates and a homogeneously distributed content of natural organic additives ≤ 1 wt.%, can be further processed into recycled aggregate like excavated soil, e.g., in landscaping, recultivation, road construction, or in agriculture and forestry. The German Federal Soil Protection Ordinance (BBodSchV) [26] and the German Ordinance on the Use of Soil Contaminated Sites (EBV) [10] must be observed.

The take-back and direct reuse of disassembled LPs is the preferred recovery scenario in IM D1 for all declared LPs. The manufacturer offers a voluntary take-back program for all declared LPs.

9.2 Recycling of waste and packaging

The recycling of packaging is carried out by certified waste management companies in accordance with the Waste Management Act (KrW-/AbfG) [13] . No production waste is generated during the manufacture of LP. Excess clay mixtures are returned to the production process.

9.3 Disposal

Dismantled building components that cannot be recovered in a single sorting manner and are unsuitable for direct reuse or recycling can be disposed of in landfills of landfill class A due to their chemically neutral and inert behavior (AVV waste code 17 09 04 [3]). They do not pose an exceptional burden on the environment and can be declared as non-hazardous waste (NHWD).

PART A LIFE CYCLE INVENTORY (LCI)

The life cycle inventory (LCI) according to DIN EN ISO 14040 / DIN EN ISO 14044 / DIN EN ISO 15804 is one part of the preparation of a Type III Environmental Product Declaration (EPD) is based on manufacturer specifications, from which resource consumption and corresponding potential environmental impacts are derived for each declared cycle stage. The balance data are average values for all relevant energy and material flows in the production year 2025.

A.1 System definition and life cycle modeling

A.1.1 Functional/Declared Unit

The functional unit for the production of LPs is defined in DIN 18948, A.3 and in the corresponding PKR [5]. It is specified as one cubic meter (1 m³) in relation to volume. Table *A1* contains conversion factors to the declared unit.

Table A.1 Declared Unit

Declared unit	**1**	**m³**
Bulk density	680	kg/m³
Weight per unit area *(average)*	13	kg/m²

A.1.2 Biogenic carbon content

According to DIN EN 15804:2022, the biogenic carbon content C contained in the product and packaging is declared separately in *Table A.2*.

Table A.2: Biogenic carbon content in kg C per m³ LP

Products according to Table 2.1	**LP 01**	**LP 02**	**LP 03**
Biogenic carbon in the product	26.2 kg C / m³ LP		
Biogenic carbon in the packaging	0 kg C		

The sequestered CO_2 content is derived from the biogenic carbon content according to DIN EN 15804 by mole factors of C an O_2 with 3,67 x C.

A.1.3 System boundaries

The selected system boundaries correspond to the UPD type: from cradle to factory gate (IM A1 – A3) with modules C1 – C4 and D [1].

Transport of raw materials, supplies, operating materials, and packaging to the plant is recorded in IM A2. Transport of loose materials after building demolition or dismantling, normally recorded in IM C2, lies outside the system boundary and has to be included in the environmental impact assessment of the respective building.

A.1.4 Cut-off criterion

According to DIN 18948, A.3, all material flows entering the production system (inputs) that represent more than 1% of the total mass of material flows or more than 1% of primary energy consumption are taken into account. This excludes e.g. wooden pallets, cardboards, and packaging films.

By way of exception, all material flows whose environmental impacts represent less than 1% of the total impacts of an impact category considered in the balance sheet are also recorded. This applies to jute fabric.

A. 1.5 Observation period

The data used refers to the year 2025. The quantities of raw materials, energy, auxiliary materials and operating supplies used were considered as annual averages for the Schönhausen (Elbe) plant.

A.1.6 Reference service life (RSL)

The Reference Service Life (RSL) is the service life that can be expected for a construction product under certain usage conditions (e.g., standard usage conditions). Based on the service life catalog of Bau-EPD GmbH, version 2014 [15], an RSL of 50 years is assumed for LP.

The machinery, equipment and infrastructure required for production were not included in the balance sheet.

A.1.7 Allocation

Allocation is understood as the assignment of the input and output flows of a life cycle assessment module to the product system under investigation and other product systems (DIN EN ISO 14040).

Clayed construction soil as secondary clayed soil is provided as residual waste from gravel excavation and reused for LP without further processing. The environmental loads are allocated to gravel processing as the main product according to the physical allocation based on DIN EN ISO 14044, section 4.3.2.

Energy, auxiliary materials and operating materials used in the plant that cannot be clearly assigned to one of the products manufactured in the plant are allocated to the balanced product according to weight percentage *(mass-related allocation)*.

A.2 Inventory balance sheet

The life cycle inventory according to DIN EN ISO 14040, DIN EN ISO 14044, or DIN EN 15804 serves to quantify the input and output flows of the LP product system based on the data collection and calculation method of the program operator. All data refer to the belt machine process (*section 4.1*). The investigated drying process is based on a mesh belt dryer operated with a combination of heat from power-heat cogeneration and wood firing.

The input includes direct raw materials (A1), energy carriers, electricity and water consumption (A3). Transportation to the plant is also included (A2). The output is 1 m³ of the product and emissions from the system. The life cycle inventory is presented separately for the life cycle phases within the selected system boundary. The life cycle inventory has been made available to the review panel and for separate verification [5] and is stored centrally at the DVL.

Table A.1 shows the input factors for the declared LPs.

Table A1: Life cycle inventory of the input factors of all declared LPs
(separation of numbers with comma, e.g. 1,000 means one not one thousand)

Parameter	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
IM/Einheit	MJ H_u	MJ H_u	MJ H_u	MJ H_u	MJ H_u	MJ H_u	kg	MJ H_u	MJ H_u	m^3
A1	7,85E+03	4,50E+01	7,89E+03	1,16E+03	8,58E+00	1,17E+03	8,14E+00	0,00E+00	0,00E+00	2,40E-01
A2	4,51E+00	0,00E+00	4,51E+00	4,71E+01	0,00E+00	4,71E+01	0,00E+00	0,00E+00	0,00E+00	4,16E-03
A3	2,63E+03	0,00E+00	2,63E+03	3,04E+02	0,00E+00	3,04E+02	0,00E+00	0,00E+00	0,00E+00	4,43E-03
A1-A3	1,05E+04	4,50E+01	1,05E+04	1,51E+03	8,58E+00	1,52E+03	8,14E+00	0,00E+00	0,00E+00	2,49E-01

PERE = Renewable Primary Energy (PE)
PERM = Renewable PE for material use
PERT = Sum of renewable PE
PENRE = Non-renewable PE as an energy source
PENRM = Non-renewable PE for material use
PENRT = Sum of non-renewable PE
SM = Use of secondary materials
RSF = Renewable Secondary Fuels
NRSF = Non-renewable secondary fuels
FW = Use of freshwater resources
MB = Module described
MNR = Module not relevant
ND = not declared

The main input factors are the mineral and plant-based raw materials of the LP, in particular approximately 73% by mass of secondary clayed construction soil excavated as soil waste from gravel extraction and around 18% by mass of hemp shives. The necessary drying heat comes primarily from the thermal utilization of wood chips (similar to wood pellets) with an average annual requirement of 181 kg of wood/m³ of LP. Fresh water for mixing the recipe and applying it to the endless belt-machine evaporates during the drying process. Electricity from the German electricity mix, as well as diesel and natural gas consumption for plant operations, are allocated proportionally to the LP product system via a mass-based allocation.

Direct reuse after manual dismantling is the preferred recovery scenario D1, assuming a mass loss of 5 M.-%. LPs that cannot be directly reused are shredded in IM C3 and recycled as raw material for new LPM in recovery scenario D2.

Table A. 2 shows the output factors for the declared LP.

Table A.2: Life cycle inventory of the output factors of all declared LPs
(separation of numbers with comma, e.g. 1,000 means one not one thousand)

Parameter	HWD	NHWD	RWD	CRU	MFR	MER	EEE	EET
IM/Einheit	kg	kg	kg	kg	kg	kg	MJ	MJ
A1	2,05E-04	4,47E-01	6,22E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A2	1,52E-06	7,67E-03	7,07E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A3	6,42E-05	9,59E-02	3,40E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A1-A3	2,71E-04	5,51E-01	4,03E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste to landfill
NHWD = Disposed of non-hazardous waste
RWD = Disposed of radioactive waste
CRU = Components for Reuse
MFR = Materials for Recycling
MER = Materials for energy recovery
EEE = Exported electrical energy
EET = Exported thermal energy
MNR = Module not relevant
MB = Module described
ND = not declared

The waste HWD, NHWD, and RWD in IM A1–A3 originates from the upstream processes involved in the provision and use of fossil fuels. The production of the LP is waste- and wastewater-free. Manual dismantling in IM C1 yields 95% of 680 kg/m³ of LP and 5% of 680 kg/m³ of LP as recycled material. Recovery scenarios D1 and D2 specifically avoid the generation of waste from IM A1 and IM A3.

PART B LIFE CYCLE ANALYSIS (LCA)

B.1 Assumptions and Estimates

The assumptions and estimates concern pit clay as a secondary raw material, plant components, waste processing (IM C3), landfilling (IM C4) and recovery potentials (IM D1 – D3).

Secondary pit clayey soil, as well as recycled clay, originates from preliminary processes that were initially mineral waste materials outside the system boundary and, upon entering the LP system, transform into raw materials for their production. These preliminary processes outside the system are not considered in the balance. Secondary pit clayey soil is recorded in *Table A.1, line 8* as "secondary materials used SM".

Dry clay is dried, possibly ground excavated clay. Dry clay is assessed according to the available environmental impact assessment of a manufacturer [18][19] . The substitution effect by dry recovered and processed clay components from dismantled LP in IM D2.

Hemp shives make up 50% of the hemp stalk, making them the most abundant product of fiber processing. Hemp shives are elongated and consist of approximately 35% cellulose, 18% hemicellulose, and 21% lignin. Proteins, pectins, and carbohydrates comprise a total of about 18%. Hemp shives can absorb up to four times their own weight in moisture and are readily compostable. Compared to other natural fibers, shives are characterized by their light weight, high porosity (resulting in excellent insulation), and high elasticity. In a fiber processing plant, dried hemp stalks are separated into fibers and shives. This process is typically purely mechanical: the lignified inner part of the straw is broken, producing the shives, which are then separated from the fibers in several processing steps. As a purified product, shives represent a marketable commodity. One ton of hemp stalks yields 0.5 tonnes of hemp shives. The production and supply of hemp shives is modeled based on the manufacturer's specific life cycle assessment data for harvesting and processing [22].

CO_2 is extracted from the atmosphere through photosynthesis and stored in the plants as carbon. At the end of the life cycle, this carbon is only released back into the atmosphere through energy recovery. At the end of their life cycle, LPs are not used for energy recovery but are dismantled, taken back by the manufacturer and reused as product (IM D1) or recovered resources are reused (IM D2). Thus, the CO_2 bound by the plant component remains technically within the system. According to DIN EN 15804, section C.2.4, emissions of biogenic CO_2 from biomass and the transfer of biomass into subsequent product systems must be characterized as +1 kg CO_2 eq/kg CO_2 of the biogenic carbon. The CO_2 credit is then balanced out again in accordance with the normative requirements in IM C3 or IM C4.

Waste processing (C3) : The assumptions for IM C3 for LP are based on studies by the Potsdam University of Applied Sciences on processing by dissolution in water (soaking/wet process) and dry grinding (dry process) [20][21]. A dry crushing technique commonly used in construction material recycling, employing an impact crusher, was assumed. The material composition was analyzed in the laboratory with regard to the possibility of reuse for new LP or further processing for other clay building materials.

Recovery potential (D) : Direct reuse of disassembled LPs replaces the entire production process and gives LPs another life cycle (IM D1).

Non-directly reusable LPs enable the reuse of recoverable mineral ingredients to substitute the starting materials for new LPs (IM D2).

B.2 Data Collection and Data Quality

Data collection for the investigated products and processes was carried out through a survey using a structured questionnaire, an on-site visit to the plant on December 13, 2025, and an update of the collected data. All data and calculations are on file with the program operator.

The majority of the data for the upstream processes originates from databases collected under consistent temporal and methodological conditions. Emphasis was placed on ensuring the most comprehensive possible recording of environmentally relevant material and energy flows. The data quality can therefore be described as very good. The data used refers to the fiscal year 2025. The life cycle assessment was carried out for the reference area of Germany.

To model the environmental impacts, the life cycle assessments listed in Table B.2, UPD and relevant study results [19][20][21][23][24][25] were also used.

Table B.2 Overview of data sources

No.	Data	Background data sets
1	Hemp shives	Life cycle assessment data for hemp harvesting/processing, Hemp Uckermark [22]
2	Jute reinforcement	Proportional calculation according to BAU-EPD-Hempflax-2022-1-GaBi [16]
3	Wood burning	UBA 2024 [23], FNR [24]; Diedrichs, Rüter [25]
4	Dry clay	EMAS Stephan Schmidt GmbH [17]; Sustainability Report Stephan Schmidt GmbH 2024 [18]. For comparison: Clay powder, 01.01.04 ÖKOBAUDAT Nov. 2025 [14]
5	Waste processing	FH Potsdam [19][20]; Schroeder/Lemke [21]
6	Recycling S	FH Potsdam [19][20]; Schroeder/Lemke [21]

To model the environmental impacts of the life cycle, current GaBi background datasets and specific product datasets from the software system ÖKOBAUDAT [14] of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) were used.

The data used is no more than 5 years old.

B. 3 Indicators of Environmental Impacts

The detailed balance data on the input, environmental impact and output factors can be found in the *table appendix, section* D.

Table B.2 Indicators for describing environmental impact (separation of numbers with comma, e.g. 1,000 means 1.00 not one thousand)

Parameter	GWP total	GWP-biogenic	GWP-luluc	GWP-fossil	ODP	POCP	AP	EP-terrestrial	EP-fresh-water	EP-marine	WDP	ADPE	ADPF
IM/Einheit	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CFC-11 eq.	kg NMVOC eq.	Mole of H+ eq.	Mole of N eq.	kg P eq.	kg N eq.	m³ world eq.	kg Sb eq.	MJ H_u eq.
A1	-3,22E+02	-3,48E+02	2,28E+01	2,96E+00	4,96E-03	1,44E-01	4,75E-01	5,42E-01	5,49E-02	9,71E-02	8,81E+00	1,84E-03	1,16E+03
A2	3,63E+00	8,13E-03	2,35E+00	1,27E+00	8,91E-10	8,14E-03	1,22E-02	6,35E-02	9,23E-03	5,62E-03	2,31E-02	4,84E-04	3,07E+04
A3	2,69E+02	2,52E+02	1,63E+01	1,31E-03	3,15E-07	-1,53E-02	7,56E-03	5,98E-02	1,91E-03	2,54E-01	4,55E-02	6,89E-04	2,88E+02
A1-A3	-4,96E+01	-9,54E+01	4,15E+01	4,23E+00	4,97E-03	1,37E-01	4,94E-01	6,65E-01	6,61E-02	3,56E-01	8,87E+00	3,02E-03	3,22E+04

GWP total = Global Warming Potential
GWP-biogenic = Global Warming Potential - biogenic
GWP-luluc = Global Warming Potential - luluc
GWP-fossil = Global Warming Potential - fossil
ODP = degradation potential of the stratospheric. Ozone layer
POCP = Formation potential for tropospheric ozone.
AP = Acidification Potential, cumulative exceedance
EP-terrestrial = Eutrophication potential - land
EP-freshwater = Eutrophication potential - Freshwater
EP-marine = Eutrophication potential - saltwater
WDP = Water Depletion Potential (User)
ADPE = Potential for the abiotic degradation of non-fossil resources
ADPF = Potential for abiotic degradation of fossil fuels
MNR = Module not relevant
MB = Module described
ND = not declared

PART C INTERPRETATION OF THE LIFE CYCLE ASSESSMENT

Part *C summarizes and interprets* selected results of the life cycle assessment (*Tables A.1 – B.3*) in the form of bar charts for the parameters primary energy input (PEI) and greenhouse gas potential (GWP 100), as well as for the post-use module IM C3 and the recovery potentials in IM D1 – D3 (*Figs. C.1 – C.3, Tables C.3.1 – C.3.3)* .

C.1 Primary energy use

The average values for PEI in the inventory (*Table A.1*) are based on evaluated manufacturer data relating to the entire year 2025.

The primary energy input PEI totals 12.000 MJ/m³ LP, of which 10.500 MJ/m³ or 88% comes from renewable energy sources *(Fig. C.1).*

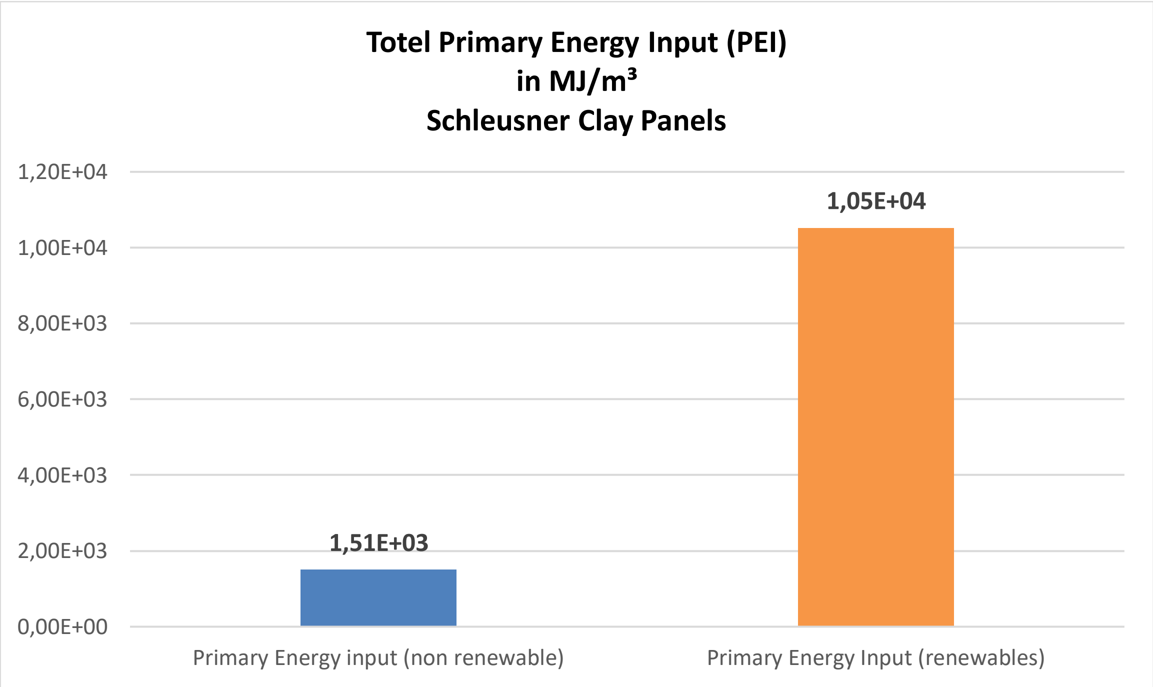

Fig. C.1 Primary energy input (PEI) of the declared LP in MJ/m³

Wood chips for heat generation and drying of the clay panels and the production of hemp shives account for the majority of renewable energy inputs, at 8.950 MJ/m³ LP, or approximately 75% *(Fig. C.2)*. In addition to the drying energy mainly from the use of wood for energy, the manufacturing process requires 2.920 MJ/m³ LP for the plant's share of electricity, diesel, and natural gas consumption. The clay panel raw materials consist of 73 M.-% secondary clayed soil excavation, 3 M.-% mineral aggregates, and 4 M.-% recycled mineral aggregates. All mineral raw materials contribute a total of 11,9 MJ/m³ LP to the total energy inputs. The provision of the secondary clay soil excavation and the recycled mineral aggregates remain outside the system; only the transport to the plant is declared. The transport to the factory consumes a total of 51,6 MJ/m³ LP.

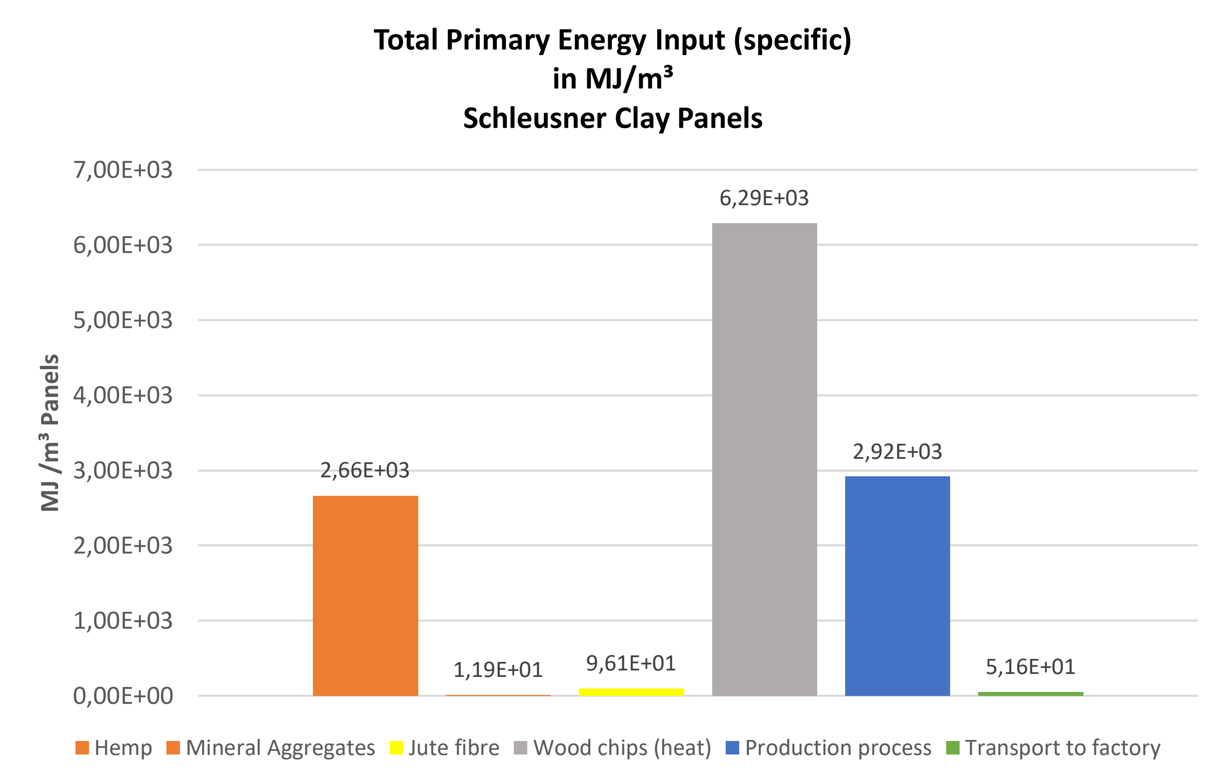

Fig. C.2 Distribution of primary energy input (PEI) for LP according to Table 2.1

C.2 Global Warming Potential (GWP)

The hemp shives and jute reinforcement used in the LP mixture contain sequestered CO_2, which was included in the calculation at -1,07 kg CO_2 per kg of these raw materials, resulting in a total of -90,2 kg $CO_{2\ equiv.}$/m³ LP.

The wood chips used for drying the LP contains also sequestered CO_2 from carbon via photosynthesis. With an average moisture content of 12% in the wood chips, this results in a CO_2 net-content of 1,39 kg CO_2 / kg wood chips according to the following stoichiometric calculation: C content 38 kg x 44/12 = 1.39 kg CO_2 . Sequestered CO_2 is credited as part of the raw materials (IM A1) and charged to IM A3 when used for heat generation during drying process.

This results in an overall negative greenhouse potential (GWP total) from the raw material to the factory gate (IM A1 – A3) of -4.96E+01 kg CO $_{2equiv}$/m³ LP.

For better comparability, it is recommended to convert the GWP to $CO_{2\ eq.}$ /m². With a bulk density of 680 kg/m³ and an average of 13 kg/m², this results in an *area-related* GWP of an average of -0.95 kg $CO_{2\ equivalent}$ /m² of LP.

In *Fig. C.3*, the manufacturing process in IM A3 totals 2.69E+02 kg $CO_{2\ equiv}$ / m³ LP, of which 86% is due to CO_2 emissions from wood chip combustion. The remainder is the electricity mix, natural gas, and diesel fuel used in the plant distributed proportionally, based on mass, between production lines in the factory *(mass allocation)*.

All transports to the plant, including secondary raw materials, together cause 3.63E+00 kg CO $_{2equiv}$/m³ LP.

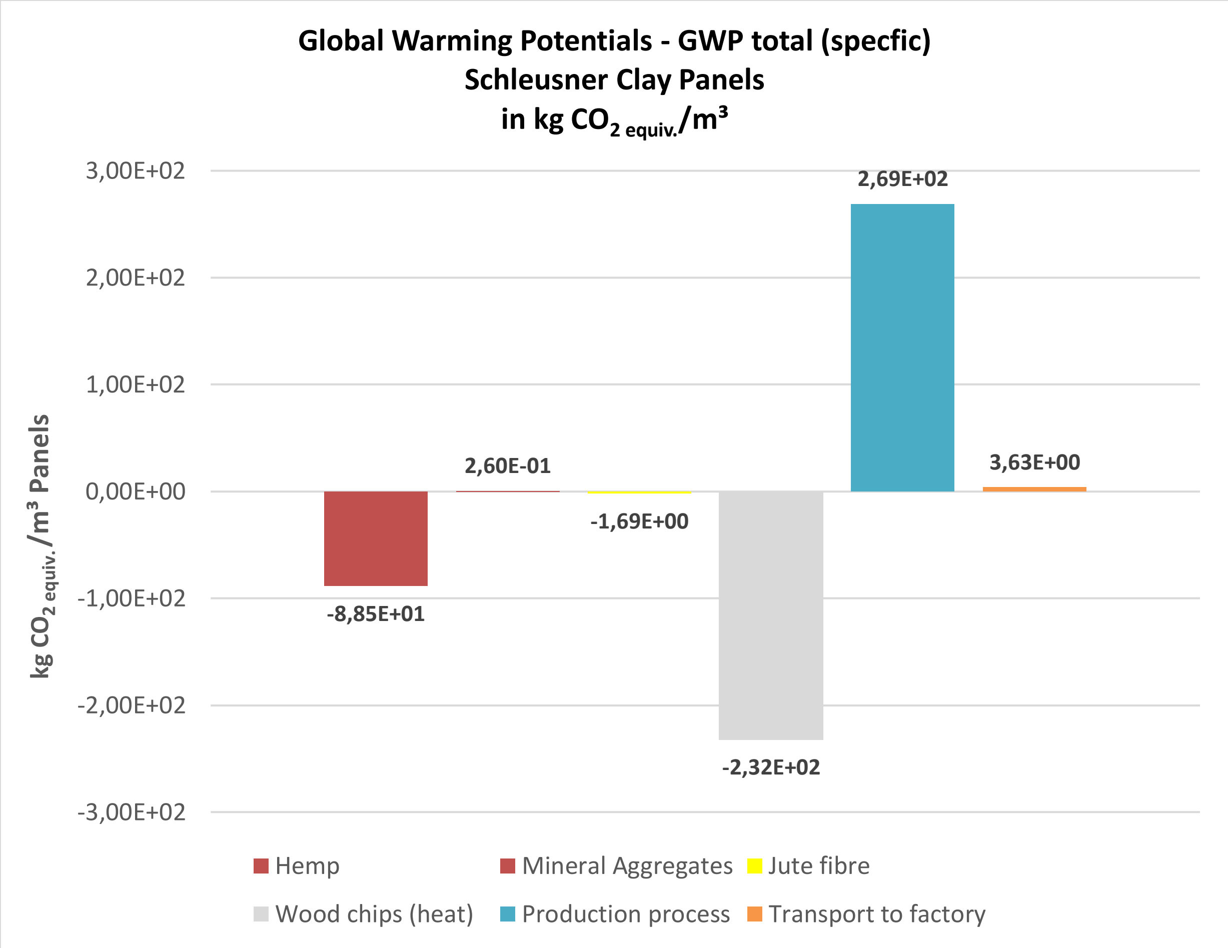

Fig. C.3 Distribution of greenhouse gas potentials (GWP) according to IM A1 – A3 for LP according to Table 2.1

C. 4 Processing (IM C3) and recovery (Module D)

Disassembled LP can generally be reused without further processing. Like all clay building materials LP can also be repaired with suitable clay-based repair products. Cracks that may occur during disassembly/dismantling can be filled and smoothed. Assuming this application practice, the recovery potential of reuse in *D1* is calculated with an assumed disassembly/dismantling loss of 5 M.-%.

Experiments and laboratory analyses on the potential processing of LP demolition material were carried out at the Potsdam University of Applied Sciences [19][20]. This demonstrated for the first time the fundamental feasibility of such processing and the reuse of recovered resources. The processing of the LP demolition material was tested using two methods:

- Soaking ("soaking") of the LP demolition material (*wet process*),

- mechanical, machine-based crushing of the demolition material *(dry process)* into recycling clay.

The processing of LP demolition material can be carried out as part of the in-plant recycling process using a *wet process* . However, it is not yet possible to meaningfully quantify the balance data for the wet process because no industrial process technology is currently known.

In the *dry process*, the original product shape of the LP is destroyed by mechanical comminution *(IM C3)* and processed into dried primary recycling clay.

Dry processing techniques are mechanical comminution processes using stationary or mobile machines, whose performance data can be used for evaluation in IM C3. This processing technique opens up additional recovery potential for resource reuse in new clay-based building materials other than building products outside the the declared clay-based product system. To assess the net effect of this recovery process, its primary energy input (PEI) and its global warming potential (GWP) are determined in order to compare these with the savings potential of reuse in other clay-based building materials (e.g. LPM).

A typical impact mill for construction material recycling was selected, with a diesel consumption of 0,23 l/t including an electric power generator. Such impact mills primarily crush materials harder than clay, such as concrete. Therefore, the consumption assumed here for LP is likely to be overestimated, but will be retained *(worst case)*. An additional air classifier with a 30 kW output and a throughput of 80 t/h separates lighter hemp components from heavier mineral components. A combined dry processing system consisting of a shredder and air classifier consumes 0,27 l diesel per ton of material throughput.

Fig. C.7 refers to the actual energy and impact factors for waste processing without the balancing of bound biogenic CO_2 prescribed by EN 15804. In recovery scenario D2, this actual value of the mechanical comminution of LP is applied.

Figure C.7 shows two key figures for the IM C3: the PEI for diesel operation with the assumed processing technology is 9,82E-03 MJ/kg LP demolition waste, or, converted to the declared unit m³, 6,34 MJ/m³ LP demolition waste. The GWP for diesel operation with the assumed processing technology is 9,52E-05 kg $CO_{2\ equiv.}$ / kg LP processing. This corresponds to a total GWP value of 0,0615 kg $CO_{2\ equivalent}$ /m³ LP processing.

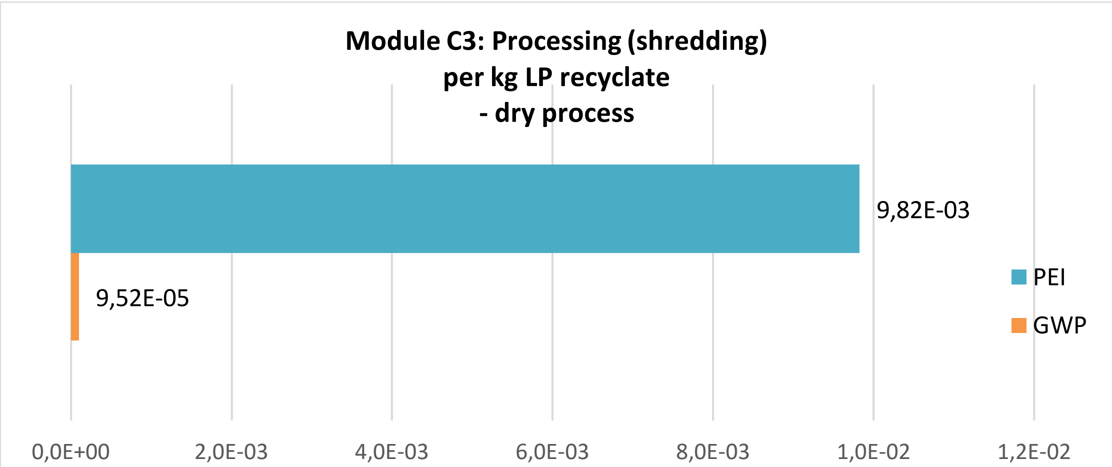

Fig. C.7 PEI and GWP for dry processing of LP demolition material

The sequestered biogenic CO_2 in plant parts from IM A1 (hemp shives, jute fabric) is neutralized again in IM C3 (see Table D3 in Appendix Part D). The sequestered CO_2 in wood chips for energy use is neutralized in IM A3 when used for heat production during drying *(Table B.3)*.

C.6 Recovery Scenarios

The following section evaluates two recovery scenarios, D1 and D2, for LP:

D1 : Non-destructive dismantling of LP with a loss of 5M.-% during renovations or prior to building demolition for reuse (*Table C.3.1*). In *D1*, the sequestered CO_2 from the plant components remains in the product and is not released.

D2 : Crushing/shredding of LP demolition debris and dry processing according to IM C3 for the recycling of the dry recovered mineral raw materials dry clay and aggregate (*Table C.3.3*). The recovery scenario *D2* is based on the mass fractions of the mineral raw materials clay excavation (73% by mass) and aggregate (7% by mass).

C.6.1 Scenario D1 – Product Reuse

Table C.6.1 illustrates the recovery potential in IM D1, assuming a 95% recovery rate during LP disassembly. The manufacturer offers a voluntary take-back program for LPs claimed in the data sheets. Manual disassembly in IM C1 does not generate any quantifiable energy or material flows. There is no reprocessing (IM C3).

Table C. 6.1 Recovery potential – Reuse of dismantled LP

Scenario D 1: Reuse of dismantled LP per m³ LP					
680 kg/m³	**parameter**	**PERT** regular primary energy	**PENRT** non-regulated primary energy	**PEI (total)**	**GWP (total)**
	Units	MJ H_u	MJ H_u	MJ H_u	kg CO_2equiv.
Dismantling/removal; manual	**C1**	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste treatment shredding	**C3**	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Reusing LPs	**D1**	-9,99E+03	-1,40E+03	-1,14E+04	-1,88E+02

Under this condition, LP- reuse can save a large part of the energy input otherwise required for newly produced LP, amounting to an average of 11.400 MJ/m³ LP (calculated according to IM A1 and A3 without A2). Reusing LP potentially avoids 188 kg $CO2_{equiv}$/m³ LP due to the avoided GWP emissions resulting from drying with wood chips in IM A3.

C.6.2 Scenario D2 – Resource reuse

Table C.6.2 shows the environmental indicators PEI and GWP for the reuse of the clayey soil excavation (73% by mass) and aggregate (7% by mass) contained in the LP (low-pressure clay) as a substitute for clay-based products manufactured using dry dosing methods (e.g., dry clay plaster acc. DIN 18947). This scenario assumes a mass loss of 5 M.-%. The homogeneous composition of clay building materials according to DIN 18945-18948 facilitates resource reuse within the clay-based product system.

To calculate the recovery potentials from the recycling of dry mineral raw materials from LP demolition, environmental balance data and the 2025 sustainability report of a manufacturer for these dry mineral components could be used [17][18] .

Table C.6.2 LP Recovery Potentials D2 – Resource reuse

Scenario D 2: Resources of dismantled LPs per m³ LP					
680 kg/m³	**parameter** **Units**	**PERT** regular primary energy MJ H u	**PENRT** non-regulated primary energy MJ H u	**PEI (total)** MJ H u	**GWP (total)** kg CO2equiv.
Dismantling/removal; manual	**C1**	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste treatment/shredding	**C3**	4,14E-02	6,30E+00	6,34E+00	6,15E-02
Recycling as LPM (Dry dosing method)	**D2**	-1,13E+01	-5,48E+02	-5,59E+02	-3,27E+01

The powdery, dry-recovered and crushed mineral components from LP demolition are suitable for dry dosing processes, such as those used for LPM (clay plaster acc. DIN 18947). The drying process of damp clay alone requires a PEI of 6,34 MJ/ kg of dry clay. Substituting dried mineral feedstock for new dry clay building materials with dry-recycled LP demolition saves 559 MJ/m³ of LP demolition in PEI for the provision of dried feedstock (clay/sand). The substitution effect according to scenario *D2* avoids greenhouse gas emissions (GWP) of 32.7 kg $CO_{2\ equivalent}$ /m³ of LP demolition (*Table C.6.2*). Taking into account the dry processing technique *(IM C.3)*, a net avoidance effect of GWP of 32.6 kg CO2equiv / m³ LP demolition or > 99% remains.

D. APPENDIX OF TABLES

Section *D* presents the input, effect and output factors for the LPs (Nos. 01 – 03, *Table 2.1*) produced according to the described shaping process in tabular form according to DIN EN 15824.

D.1 Input factors

In *section D.1*, the input factors for the declared LP are presented in tabular form in *table D.1* .

Tab. D.1 Hemp-clay panels Schleusner, band-painted, input factors

Declaration of EPD-Parameter (LCA)												
Hemp-Clay Panels Schleusner												
Functional Unit m³: 680kg/m³		**Parameter**	**PERE**	**PERM**	**PERT**	**PENRE**	**PENRM**	**PENRT**	**SM**	**RSF**	**NRSF**	**FW**
		IM/Einheit	MJ H_u	MJ H_u	MJ H_u	MJ H_u	MJ H_u	MJ H_u	kg	MJ H_u	MJ H_u	m^3
Production stage	Raw Materials	**A1**	7,85E+03	4,50E+01	7,89E+03	1,16E+03	8,58E+00	1,17E+03	8,14E+00	0,00E+00	0,00E+00	2,40E-01
	Transport	**A2**	4,51E+00	0,00E+00	4,51E+00	4,71E+01	0,00E+00	4,71E+01	0,00E+00	0,00E+00	0,00E+00	4,16E-03
	Manufacturing	**A3**	2,63E+03	0,00E+00	2,63E+03	3,04E+02	0,00E+00	3,04E+02	0,00E+00	0,00E+00	0,00E+00	4,43E-03
	Total (cradle to gate)	**A1-A3**	1,05E+04	4,50E+01	1,05E+04	1,51E+03	8,58E+00	1,52E+03	8,14E+00	0,00E+00	0,00E+00	2,49E-01
Usage stage	Use	**B1**	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Maintenance	**B2**	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Repair	**B3**	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Replacement	**B4**	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Renewal	**B5**	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Operational Energy Use	**B6**	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
	Operational Water Use	**B7**	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
End-of-life Stags	Demolition/Dismantling	**C1**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	**C2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Waste Processing, Shredding	**C3**	4,14E-02	0,00E+00	4,14E-02	6,30E+00	0,00E+00	6,30E+00	0,00E+00	0,00E+00	0,00E+00	2,96E-05
	Landfil	**C4**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Recovery Potentials	Reuse as LP	**D1**	-9,95E+03	-4,27E+01	-9,99E+03	-1,39E+03	-8,15E+00	-1,40E+03	-7,74E+00	0,00E+00	0,00E+00	-2,32E-01
	Resource use, e.g. for LPM	**D2**	-1,13E+01	0,00E+00	-1,13E+01	-5,48E+02	0,00E+00	-5,48E+02	0,00E+00	0,00E+00	0,00E+00	-1,11E-02

PERE = Renewable Primary Energy (PE)
PERM = Renewable PE for material use
PERT = Total of renewable PE
PENRE = Non-renewable PE as an energy source
PENRM = Non-renewable PE for material use
PENRT = Total of non-renewable PE
SM = Use of secondary materials
RSF = Renewable Secondary Fuels
NRSF = Non-renewable secondary fuels
FW = Use of freshwater resources
MB = Module described
MNR = Module not relevant
ND = not declared

D.2 Output factors

In *section D.2*, the output factors for the declared LP are presented in tabular form in *Table D 2* .

Tab. D.2 Hemp-clay panels Schleusner, band-coated, output factors

Declaration of EPD-Parameter (LCA)											
Hemp-Clay Panels Schleusner											
Functional Unit m³ : 680kg/m³		**Parameter**	**HWD**	**NHWD**	**RWD**	**CRU**	**MFR**	**MER**	**EEE**	**EET**
		IM/Einheit	kg	kg	kg	kg	kg	kg	MJ	MJ
Production stage	Raw Materials	**A1**	2,05E-04	4,47E-01	6,22E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	**A2**	1,52E-06	7,67E-03	7,07E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Manufacturing	**A3**	6,42E-05	9,59E-02	3,40E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Total (cradle to gate)	**A1-A3**	2,71E-04	5,51E-01	4,03E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Usage stage	Use	**B1**	MB	MB	MB	MB	MB	MB	MB	MB
	Maintenance	**B2**	MB	MB	MB	MB	MB	MB	MB	MB
	Repair	**B3**	MB	MB	MB	MB	MB	MB	MB	MB
	Replacement	**B4**	MB	MB	MB	MB	MB	MB	MB	MB
	Renewal	**B5**	MB	MB	MB	MB	MB	MB	MB	MB
	Operational Energy Use	**B6**	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
	Operational Water Use	**B7**	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
End-of-life Stags	Demolition/Dismantling	**C1**	0,00E+00	0,00E+00	0,00E+00	6,46E+02	3,40E+01	0,00E+00	0,00E+00	0,00E+00
	Transport	**C2**	ND	ND	ND	ND	ND	ND	ND	ND
	Waste Processing, Shredding	**C3**	1,05E-08	3,40E+01	5,79E-06	0,00E+00	6,46E+02	0,00E+00	0,00E+00	0,00E+00
	Landfil	**C4**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Recovery Potentials	Reuse as LP	**D1**	-2,56E-04	-5,16E-01	-3,82E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Resource use, e.g. for LPM	**D2**	-1,20E-05	-1,32E+00	-5,24E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste

NHWD = Dispose of non-hazardous waste

RWD = Dispose of radioactive waste

CRU = Components for Reuse

MFR = Materials for Recycling

MER = Materials for energy recovery

EEE = Exported electrical energy

EET = Exported thermal energy

MNR = Module not relevant

MB = Module described

ND = not declared

D.3 Environmental impact factors

In *section D.3*, the environmental impact factors for the declared LP are presented in tabular form in *Table D 3 .*

Tab. D.3 Hemp-clay panels Schleusner, band-coated, environmental impact factors

Declaration of Environmental Impact (LCA)															
Hemp-Clay Panel Schleusner															
Funktionale Einheit m³ : 680kg/m³		Parameter	GWP total	GWP-biogenic	GWP-luluc	GWP-fossil	ODP	POCP	AP	EP-terrestrial	EP-fresh-water	EP-marine	WDP	ADPE	ADPF
		IM/Einheit	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CFC-11 eq.	kg NMVOC eq.	Mole of H+ eq.	Mole of N eq.	kg P eq.	kg N eq.	m³ world eq.	kg Sb eq.	MJ H_u eq.
Produkt-stadium	Ausgangsstoffe	A1	-3,22E+02	-3,48E+02	2,28E+01	2,96E+00	4,96E-03	1,44E-01	4,75E-01	5,42E-01	5,49E-02	9,71E-02	8,81E+00	1,84E-03	1,16E+03
	Transport	A2	3,63E+00	8,13E-03	2,35E+00	1,27E+00	8,91E-10	8,14E-03	1,22E-02	6,35E-02	9,23E-03	5,62E-03	2,31E-02	4,84E-04	3,07E+04
	Herstellung	A3	2,69E+02	2,52E+02	1,63E+01	1,31E-03	3,15E-07	-1,53E-02	7,56E-03	5,98E-02	1,91E-03	2,54E-01	4,55E-02	6,89E-04	2,88E+02
	Summe (cradle to gate)	A1-A3	-4,96E+01	-9,54E+01	4,15E+01	4,23E+00	4,97E-03	1,37E-01	4,94E-01	6,65E-01	6,61E-02	3,56E-01	8,87E+00	3,02E-03	3,22E+04
Nutzungs-stadium	Nutzung	B1	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Instandhaltung	B2	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Reparatur	B3	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Ersatz	B4	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Erneuerung	B5	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB	MB
	Betriebliche Energienutzung	B6	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
	Betriebliche Wassernutzung	B7	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--	MNR--
Entsorgungs-stadium	Demontage, Abriss; manuell	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Aufbereitung, Auflösung GWP bionic	C3	9,63E+01	9,62E+01	9,92E-06	6,07E-02	7,65E-11	1,55E-04	1,75E-04	3,55E-04	9,49E-05	3,24E-05	4,84E-04	5,01E-06	6,30E+00
	Deponierung	C4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Rückgewinnungs-potenziale	Wiederverwendung LP	D1	-1,88E+02	-1,48E+02	-3,72E+01	-2,81E+00	-4,72E-03	-1,23E-01	-4,58E-01	-5,71E-01	-5,40E-02	-3,33E-01	-8,41E+00	-2,41E-03	-1,38E+03
	Wiederverwertung LPM	D2	-3,27E+01	-7,31E-02	-1,77E-03	-3,27E+01	-4,71E-09	-2,57E-02	-2,02E-02	-1,01E-01	-3,51E-03	-9,13E-03	-1,55E-01	-3,71E-04	-5,48E+02

GWP total = Global Warming Potential
GWP-biogenic = Global Warming Potential - biogenic
GWP-luluc = Global Warming Potential - luluc
GWP-fossil = Global Warming Potential - fossil
ODP = degradation potential of the stratospheric. Ozone layer
POCP = Formation potential for tropospheric ozone.
AP = Acidification Potential, cumulative exceedance
EP-terrestrial = Eutrophication potential - land
EP-freshwater = Eutrophication potential - Freshwater
EP-marine = Eutrophication potential - saltwater
WDP = Water Depletion Potential (User)
ADPE = Potential for the abiotic degradation of non-fossil resources
ADPF = Potential for abiotic degradation of fossil fuels
MNR = Module not relevant
MB = Module described
ND = not declared

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