Finanziato dall'Unione europea NextGenerationEU

Ministero della Salute

Italiadomani – Piano Nazionale di Ripresa e Resilienza

Sistema Socio Sanitario Regione Lombardia ASST Mantova

PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR)

M6.C1 - 1.2.2 Implementazione di un nuovo modello organizzativo: centrali operative territoriali

CENTRALE OPERATIVA TERRITORIALE NEL COMUNE DI CASTIGLIONE DELLE STIVIERE (MN) - CUP E25F21001580002

Soggetto Attuatore Delegato: Regione Lombardia AZIENDA ASST MANTOVA

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REALIZZAZIONE DELLA CASA DI COMUNITA' NEL COMUNE DI CASTIGLIONE DELLE STIVIERE (MN)

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DIREZIONE LAVORI

ELABORATI GENERALI

Relazione sulla sostenibilità ambientale DNSH

Emissione/revisione	Data	Riferimento emissione/revisione

Scala	File di riferimento		Codice commessa	Fase	Argomento	Categoria	Elaborato	Revisione
- -	22.21.PE.G.00.01.01		22.21	DL	G	00	05	00
Data		Redatto Ing. Lorenzo Marini	Controllato	Verificato		Approvato Ing. Nicola Freddi		

ATTESTAZIONE CONFORMITA' REQUISITI "DO NO SIGNIFICANT HARM" (DNSH) intervento di "REALIZZAZIONE CENTRALE OPERATIVA TERRITORIALE NEL COMUNE DI CASTIGLIONE DELLE STIVIERE (MN)"

PROGETTO FINANZIATO DALL'UNIONE EUROPEA - NEXT GENERATION EU- NELL'AMBITO DEL PNRR

Missione 6 Componente 1 Investimento 1.2.2

CUP: E25F21001580002 - CIG del contratto specifico: 9743306E74

Finanziato dall'Unione europea
NextGenerationEU

S.A.L. N.3 AL 06/02/2026

0. SOMMARIO

1. PREMESSA

La presente relazione è redatta in applicazione e secondo gli orientamenti tecnici stabiliti dalla Commissione nel documento *"Orientamenti tecnici sull'applicazione del principio "non arrecare un danno significativo" a norma del regolamento sul dispositivo per la ripresa e la resilienza".*

Il Dispositivo per la ripresa e la resilienza (Regolamento UE 241/2021) stabilisce che tutte le misure dei Piani nazionali per la ripresa e resilienza (PNRR) debbano soddisfare il principio di "non arrecare danno significativo agli obiettivi ambientali". Tale vincolo si traduce in una valutazione di conformità degli interventi al principio del "Do No Significant Harm" (DNSH), con riferimento al sistema di tassonomia delle attività ecosostenibili indicato all'articolo 17 del Regolamento (UE) 2020/852.

Il principio DNSH, declinato sui sei obiettivi ambientali definiti nell'ambito del sistema di tassonomia delle attività ecosostenibili, ha lo scopo di valutare se una misura possa o meno arrecare un danno ai sei obiettivi ambientali individuati nell'accordo di Parigi (Green Deal europeo). In particolare, un'attività economica arreca un danno significativo:

• alla mitigazione dei cambiamenti climatici, se porta a significative emissioni di gas serra (GHG);

• all'adattamento ai cambiamenti climatici, se determina un maggiore impatto negativo del clima attuale e futuro, sull'attività stessa o sulle persone, sulla natura o sui beni;

• all'uso sostenibile e protezione delle risorse idriche e marine, se è dannosa per il buono stato dei corpi idrici (superficiali, sotterranei o marini) determinandone il loro deterioramento qualitativo o la riduzione del potenziale ecologico;

• alla transizione verso un'economia circolare, inclusa la prevenzione, il riutilizzo ed il riciclaggio dei rifiuti, se porta a significative inefficienze nell'utilizzo di materiali recuperati o riciclati, ad incrementi nell'uso diretto o indiretto di risorse naturali, all'incremento significativo di rifiuti, al loro incenerimento o smaltimento, causando danni ambientali significativi a lungo termine;

• alla prevenzione e riduzione dell'inquinamento, se determina un aumento delle emissioni di inquinanti nell'aria, nell'acqua o nel suolo;

• alla protezione e al ripristino di biodiversità e degli ecosistemi, se è dannosa per le buone condizioni e resilienza degli ecosistemi o per lo stato di conservazione degli habitat e delle specie, comprese quelle di interesse per l'Unione europea.

L'obbiettivo del seguente investimento persegue l'impegno di non:

• produrre significative emissioni di gas ad effetto serra, tali da non permettere il contenimento dell'innalzamento delle temperature di 1,5 C° fino al 2030. Sono pertanto escluse iniziative connesse con l'utilizzo di fonti fossili;

• essere esposte agli eventuali rischi indotti dal cambiamento del Clima, quali ad es. innalzamento dei mari, siccità, alluvioni, esondazioni dei fiumi, nevicate abnormi;

• compromettere lo stato qualitativo delle risorse idriche con una indebita pressione sulla risorsa;

• utilizzare in maniera inefficiente materiali e risorse naturali e produrre rifiuti pericolosi per i quali non è possibile il recupero;

• introdurre sostanze pericolose, ad es. quelle elencate nell'Authorization List del Regolamento Reach;

• compromettere i siti ricadenti nella rete Natura 2000.

Oltre al principio generale secondo il quale tutti gli interventi del PNRR devono rispettare il DNSH, almeno il 37% delle risorse complessive del Piano sono destinate alla transizione verde e alla mitigazione dei cambiamenti climatici, compresa la biodiversità, come definito dall'obiettivo ambientale cd. tagging climatico. Le misure che contribuiscono all'obiettivo ambientale sono individuate sulla base di una classificazione dei campi di intervento definita nell'ambito del Dispositivo per la ripresa e resilienza. A ciascun campo d'intervento è associato un coefficiente di sostegno pari a 0%, 40% o 100%. Le misure con coefficiente di sostegno pari al 100% dovranno ulteriormente dimostrare il loro contributo all'obiettivo ambientale tramite elementi di verifica più cogenti.

L'obiettivo di intervento è la realizzazione di una Centrale Operativa Territoriale - COT, in coerenza con quanto definito dal Piano Nazionale di Ripresa e Resilienza per la missione **M6 - Componente 1, Investimento 1.2.2: ''implementazione di un nuovo modello organizzativo: centrali operative territoriali''.**

Dalla mappatura, l'intervento ricadrebbe quindi in **Regime 2**, ma poiché la nuova centrale operativa territoriale si inserisce all'interno di un intervento più ampio, collocandosi in una parte del secondo piano della nuova casa della salute, l'intervento seguirà il regime previsto per l'intera costruzione, quindi Regime 1, ovvero l'investimento deve ''**contribuire sostanzialmente al raggiungimento dell'obiettivo della mitigazione dei cambiamenti climatici**'', rispettando i principi del DNSH **(Regime1).** Le procedure dovranno presentare una domanda di energia primaria globale non rinnovabile inferiore al 20% alla domanda di energia primaria non rinnovabile risultante dai requisiti NZEB (nearly zero-energy building). **La realizzazione dell'opera dovrà quindi, rispondere e rispettare le verifiche della *Scheda 1 - Costruzione di nuovi edifici.***

Si utilizza, per la presente relazione, la scheda tecnica che contiene le informazioni utili a consentire la verifica e il rispetto del principio DNSH in relazione ai 6 obiettivi ambientali.

Tale scheda è accompagnata da una CHECK LIST di controllo, che sintetizza i controlli da effettuare per garantire il principio DNSH.

2. DESCRIZIONE DELL'INTERVENTO

Come precedentemente spiegato, l'intervento di realizzazione della nuova Centrale Operativa Territoriale, si inserisce all'interno di un investimento più ampio che consiste nella realizzazione del complesso atto ad ospitare anche la nuova Casa di Comunità. La COT, infatti, si svilupperà su parte del secondo piano dell'edificio.

Il progetto d'insieme, oltre alla costruzione del nuovo edificio, comprende anche la sistemazione delle aree esterne di pertinenza a quest'ultimo. L'obiettivo di progetto, da perseguire per le aree esterne, consiste nel minimizzare le superfici pavimentate impermeabili, conservare e integrare il più possibile i servizi ad oggi esistenti nel contesto (fermata autobus, parcheggi disabili e parcheggi utenti) e realizzare i percorsi strettamente necessari. Il risultato è un masterplan lineare, poco invasivo e collegato agli accessi pedonali esistenti, senza stravolgere quindi la viabilità. La nuova struttura, composta da tre piani fuori terra, rispetta le distanze minime, pari a 5 metri, dai confini sul lato nord, sud ed est, mentre sul lato ovest rispetta la distanza pari a 10 mt dal bordo del canale Arnò (fascia di rispetto del reticolo idrografico Regionale - RD n. 523 del 1904). **L'obiettivo è creare un edificio accattivante che arricchisca la città con nuovi servizi, senza compromettere la funzionalità dell'area cittadina interessata, ma valorizzandola attraverso percorsi più sicuri e facilmente individuabili.**

L'intervento riguarda la realizzazione di una Centrale Operativa Territoriale all'interno di una Casa di Comunità, quale luogo che consente di potenziare e organizzare i servizi offerti sul territorio, migliorandone la qualità, diventando lo strumento attraverso cui coordinare tutti i servizi offerti, in coerenza con quanto definito dal

Piano Nazionale di Ripresa e Resilienza.

Il nuovo edificio verrà realizzato con struttura in calcestruzzo armato con muri perimetrali in calcestruzzo aerato autoclavato. I tramezzi saranno fatti con tavolati in cartongesso a doppia lastra, che garantiscono velocità d'installazione, una migliore gestione del cantiere, ottimi requisiti di fonoisolamento e le necessarie prestazioni REI previste a progetto. Al suo interno ci sarà un pannello di isolamento in lana di vetro, così come per la stratigrafia dei solai di copertura, mentre contro terra si prevende uno strato di vetro cellulare.

I pavimenti saranno in latero cemento con materiali idonei, quali teli in pvc omogeneo (classe A1 nei corridoi) e piastrelle in gres nei locali bagni e spogliatoi e nei locali tecnici.

I serramenti interni saranno realizzati in alluminio anodizzato di tipo monoblocco in vetro e alluminio, completati da sistema di oscuramento interno, con trasmittanza termica Uw ≤ 1,30 W/mqK (adatto per applicazione in zona climatica E);

3. DESCRIZIONE DELLA LINEA DI FINANZIAMENTO PNRR

Il regime è stato scelto in fase di predisposizione del Piano Nazionale, sulla base dei tag previsti dall'All. VI del Regolamento istitutivo del Recovey Fund.

Nel caso specifico, l'intervento per la realizzazione della nuova Casa di Comunità e nuova **Centrale Operativa Territoriale** per il comune di Castiglione delle Stiviere (MN), rientrano all'interno del Piano Nazionale di Ripresa e Resilienza (PNRR), Missione SALUTE: M6 - Componente 1 – Investimento 1.1 Case della comunità e presa in carico della persona e Missione 6 – Componente 1 - Investimento 1.2.2 Implementazione di un nuovo modello organizzativo: centrali operative territoriali.

Come sopra descritto, l'intervento relativo alla COT ricade in Regime 2, ma visto e considerato che l'intervento principale e predominante (Casa di comunità), rientra in Regime 1 (quindi più restrittivo), tale Regime si applica all'intervento globale. Di conseguenza, anche la realizzazione della COT persegue l'obiettivo di ''**contribuire sostanzialmente al raggiungimento dell'obiettivo della mitigazione dei cambiamenti climatici**'', rispettando i principi del DNSH **(regime1).**

La realizzazione dell'opera dovrà quindi rispondere e rispettare le verifiche della *Scheda 1 - Costruzione di nuovi edifici.*

4. VERIFICA DEL RISPETTO DEI REQUISITI PER LE OPERE CONTABILIZZATE NEL SAL 3

DESCRIZIONE OPERE SAL 3

I documenti contabili relativi al terzo stato di avanzamento dei lavori di realizzazione della nuova C.O.T. in via Sacchi n. 3 a Castiglione delle Stiviere (MN), elaborati dal Direttore dei Lavori Ing. Nicola Freddi della società MAIN srl.

Gli stessi sono stati firmati, senza riserve, dall'ing. Dennis Foglio, delegato con procura speciale di rappresentanza dell'impresa esecutrice PAVONI S.p.A. (mandataria), in R.T.I. con l'impresa A.B.P. NOCIVELLI S.p.A. (mandante).

Il valore delle opere eseguite a tutto il 06 febbraio 2026 ammonta a euro 174.822,10 lordi, che al netto del ribasso d'asta di 12.88%, risultano 152.305,01 euro, oltre a 9.742,39 euro per oneri di sicurezza, per un totale netto di 162047.40 euro + iva 10% (euro 178.252,14 iva compresa).

Le opere eseguite sono elencate di seguito:

- Realizzazione solaio piano secondo (travi e solaio predalles);
- Cartongessi
- Movimenti terra opere esterne
- Impianti elettrici

5. VERIFICA TIPOLOGIA DI INTERVENTO SECONDO I PRINCIPI DNSH E I SUOI VINCOLI – SCHEDA 1

TIPOLOGIA DI VERIFICA:
nuova costruzione, da assimilare alla categoria:
COSTRUZIONE DI NUOVI EDIFICI

Di seguito si riportano esclusivamente i requisiti richiesti nella scheda tecnica 1 – *costruzione di nuovi edifici*, pertinente alle lavorazioni computate nello stato di avanzamento lavori 3.

6.1 Mitigazione del cambiamento climatico

6.1.1 Elemento di controllo 1

L'edificio non è adibito all'estrazione, allo stoccaggio, al trasporto o alla produzione di combustibili fossili?

Non sono ammessi edifici ad uso produttivo o similari destinati a:

• estrazione, lo stoccaggio, il trasporto o la produzione di combustibili fossili, compreso l'uso a valle;

• attività nell'ambito del sistema di scambio di quote di emissione dell'UE (ETS) che generano emissioni di gas a effetto serra previste non inferiori ai pertinenti parametri di riferimento;

• attività connesse alle discariche di rifiuti, agli inceneritori e agli impianti di trattamento meccanico biologico.

VERIFICA: Si conferma che l'edificio non è soggetto ai fini riportati in questo elemento di controllo.

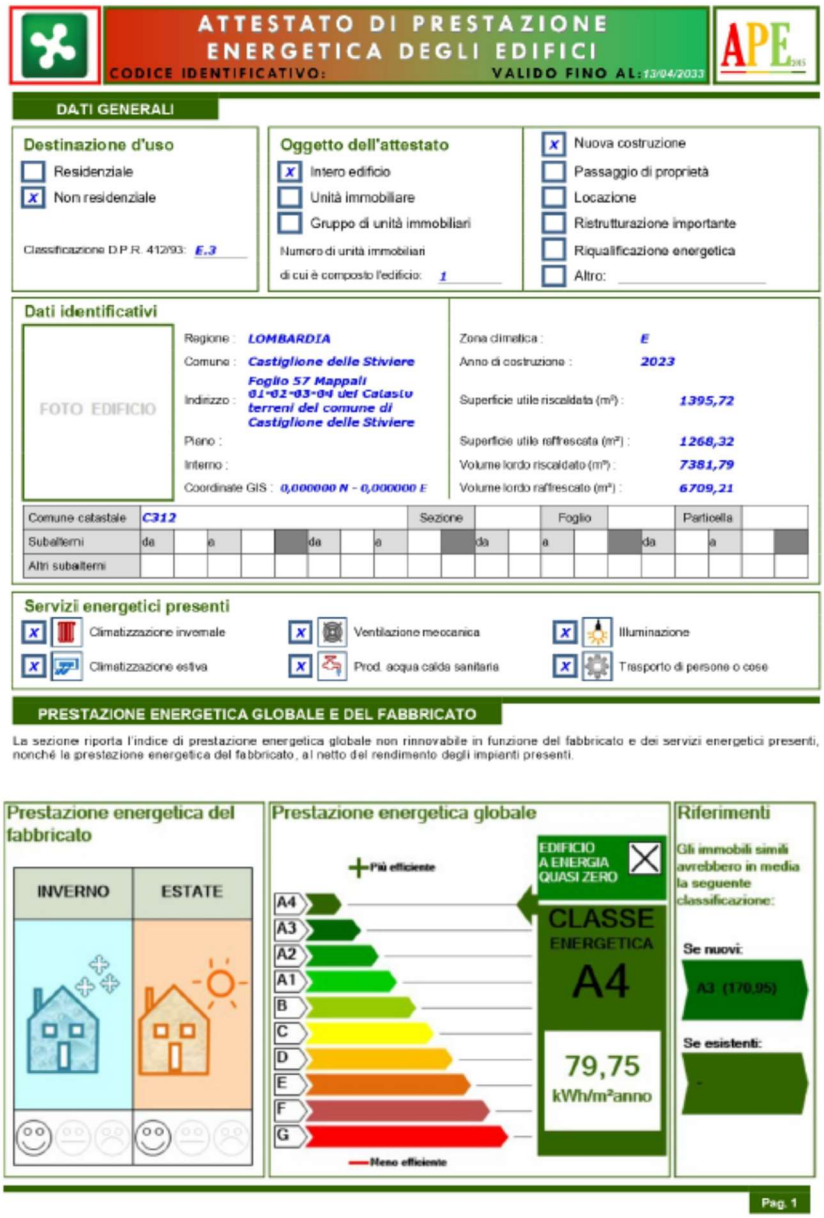
6.1.2 Elemento di controllo 2

Il fabbisogno di energia primaria (EPgl,tot) che definisce la prestazione energetica dell'edificio risultante dalla costruzione è almeno del 20% inferiore alla soglia fissata per i requisiti degli edifici a energia quasi zero (NZEB, Nearly Zero-Energy Building).

La soglia fissata per i requisiti degli edifici corrisponde al 40% del fabbisogno di energia primaria dell'edificio di riferimento (EPgl,tot, limite) calcolato secondo i parametri energetici, le caratteristiche termiche e di generazione dati nelle pertinenti tabelle del Capitolo 1 dell'Appendice A del Decreto interministeriale 26 giugno 2015 - Applicazione delle metodologie di calcolo delle prestazioni energetiche e definizione delle prescrizioni e dei requisiti minimi degli edifici, contrassegnate dall'indicazione 2019/21.

È stata sviluppata una relazione della ex Legge 10 che segue e rispetta i parametri stabiliti nel Decreto interministeriale 26 giugno 2015, arrivando a un fabbisogno di energia primaria inferiore a 31% del EPgl, tot, limite per la Casa di comunità. Pertanto, soddisfano il requisito di riduzione del 20% del fabbisogno di energia primaria dell'edificio di riferimento (EPgl,tot, limite).

Di seguito si riporta l'APE ex post di simulazione allegata al progetto esecutivo:



ATTESTATO DI PRESTAZIONE ENERGETICA DEGLI EDIFICI

CODICE IDENTIFICATIVO: VALIDO FINO AL: 13/04/2033

APE

DATI GENERALI

Destinazione d'uso
- [ ] Residenziale
- [x] Non residenziale

Classificazione D.P.R. 412/93: E.3

Oggetto dell'attestato
- [x] Intero edificio
- [ ] Unità immobiliare
- [ ] Gruppo di unità immobiliari

Numero di unità immobiliari di cui è composto l'edificio: 1

- [x] Nuova costruzione
- [ ] Passaggio di proprietà
- [ ] Locazione
- [ ] Ristrutturazione importante
- [ ] Riqualificazione energetica
- [ ] Altro:

Dati identificativi

FOTO EDIFICIO

Regione: LOMBARDIA
Comune: Castiglione delle Stiviere
Indirizzo: Foglio 57 Mappali 81-82-83-84 del Catasto terreni del comune di Castiglione delle Stiviere
Piano:
Interno:
Coordinate GIS: 0,000000 N - 0,000000 E

Zona climatica: E
Anno di costruzione: 2023
Superficie utile riscaldata (m²): 1395,72
Superficie utile raffrescata (m²): 1268,32
Volume lordo riscaldato (m³): 7381,79
Volume lordo raffrescato (m³): 6709,21

Comune catastale	C312	Sezione		Foglio		Particella	
Subalterni	da	a	da	a	da	a	da	a
Altri subalterni								

Servizi energetici presenti
- [x] Climatizzazione invernale
- [x] Climatizzazione estiva
- [x] Ventilazione meccanica
- [x] Prod. acqua calda sanitaria
- [x] Illuminazione
- [x] Trasporto di persone o cose

PRESTAZIONE ENERGETICA GLOBALE E DEL FABBRICATO

La sezione riporta l'indice di prestazione energetica globale non rinnovabile in funzione del fabbricato e dei servizi energetici presenti, nonché la prestazione energetica del fabbricato, al netto del rendimento degli impianti presenti.

Prestazione energetica del fabbricato

INVERNO | ESTATE

Prestazione energetica globale

+Più efficiente
A4
A3
A2
A1
B
C
D
E
F
G
—Meno efficiente

EDIFICIO A ENERGIA QUASI ZERO

CLASSE ENERGETICA A4

79,75 kWh/m²anno

Riferimenti

Gli immobili simili avrebbero in media la seguente classificazione:

Se nuovi: A3 (170,95)

Se esistenti:

Pag. 1

Asseverazione di soggetto abilitato attestante che l'indice di prestazione energetica globale non rinnovabile (EPgl,tot) dell'edificio è almeno del 20 % inferiore alla soglia fissata per i requisiti degli edifici a energia quasi zero (NZEB, Nearly Zero-Energy Building).

Il EPgl,tot è ridotto di almeno 30% per edificio rispetto all'EPgl,tot, limite che definisce il valore di riferimento per l'edificio NZEB.

VERIFICA: A fine lavori verrà redatto idoneo Attestato di Prestazione Energetica (APE), redatto ai sensi della normativa vigente.

Non pertinente in questa fase di costruzione.

6.2 Adattamento ai cambiamenti climatici

Come riportato nella relazione sull'attuazione del principio DNSH allegata agli elaborati progettuali, è stato eseguito un report di analisi dell'adattabilità, del quale si riporta di seguito, un estratto.

Per ovviare ai rischi legati alla temperatura (la variabilità della temperatura, l'onda di calore e la tromba d'aria) le soluzioni sono assicurate dall'involucro esterno e degli impianti. I muri in blocchi di laterizio alveolato con trasmittanza di 0,146 W/m^{2}K e i serramenti performanti in alluminio, con vetro triplo basso emissivo, e trasmittanza minore di 1,40 W/m^{2}K sostengono il comfort termico agli utenti all'interno dell'edificio.

Il progetto è localizzato fuori delle aree in pericolo di alluvione (come rilevato dai dati estratti dal geoportale della Lombardia), nonostante quello, con l'obiettivo di ridurre le possibili conseguenze dei rischi climatici di siccità e inondazione, è stato previsto un sistema di raccolta delle acque piovane nella copertura. La rete meteorica sarà composta da due linee principali: una raccoglierà le acque drenati dai pluviali per convogliarle alla vasca per il recupero e il riuso delle acque meteoriche, mentre la seconda riceverà le acque in esubero del sistema di recupero e raccoglierà le acque dei piazzali, per indirizzare il tutto alla vasca di laminazione.

VERIFICA: Non pertinente in questa fase di costruzione.

6.3 Uso sostenibile e protezione delle acque e delle risorse marine

Il progetto prevede l'installazione di dispositivi che consentano di ridurre i flussi e controllare la portata e la temperatura dell'acqua, garantendo una riduzione dei consumi dell'edificio del 30%, considerando:

- l'installazione di miscelatori con riduzione di flusso d'acqua per lavabi dei bagni e delle docce e a basso consumo d'acqua *6 1/min per lavandini, lavabi, bidet, 8 1/min per docce misurati secondo le norme UNI EN 816, UNI EN 15091;

- l'impiego di apparecchi sanitari con cassette a doppio scarico aventi scarico completo di massimo 6 litri e scarico ridotto di massimo 3 litri.

L'impiantistica destinata alla raccolta, pressurizzazione e distribuzione dell'acqua sanitaria è stata progettata al fine di garantire l'idonea funzionalità e prestazione stabilite dalla normativa tecnica vigente per l'impiantistica sanitaria.

VERIFICA: Non pertinente all'intervento oggetto della presente.

6.4 Economia Circolare

Il requisito da dimostrare è che almeno il 70% (in termini di peso) dei rifiuti da costruzione e demolizione non pericolosi (escluso il materiale allo stato naturale definito alla voce 17 05 04 dell'elenco europeo dei rifiuti istituito dalla decisione 2000/532/CE) prodotti in cantiere è preparato per il riutilizzo, il riciclaggio e altri tipi di recupero di materiale, conformemente alla gerarchia dei rifiuti e al protocollo UE per la gestione dei rifiuti da costruzione e demolizione.

VERIFICA:

con le lavorazioni relative al SAL 3 non sono stati conferiti rifiuti.

6.5 Prevenzione e riduzione dell'inquinamento

Tale aspetto coinvolge:

a) i materiali in ingresso;

b) la gestione ambientale del cantiere;

Per i materiali in ingresso non potranno essere utilizzati componenti, prodotti e materiali contenenti sostanze pericolose di cui al "Authorization List" presente nel regolamento REACH. A tal proposito dovranno essere fornite le Schede tecniche dei materiali e sostanze impiegate.

Per la gestione ambientale del cantiere dovrà essere redatto specifico Piano ambientale di cantierizzazione (PAC), qualora previsto dalle normative regionali o nazionali.

Tali vincoli possono considerarsi rispettati mediante il rispetto dei criteri prestazioni ambientali del cantiere (2.6.1) e specifiche tecniche per i prodotti da costruzione (2.5) descritte all'interno dei "Criteri ambientali minimi per l'affidamento di servizi di progettazione e ed esecuzione dei lavori di interventi edilizi", approvato con DM 23 giugno 2022 n. 256, GURI n. 183 del 6 agosto 2022.

VERIFICA:

a) per la realizzazione delle opere, sono stati utilizzati materiali privi di sostanze pericolose di cui al *"Authorization List"* presente nel regolamento REACH e certificati CAM, attestanti il contenuto di materiale riciclato/recuperato/sottoprodotto.

Si allegano relative certificazioni di conformità ai requisiti CAM e DNSH dei cartongessi e del solaio predalles.

b) si rimanda al Piano Ambientale di Cantierizzazione e Piano di Gestione dei Rifiuti redatto dall'impresa Pavoni S.p.A. in data maggio 2024.

6.6 Protezione e Ripristino della biodiversità e degli ecosistemi

Al fine di garantire la protezione della biodiversità e delle aree di pregio, gli edifici non potranno essere costruiti all'interno di:

- Terreni coltivati e seminativi con un livello da moderato ad elevato di fertilità del suolo e biodiversità sotterranea, destinabili alla produzione di alimenti o mangimi, come indicato nell'indagine LUCAS dell'UE e nella Direttiva (UE) 2015/1513 (ILUC) del Parlamento europeo e del Consiglio;
- Terreni che corrispondono alla definizione di foresta, laddove per foresta si intende un terreno che corrisponde alla definizione di bosco di cui all'art. 3, comma 3 e 4, e art. 4 del D. lgs 34 del 2018, per le quali le valutazioni previste dall'art. 8 del medesimo decreto non siano concluse con parere favorevole alla trasformazione permanente dello stato dei luoghi.
- Terreni che costituiscono l'habitat di specie (flora e fauna) in pericolo elencate nella lista rossa europea23 o nella lista rossa dell'IUCN24;

Pertanto, fermo restando i divieti sopra elencati, per gli impianti situati in aree sensibili sotto il profilo della biodiversità o in prossimità di esse (parchi e riserve naturali, siti della rete Natura 2000, corridoi ecologici, altre aree tutelate dal punto di vista naturalistico, oltre ai beni naturali e paesaggistici del Patrimonio Mondiale dell'UNESCO e altre aree protette) deve essere condotta un'opportuna valutazione che preveda tutte le necessarie misure di mitigazione nonché la valutazione di conformità rispetto ai regolamenti delle aree protette, etc.

Nel caso di utilizzo di legno per la costruzione di strutture, rivestimenti e finiture, dovrà essere garantito che 80% del legno vergine utilizzato sia certificato FSC/PEFC o altra certificazione equivalente. Sarà

pertanto necessario acquisire le Certificazioni FSC/PEFC o altra certificazione equivalente di prodotto rilasciata sotto accreditamento.

Tutti gli altri prodotti in legno devono essere realizzati con legno riciclato/riutilizzato come descritto nella Scheda tecnica del materiale. Quest'ultimo punto può ritenersi verificato rispettando il criterio dei "Criteri ambientali minimi per l'affidamento di servizi di progettazione e ed esecuzione dei lavori di interventi edilizi", approvato con DM 23 giugno 2022 n. 256, GURI n. 183 del 6 agosto 2022, relativo ai prodotti legnosi (2.5.6).

VERIFICA: l'edificio non è realizzato all'interno di una delle tipologie di aree sopra indicate.

Inoltre, l'edificio non è realizzato in legno e ad oggi, non sono state eseguite lavorazioni o utilizzati materiali che necessitino di tale valutazione di incidenza sugli ecosistemi e sulla biodiversità.

6. ESITI DELLA RELAZIONE

In base a quanto sopra descritto, tutte le lavorazioni eseguite all'interno del SAL 3 riscontrano i requisiti richiesti per il rispetto dei criteri DNSH, secondo la check list di pertinenza.

La presente relazione di verifica del principio del "Do No Significant Harm" (DNSH), fornisce un quadro della sostenibilità delle opere realizzate al 06/02/2026, e la coerenza con i principi e gli obblighi specifici del PNRR.

Lì, 06 Febbraio 2026

Il Direttore dei Lavori

Ing. Nicola Freddi

Il Responsabile di Cantiere

Ing. Dennis Foglio

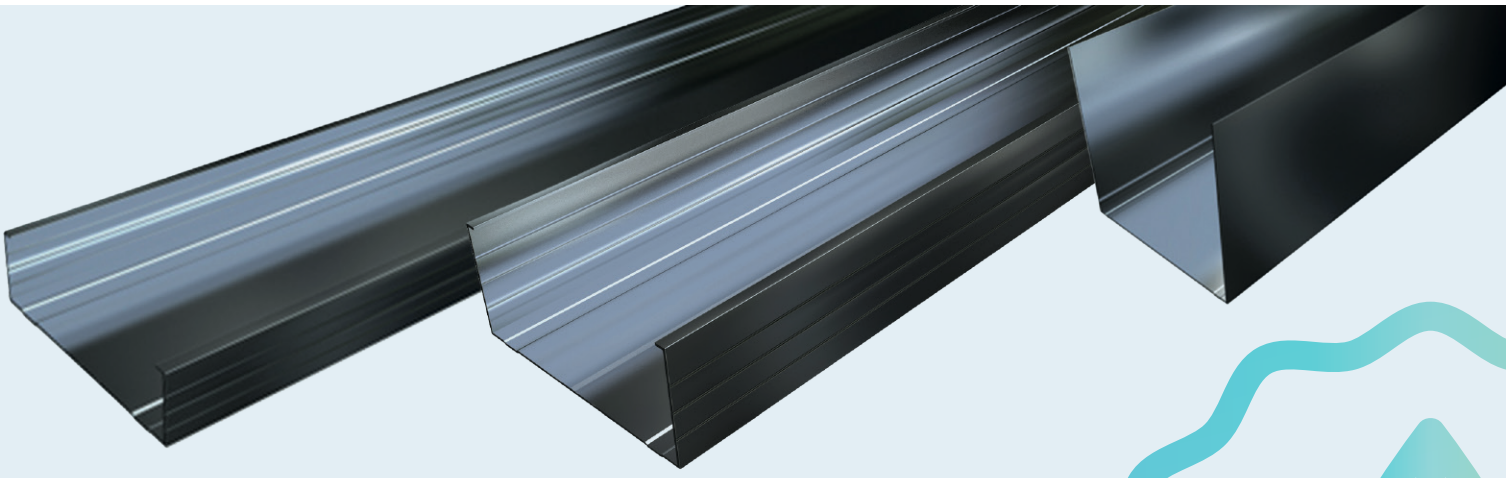
ECO PLATFORM EPD VERIFIED

EPD®

N° VERIFICATION : S-P-05737

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804 for:
Knauf Steel profiles



> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-05737

> **Publication date:**
2022/03/31

> **Valid until:**
2027/03/30

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s. - Via Livornese, 20
56040 Castellina Marittima (PI), Italy

KNAUF

RINA

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com

EPD registration number/declaration number: S-P-05737

Product / product family name and manufacturer represented: Steel profiles, manufactured by Knauf di Knauf S.r.l. S.a.s.

Product description and use: steel profiles DX51 D+Z are used to be applied as part assemblies in internal walls and ceiling constructions.

Declaration issued: 2022/03/30

Valid until: 2027/03/30

Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Via Livornese 20, 56040 Castellina Marittima (PI), Italy. Tel. 050 69211 - Fax 050 692301, knauf@knauf.it.

EPD prepared by: Ergo S.r.l., www.ergosrl.net

Scope: The LCA is based on 2020 production data for Castellina Marittima manufacturing site in Italy for Knauf steel profiles. This EPD covers information modules A1 to C4 (cradle to gate with module C1-C4, module D and optional modules) as defined in EN 15804:2012+A2:2019 for Knauf steel profiles sold and used in Italy and Europe. The use stage (B1-B7) was not considered in this study.

Functional unit/declared unit: The declared unit (DU) is 1 linear meter of hot-dip galvanized steel profile, 0.6 mm thickness.

CEN standard EN 15804 served as the core Product Category Rules - PCR	
PCR:	PCR 2019:14 Construction products and construction services, Version 1.11.
Product group classification:	The UN CPC code of the product is 42190.
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A.Via Corsica 12, Genova - Italy, Tel +39 010 5385306, www.rina.org ACCREDIA Registration number: 001H REV. 17
Accredited or approved by:	The International EPD® System

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 150 production facilities and sales organizations in over 86 countries, 27,500 employees worldwide, and sales of 6.5 billion Euro (in 2016), the Knauf Group is without doubt one of the big players on the market - in Europe, the USA, South America, Russia, Asia, Africa, and Australia.
The company's headquarter in Italy is in Castellina Marittima (Pisa). Currently, the Castellina Marittima plant has a global area of 90,000 square meters, covers an area of 30,000 square meters and owns more than 100 hectares of quarries. The products manufactured in Knauf plant in Castellina Marittima are plasterboard, steel profiles required for the implementation of the plasterboards, ceilings, stucco and impregnators.

3. PRODUCT INFORMATION

3.1 Product description

Knauf steel profiles are used to be applied as part assemblies in internal walls and ceiling constructions. Typical applications are residential buildings, industrial and commercial buildings, sports facilities, schools and hospitals. Knauf profiles are made of hot-dip galvanized sheet steel in conformity with EN 10346 cut and bent to attain the right dimensions and characteristics.
Steel profiles analysed are available with zinc (Z) or zinc-aluminium-magnesium (MgZ) based coatings (only except for the profile Z U 15x30 which has only zinc coating) in order to provide a good level of protection against corrosion. The presence of magnesium in the coating promotes the formation of compact corrosion products highly stable over time, thereby substantially reducing coating consumption dynamics and enhancing edge protection. The profiles are available in thicknesses range from 0.6mm to 1mm. Thickness of studied products is 0.6mm.
Figure 1 shows an illustration of one of the products covered by this EPD. Table 1 lists the steel profile system products from Knauf for which this EPD is valid.

Table 1 - Steel profile products covered by this EPD.

Products	Weight (Kg/m)
Prof Z C Plus 50x27 mm	0.505
Prof Z U 27x30 mm	0.358
Prof Z C 75x50 mm	0.794
Prof Z U 75x40 mm	0.648
Prof Z C 50x50 mm	0.686
Prof Z U 50x40 mm	0.540
Prof Z C Plus 50x15 mm	0.410
Prof Z U 15x30 mm	0.307
Prof Z C 100x50 mm	0.902
Prof Z U 100x40 mm	0.890
Prof Z C 150x50 mm	1.118
Prof Z U 150x40 mm	0.971

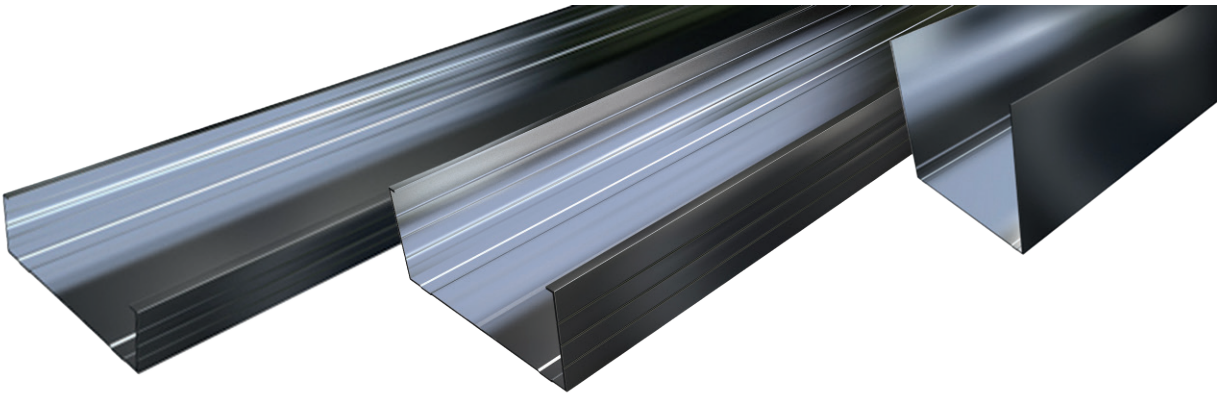


Figure 1. Illustration of one of the products within the product category steel profiles, for which this EPD is valid.

3.2 Technical data

Technical data referred to steel profiles are given in Table 2.

Table 2 - Technical information.

Product identification	DIN 18182-1 UNI EN 14195 UNI EN 10346
Tensile strength	≥ 300 N/mm^2
Quality steel grade	DX51 D+Z100 - M/N-A-C DX51 D+Z100 - M/N-A-C - MgZ
Class of reaction to fire performance	A1

3.3 Delivery Status

The EPD refers to 0.6mm thick steel profiles shown in table 1.

3.4 Base materials / Ancillary materials

The average composition of steel profiles, including the packaging materials, is reported in Table 3:

Table 3 - Content declaration of profile and its packaging.

Product components	**Weight %**	**Post-consumer material, weight %**	**Renewable material, weight %**
Steel	99	53.49	0
Other elements (eg. C, Si, Mn, P, S, Ti)	<1%	0	0
Packaging materials	**Weight %**	**Post-consumer material, weight %**	**Renewable material, weight %**
Plastic strapping	6	0	0
Wooden elements	94	0	94

No substances included in the Candidate List of Substances of Very High Concern for authorisation under the REACH Regulations are present in the steel profiles.

3.5 Packaging

The analysed steel profiles are packaged in plastic wrap and loaded onto wooden element prior to distribution. Packing materials are externally recovered/disposed of.

3.6 Re-use phase

The analysed steel profiles can be recycled without any problems after dismantling.

3.7 Disposal

Waste from steel profiles is fully recyclable. The European waste catalogue code is 17 04 05.

3.8 Further information

Further information can be found through the enquiry desk: +39 050 69211
knauf@knauf.it | www.knauf.it

3.9 Manufacture

The product is manufactured from hot-dip galvanized carbon steel. The steel used to produce hot-dip galvanized profiles is imported by different suppliers located in Italy (95.06%), Europe (0.72%) and Asia (4.22%). Purchased galvanized coils are divide into narrower bands whose width fits the specific profiles. Then, steel profiles are manufactur ed through cold roll forming technique.

3.10 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free.
A target of zero accidents at work for employees, visitors and contractors is set by the business. In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured. To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 18001 certified systems.

4. LCA INFORMATION

Figure 3 shows a flow diagram of the system under study. The system boundary covers A1- A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'.
In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4; benefits and loads beyond the system boundary, as module D). Accordingly, the EPD is a cradle-to-gate declaration with module C1-C4, module D and optional modules. The system boundaries in tabular form for all modules are shown in the Table 4 below.

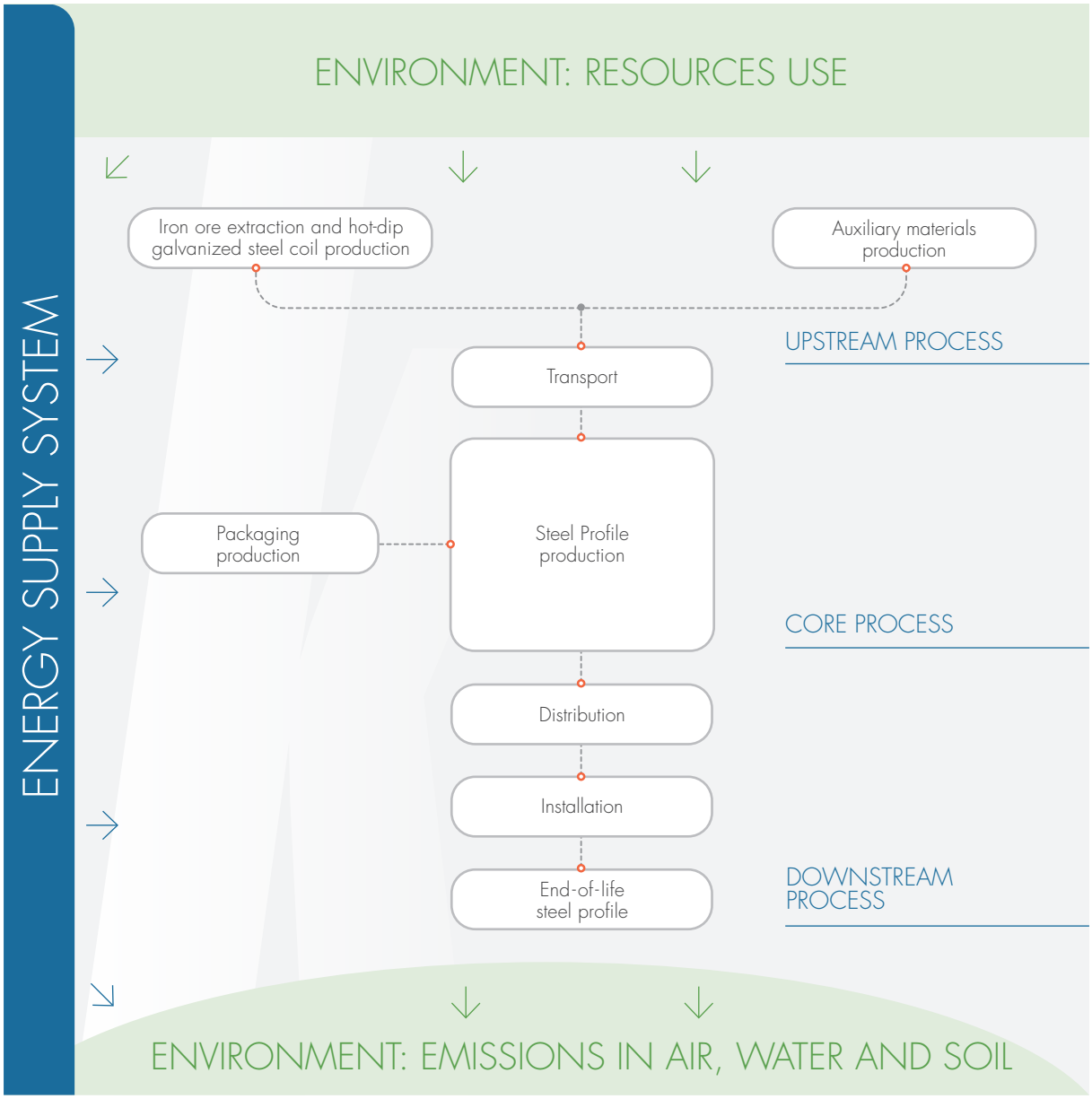


Figure 3 - Flow diagram of system boundary under assessment.

Table 4 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse Recovery Recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 5.

Table 5 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 m of hot-dip galvanized steel profile 0.6 mm thickness.
5.2	**System boundaries**	Cradle to gate with module C1-C4, module D and optional modules (A4, A5).
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts. The profiles have a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. For the production of auxiliaries and packaging materials (and their disposal), generic data have been used, since their mass flow in relation to the declared unit is limited. Transport of final product to construction site is taken as the transport of 1 m of steel profile from Castellina Marittima plant to the construction site as distance value based on weighted average values for 2020 as transport to customers (A4). An average of 50 km is taken as a distance from construction site to waste processing and disposal sites (C2). Waste processing for reuse, recovery and/or recycling is taken into consideration for the current study (C3). At the end of life of the products, 95% of galvanized steel profiles are collected to be recycled and the rest end up at landfills according to European steel recycling statistics (C4). Potential impacts and avoided burdens resulting from the packaging and steel scrap recycling in the end of life are assigned to module D.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2012+A2:2019 Clause 6.3.6 In compliance with these criteria, the infrastructure of the manufacturing site and personnel related activities (travel, office operations and supplies) are excluded from the study.

5.5	**Background Data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Castellina Marittima plant. All secondary data was retrieved using SIMAPRO 9 software, with Ecoinvent 3.6 database.
5.6	**Data quality**	Primary data refer to 2020 and have been collected at Knauf S.r.l. S.a.s. plant located in Castellina Marittima (IT), whereas selected generic data have been retrieved from Ecoinvent 3.6 database and using the most updated datasets and - as far as possible- those representatives for at least 5 years into the future. Moreover, as required by the General Programme Instructions, the environmental impacts associated to proxy data do not exceed 10% of the overall environmental impact from the product system. The energy mix of Knauf di Knauf S.r.l. S.a.s. Castellina Marittima plant is characterized by 61,5% of electricity self-produced by cogeneration and 38.5% by electricity purchased from an external energy company. The energy-related data from the energy supplier refer to the supplier energy mix, whereas for the production of raw materials a European energy mix has been accounted for.
5.7	**Period under review**	The data is representative of the manufacturing processes of 2020.
5.8	**Allocations**	Allocations were avoided in the calculation model.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries

This EPD evaluates the environmental impacts of 1 linear meter of hot-dip galvanized steel profile from cradle to gate with module C1-C4, module D and optional modules. Within the Life Cycle Assessment of the declared profile, the following processes are considered:

Product stage, A1-A3

Description of the stage

The product stage of the plasterboard products is subdivided into three modules; A1, A2 and A3 respectively “raw material supply”, “transport” and “manufacturing”.

A1, raw material supply
Extraction and processing of raw material occurring upstream from the manufacturing process, including the energy generation needed for these processes (extraction, refining and transport of energy from primary energy sources). Recycling processes of secondary materials from a previous product system that are used in the manufacturing process are also included, however processes that are part of the waste processing in the previous product system are excluded, referring to the polluter-pays principle.

A2, transport to the manufacturer
The external transportation of raw materials and auxiliaries to the manufacturing site.
The modelling includes transportation with truck and ship with processes for each supplier.

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

Construction process stage, A4-A5

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

A4, transport to the building site
Table 6 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO 4, EURO 5 and EURO 6 articulated trucks and ship has been accounted for, based on the sale figures in Italy and Europe in the reference year. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed.
Table 6 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck 16-32 tons. EURO4, EURO5, EURO 6 Boat, freight ship
Distanceto central warehouse	360 km weighted average by truck to all markets 41 km weighted average by boat to all markets
Distance to construction site	16 km
Fuel/energy consumption	0.04 l diesel fuel per tkm (truck) 0.0002 l diesel fuel per tkm (boat)
Capacity utilization	70%
Bulk density of transported products	7,860 kg/m^3

A5, installation into the building

Table 7 below quantifies the parameters for installing 1 m of steel profile at the building site. No installation materials are required. Packaging wastes of profile are included in this module.

Table 7 - Parameters for installing the product at the building site.

Parameter	Value (expressed per functional/ declared unit)
Ancillary materials for installation (specified by materials)	None
Water use	None
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Plastic strapping: 0.42 g (waste from packaging) Wooden elements: 6.48 g (waste from packaging)
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Plastic strapping: 0.197 g to landfill 0.223 g to recovery Wooden elements: 2.57 g to landfill 3.91 g to recovery **Steel profile Z C Plus 50x27 mm:** 0.038 kg 0.036 kg to recycling (95%) 0.00189 kg to landfill (5%) **Steel profile Z U 27x30 mm:** 0.027 kg 0.025 kg to recycling (95%) 0.00134 kg to landfill (5%) **Steel profile Z C 75x50 mm:** 0.059 kg 0.0566 kg to recycling (95%) 0.00298 kg to landfill (5%) **Steel profile Z U 75x40 mm:** 0.048 kg 0.0462 kg to recycling (95%) 0.00243 kg to landfill (5%) **Steel profile Z C 50x50 mm:** 0.051 kg 0.0489 kg to recycling (95%) 0.00257 kg to landfill (5%) **Steel profile Z U 50x40 mm:** 0.040 kg 0.0385 kg to recycling (95%) 0.00202 kg to landfill (5%) **Steel profile Z C Plus 50x15 mm:** 0.030 kg 0.0292 kg to recycling (95%) 0.00154 kg to landfill (5%) **Steel profile Z U 15x30 mm:** 0.023 kg 0.0219 kg to recycling (95%) 0.00115 kg to landfill (5%) **Steel profile Z C 100x50 mm:** 0.067 kg 0.0643 kg to recycling (95%) 0.00338 kg to landfill (5%)

Parameter	Value (expressed per functional/ declared unit)
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	**Steel profile Z U 100x40 mm:** 0.067 kg 0.0634 kg to recycling (95%) 0.00334 to landfill (5%) **Steel profile Z C 150x50 mm:** 0.083 kg 0.0797 kg to recycling (95%) 0.00419 kg to landfill (5%) **Steel profile Z U 150x40 mm:** 0.072 kg 0.0692 kg to recycling (95%) 0.00364 kg to landfill (5%)

Use stage (excluding potential savings), B1-B7

Description of the stage
The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information
The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf steel profile is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
It was assumed that building machine was used in deconstruction process. Deconstruction including demolition of the product from the construction, including initial on-site sorting of the materials.
C2, transport to waste processing
Transportation of the discarded product to a recycling site, and transportation of waste to final sorting yard or disposal.
C3, waste processing for reuse, recovery and/or recycling
Steel profile must be mechanically separated from the other construction materials prior to recycling so that the steel can be made available to a downstream product system as secondary material.

This is considered in module C3. Steel profiles are collected as mixed construction waste and delivered to sorting facility, where 95% of products were separated for recycling and 5% left in the process as waste and landfilled.

C4, disposal

Waste disposal, including physical pre-treatment and management of the disposal site, as well as emissions from the disposal.

Parameter	Value (expressed per functional/declared unit)
C1) Collection process specified by type	**Steel profile ZC Plus 50x27mm:** - 0.480 kg collected separately for metal recycling and transported by truck to recycling site - 0.025 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile ZU 27x30 mm:** - 0.340 kg collected separately for metal recycling and transported by truck to recycling site - 0.018 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z C 75x50 mm:** - 0.754 kg collected separately for metal recycling and transported by truck to recycling site - 0.040 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z U 75x40 mm:** - 0.616 kg collected separately for metal recycling and transported by truck to recycling site - 0.032 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z C 50x50 mm:** - 0.651 kg collected separately for metal recycling and transported by truck to recycling site - 0.034 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z U 50x40 mm:** - 0.513 kg collected separately for metal recycling and transported by truck to recycling site - 0.027 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z C Plus 50x15 mm:** - 0.390 kg collected separately for metal recycling and transported by truck to recycling site - 0.021 kg collected with mixed construction waste and transported by truck to landfill site

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	**Steel profile Z U 15x30 mm:** - 0.292 kg collected separately for metal recycling and transported by truck to recycling site - 0.015 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z C 100x50 mm:** - 0.857 kg collected separately for metal recycling and transported by truck to recycling site - 0.045 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z U 100x40 mm:** - 0.846 kg collected separately for metal recycling and transported by truck to recycling site - 0.045 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z C 150x50 mm:** - 1.062 kg collected separately for metal recycling and transported by truck to recycling site - 0.056 kg collected with mixed construction waste and transported by truck to landfill site **Steel profile Z U 150x40 mm:** - 0.922 kg collected separately for metal recycling and transported by truck to recycling site - 0.049 kg collected with mixed construction waste and transported by truck to landfill site
C2) Assumption for scenario development (e.g., transportation)	Diesel consumption 0.04L per tkm; 40 km from demolition site to recycling facility 40 km from demolition site to landfill site
C3) Recovery system specified by type	95% steel profile to recycling
C4) Disposal specified by type	5% of waste to landfill

Reuse/recovery/recycling potential, D

Description of the stage

Module D, relating to information on the potential for reuse/recovery/recycling, is assessed considering the benefits of the avoided impact of future extractions and production of raw materials, brought about by the recycling of the main materials from A to C (e.g., steel scraps, plastic, wood). The processes necessary to make the materials of the product (at the end of life) new raw materials for subsequent life cycles are considered.

6. LCA RESULTS

In the following tables, the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 3.01, September 2019) and those indicated in PCR 2019:14 version 1.11 for Construction Products and construction services. The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
EN 15804+A2 (adapted) method has been used as the impact model. The numbers reported in the following tables are the outcome of rounding. For this reason, total results could slightly differ from the sum of contributions of the different phases..

7. LCA RESULTS INTERPRETATION

The following interpretation of results is in general valid for all analysed Knauf steel profiles with zinc coating. Effect of zinc-aluminium-magnesium (MgZ) coating on LCIA results for product stage (A1-A3) are less than ±10%. Therefore, the results showed in the tables below are also representative for profiles with MgZ coating. The LCIA results indicate that most of the impacts of Knauf steel profile is dominated by the raw material production (module A1). Over 90% of GWP comes from steel production as steel manufacturing is quite energy intensive process.

ADDITIONAL INFORMATION

Greenhouse gas emission from the use of electricity in the manufacturing phase

Electricity used in the manufacturing processes has been accounted for using the electricity mix (21.28% renewables, 11.39% coal, 57.92% natural gas, 0.67% oil, 4.56% nuclear, 4.18% other sources) from energy supplier (for the year 2020):

Greenhouse gas emissions: 0.136 kg CO_2 eq/MJ

Table 9 - LCA results of potential environmental impact referred to 1 m of Z C Plus 50x27x0.6 mm and MgZ C Plus 50x27x0.6 mm steel profiles.

Prof Z C Plus 50x27x0.6 mm, MgZ C Plus 50x27x0.6mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.12E+00	3.18E-02	1.92E-03	-	-	-	-	-	-	-	1.66E-03	2.50E-02	1.04E-02	1.33E-04	-4.07E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.12E+00	3.18E-02	1.72E-03	-	-	-	-	-	-	-	1.66E-03	2.50E-02	1.03E-02	1.33E-04	-4.07E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.62E-03	1.17E-05	2.02E-04	-	-	-	-	-	-	-	2.78E-07	2.86E-06	4.34E-05	7.77E-08	-4.56E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	6.21E-04	1.13E-05	1.54E-07	-	-	-	-	-	-	-	1.31E-07	2.08E-06	1.24E-05	3.71E-08	-2.05E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.30E-07	7.24E-09	3.64E-10	-	-	-	-	-	-	-	3.59E-10	5.29E-09	1.39E-09	5.48E-11	-2.39E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	7.53E-02	1.22E-04	1.04E-05	-	-	-	-	-	-	-	1.74E-05	1.51E-04	1.34E-04	1.26E-06	-1.86E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.38E-04	7.74E-07	1.22E-08	-	-	-	-	-	-	-	1.86E-08	1.51E-07	2.42E-06	4.58E-09	-6.73E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	3.10E-03	3.33E-05	4.50E-06	-	-	-	-	-	-	-	7.67E-06	6.46E-05	2.82E-05	4.34E-07	-3.61E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	3.25E-01	3.70E-04	4.84E-05	-	-	-	-	-	-	-	8.41E-05	7.10E-04	3.29E-04	4.79E-06	-3.99E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C Plus 50x27x0.6 mm, MgZ C Plus 50x27x0.6mm - ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	4.74E-03	1.17E-05	2.31E-05	-	-	-	-	-	-	-	2.31E-05	2.50E-04	8.96E-05	1.39E-06	-1.98E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	6.00E-01	1.35E-03	4.96E-05	-	-	-	-	-	-	-	3.06E-05	1.41E-04	1.56E-03	1.67E-04	-4.27E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	1.67E-03	8.69E-07	1.03E-08	-	-	-	-	-	-	-	2.55E-09	1.50E-07	6.23E-07	1.22E-09	-1.75E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	1.46E+01	4.81E-01	2.28E-02	-	-	-	-	-	-	-	2.28E-02	3.30E-01	1.42E-01	3.72E-03	-4.89E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 10 - LCA results of potential environmental impact referred to 1 m of Z U 27x30x0.6 mm and MgZ U 27x30x0.6 mm steel profiles.

Prof Z U 27x30x0.6 mm, MgZ U 27x30x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	8.44E-01	2.32E-02	1.56E-03	-	-	-	-	-	-	-	1.18E-03	1.77E-02	7.36E-03	9.43E-05	-2.88E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	8.41E-01	2.32E-02	1.35E-03	-	-	-	-	-	-	-	1.18E-03	1.77E-02	7.33E-03	9.43E-05	-2.88E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.06E-03	8.51E-06	2.02E-04	-	-	-	-	-	-	-	1.97E-07	2.03E-06	3.08E-05	5.51E-08	-3.17E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	4.94E-04	8.25E-06	1.23E-07	-	-	-	-	-	-	-	9.28E-08	1.47E-06	8.82E-06	2.63E-08	-1.48E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.03E-07	5.28E-09	2.87E-10	-	-	-	-	-	-	-	2.54E-10	3.75E-09	9.83E-10	3.88E-11	-1.69E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	6.26E-02	8.92E-05	8.18E-06	-	-	-	-	-	-	-	1.23E-05	1.07E-04	9.50E-05	8.95E-07	-1.31E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.04E-04	5.64E-07	9.92E-09	-	-	-	-	-	-	-	1.32E-08	1.07E-07	1.71E-06	3.24E-09	-4.77E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	2.51E-03	2.43E-05	3.56E-06	-	-	-	-	-	-	-	5.43E-05	4.58E-05	2.00E-05	3.08E-07	-2.55E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	2.71E-01	2.69E-04	3.81E-05	-	-	-	-	-	-	-	5.96E-05	5.03E-04	2.33E-04	3.39E-06	-2.83E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z U 27x30x0.6 mm, MgZ U 27x30x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	3.52E-03	8.54E-05	1.34E-05	-	-	-	-	-	-	-	1.64E-05	1.77E-04	6.35E-05	9.86E-07	-1.40E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	4.55E-01	9.82E-04	4.39E-05	-	-	-	-	-	-	-	2.17E-05	9.97E-05	1.10E-03	1.18E-04	-3.04E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	1.40E-03	6.33E-07	8.15E-09	-	-	-	-	-	-	-	1.80E-09	1.06E-07	4.42E-07	8.63E-10	-1.24E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	1.13E+01	3.51E-01	1.80E-02	-	-	-	-	-	-	-	1.62E-02	2.34E-01	1.01E-01	2.64E-03	-3.47E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 11 - LCA results of potential environmental impact referred to 1 m of Z C 75x50x0.6 mm and MgZ C 75x50x0.6 mm steel profiles.

Prof Z C 75x50x0.6 mm, MgZ C 75x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.80E+00	5.10E-02	2.63E-03	-	-	-	-	-	-	-	2.61E-03	3.93E-02	1.63E-02	2.09E-04	-6.39E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.79E+00	5.09E-02	2.42E-03	-	-	-	-	-	-	-	2.61E-03	3.93E-02	1.62E-02	2.09E-04	-6.38E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	4.28E-03	1.87E-05	2.02E-04	-	-	-	-	-	-	-	4.38E-07	4.49E-06	6.83E-05	1.22E-07	-7.25E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.01E-03	1.81E-05	2.14E-07	-	-	-	-	-	-	-	2.06E-07	3.27E-06	1.96E-05	5.83E-08	-3.15E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	2.13E-07	1.16E-08	5.15E-10	-	-	-	-	-	-	-	5.64E-10	8.32E-09	2.18E-09	8.61E-11	-3.74E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.26E-01	1.96E-04	1.47E-05	-	-	-	-	-	-	-	2.73E-05	2.38E-04	2.11E-04	1.98E-06	-2.91E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	2.22E-04	1.24E-06	1.66E-08	-	-	-	-	-	-	-	2.92E-08	2.38E-07	3.80E-06	7.19E-09	-1.05E-04
Eutrophication marine Potential (EP) - kg N eq. / DU	5.13E-03	5.34E-05	6.34E-06	-	-	-	-	-	-	-	1.21E-05	1.02E-04	4.43E-05	6.83E-07	-5.65E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	5.45E-01	5.91E-04	6.86E-05	-	-	-	-	-	-	-	1.32E-04	1.12E-03	5.18E-04	7.53E-06	-6.26E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C 75x50x0.6 mm, MgZ C 75x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	7.56E-03	1.88E-04	2.41E-05	-	-	-	-	-	-	-	3.64E-05	3.93E-04	1.41E-04	2.19E-06	-3.11E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	9.67E-01	2.16E-03	6.07E-05	-	-	-	-	-	-	-	4.81E-05	2.21E-04	2.45E-03	2.62E-04	-6.65E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	2.80E-03	1.39E-06	1.46E-08	-	-	-	-	-	-	-	4.00E-09	2.35E-07	9.80E-07	1.91E-09	-2.74E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.36E+01	7.70E-01	3.23E-02	-	-	-	-	-	-	-	3.59E-02	5.18E-01	2.23E-01	5.84E-03	-7.66E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 12 - LCA results of potential environmental impact referred to 1 m of Z U 75x40x0.6 mm and MgZ U 75x40x0.6 mm steel profiles.

Prof Z C 75x40x0.6 mm, MgZ C 75x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.55E+00	4.17E-02	2.27E-03	-	-	-	-	-	-	-	2.13E-03	3.20E-02	1.33E-02	1.71E-04	-5.22E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.55E+00	4.16E-02	2.07E-03	-	-	-	-	-	-	-	2.13E-03	3.20E-02	1.33E-02	1.71E-04	-5.21E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	3.69E-03	1.53E-05	2.02E-04	-	-	-	-	-	-	-	3.57E-07	3.67E-06	5.57E-05	9.97E-08	-5.89E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	8.88E-04	1.48E-05	1.84E-07	-	-	-	-	-	-	-	1.68E-07	2.67E-06	1.60E-05	4.76E-08	-2.59E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.91E-07	9.48E-09	4.39E-10	-	-	-	-	-	-	-	4.60E-10	6.79E-09	1.78E-09	7-03E-11	-3.05E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.12E-01	1.60E-04	1.25E-05	-	-	-	-	-	-	-	2.23E-05	1.94E-04	1.72E-04	1.62E-06	-2.38E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.88E-04	1.01E-06	1.44E-08	-	-	-	-	-	-	-	2.38E-08	1.94E-07	3.10E-06	5.87E-09	-8.62E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	4.60E-03	4.36E-05	5.41E-06	-	-	-	-	-	-	-	9.84E-06	8.29E-05	3.62E-05	5.57E-07	-4.62E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	4.83E-01	4.84E-04	5.84E-05	-	-	-	-	-	-	-	1.08E-04	9.11E-04	4.23E-04	6.14E-06	-5.12E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C 75x40x0.6 mm, MgZ C 75x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	6.69E-03	1.53E-04	2.05E-05	-	-	-	-	-	-	-	2.97E-05	3.20E-04	1.15E-04	1.78E-06	-2.54E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	8.19E-01	1.77E-03	5.51E-05	-	-	-	-	-	-	-	3.93E-05	1.81E-04	2.00E-03	2.14E-04	-5.45E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	2.48E-03	1.14E-06	1.24E-08	-	-	-	-	-	-	-	3.27E-09	1.92E-07	8.00E-07	1.56E-09	-2.24E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.07E+01	6.30E-01	2.75E-02	-	-	-	-	-	-	-	2.93E-02	4.23E-01	1.82E-01	4.77E-03	-6.27E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 13 - LCA results of potential environmental impact referred to 1 m of Z C 50x50x0.6 mm and MgZ C 50x50x0.6 mm steel profiles.

Prof Z C 50x50x0.6 mm, MgZ C 50x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.55E+00	4.41E-02	2.36E-03	-	-	-	-	-	-	-	2.26E-03	3.39E-02	1.41E-02	1.81E-04	-5.53E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.54E+00	4.41E-02	2.16E-03	-	-	-	-	-	-	-	2.26E-03	3.39E-02	1.40E-02	1.81E-04	-5.52E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	3.68E-03	1.62E-05	2.02E-04	-	-	-	-	-	-	-	3.78E-07	3.88E-06	5.90E-05	1.06E-07	-6.25E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	8.74E-04	1.57E-05	1.92E-07	-	-	-	-	-	-	-	1.78E-07	2.83E-06	1.69E-05	5.03E-08	-2.74E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.83E-07	1.00E-08	4.59E-10	-	-	-	-	-	-	-	4.87E-10	7.19E-09	1.88E-09	7.44E-11	-3.23E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.08E-01	1.70E-04	1.31E-05	-	-	-	-	-	-	-	2.36E-05	2.06E-04	1.82E-04	1.71E-06	-2.52E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.91E-04	1.07E-06	1.50E-08	-	-	-	-	-	-	-	2.52E-08	2.06E-07	3.28E-06	6.22E-09	-9.12E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	4.41E-03	4.62E-05	5.65E-06	-	-	-	-	-	-	-	1.04E-05	8.78E-05	3.83E-05	5.90E-07	-4.89E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	4.67E-01	5.12E-04	6.10E-05	-	-	-	-	-	-	-	1.14E-04	9.65E-04	4.47E-04	6.50E-06	-5.42E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C 50x50x0.6 mm, MgZ C 50x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	6.53E-03	1.62E-04	2.14E-05	-	-	-	-	-	-	-	3.14E-05	3.39E-04	1.22E-04	1.89E-06	-2.69E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m³ depriv/DU	8.33E-01	1.87E-03	5.66E-05	-	-	-	-	-	-	-	4.16E-05	1.91E-04	2.12E-03	2.26E-04	-5.76E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	2.40E-03	1.20E-06	1.30E-08	-	-	-	-	-	-	-	3.46E-09	2.03E-07	8.47E-07	1.65E-09	-2.37E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.04E+01	6.66E-01	2.87E-02	-	-	-	-	-	-	-	3.10E-02	4.48E-01	1.93E-01	5.05E-03	-6.63E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 14 - LCA results of potential environmental impact referred to 1 m of Z U 50x40x0.6 mm and MgZ U 50x40x0.6 mm steel profiles.

Prof Z U 50x40x0.6 mm, MgZ U 50x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.26E+00	3.48E-02	2.00E-03	-	-	-	-	-	-	-	1.78E-03	2.67E-02	1.11E-02	1.42E-04	-4.34E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.26E+00	3.47E-02	1.80E-03	-	-	-	-	-	-	-	1.78E-03	2.67E-02	1.10E-02	1.42E-04	-4.34E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	3.08E-03	1.27E-05	2.02E-04	-	-	-	-	-	-	-	2.98E-07	3.06E-06	4.64E-05	8.31E-08	-4.87E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	7.35E-04	1.24E-05	1.61E-07	-	-	-	-	-	-	-	1.40E-07	2.22E-06	1.33E-05	3.96E-08	-2.18E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.53E-07	7.91E-09	3.82E-10	-	-	-	-	-	-	-	3.83E-10	5.66E-09	1.48E-09	5.85E-11	-2.54E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	9.33E-02	1.34E-04	1.09E-05	-	-	-	-	-	-	-	1.86E-05	1.62E-04	1.43E-04	1.35E-06	-1.98E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.56E-04	8.45E-07	1.27E-08	-	-	-	-	-	-	-	1.98E-08	1.62E-07	2.58E-06	4.89E-09	-7.17E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	3.75E-03	3.64E-05	4.72E-06	-	-	-	-	-	-	-	8.20E-06	6.91E-05	3.02E-05	4.64E-07	-3.84E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	4.04E-01	4.03E-04	5.08E-05	-	-	-	-	-	-	-	8.99E-05	7.59E-04	3.52E-04	5.12E-06	-4.26E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z U 50x40x0.6 mm, MgZ U 50x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	5.28E-03	1.28E-04	1.78E-05	-	-	-	-	-	-	-	2.47E-05	2.67E-04	9.59E-05	1.49E-06	-2.12E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m³ depriv/DU	6.82E-01	1.47E-03	5.09E-05	-	-	-	-	-	-	-	3.27E-05	1.50E-04	1.67E-03	1.78E-04	-4.54E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	2.08E-03	9.49E-07	1.08E-08	-	-	-	-	-	-	-	2.72E-09	1.60E-07	6.67E-07	1.30E-09	-1.86E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	1.68E+01	5.25E-01	2.40E-02	-	-	-	-	-	-	-	2.44E-02	3.52E-01	1.52E-01	3.97E-03	-5.22E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 15 - LCA results of potential environmental impact referred to 1 m of Z C Plus 50x15x0.6 mm and MgZ C Plus 50x15x0.6 mm steel profiles.

Prof Z C Plus 50x15x0.6 mm, MgZ C Plus 50x15x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	8.90E-01	2.65E-02	1.68E-03	-	-	-	-	-	-	-	1.35E-03	2.03E-02	8.43E-03	1.08E-04	-3.30E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	8.88E-01	2.65E-02	1.48E-03	-	-	-	-	-	-	-	1.35E-03	2.03E-02	8.39E-03	1.08E-04	-3.29E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.06E-03	9.72E-06	2.02E-04	-	-	-	-	-	-	-	2.26E-07	2.32E-06	3.53E-05	6.31E-08	-3.66E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	4.87E-04	9.42E-06	1.34E-07	-	-	-	-	-	-	-	1.06E-07	1.69E-06	1.01E-05	3.01E-08	-1.68E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	1.02E-07	6.03E-09	3.14E-10	-	-	-	-	-	-	-	2.91E-10	4.30E-09	1.13E-09	4.45E-11	-1.93E-09
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	5.80E-02	1.02E-04	8.96E-06	-	-	-	-	-	-	-	1.41E-05	1.23E-04	1.09E-04	1.02E-06	-1.50E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	1.10E-04	6.44E-07	1.07E-08	-	-	-	-	-	-	-	1.51E-08	1.23E-07	1.96E-06	3.71E-09	-5.45E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	2.41E-03	2.78E-05	3.89E-06	-	-	-	-	-	-	-	6.22E-06	5.25E-05	2.29E-05	3.52E-07	-2.92E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	2.50E-01	3.08E-04	4.17E-05	-	-	-	-	-	-	-	6.83E-05	5.77E-04	2.67E-04	3.89E-06	-3.23E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C Plus 50x15x0.6 mm, MgZ C Plus 50x15x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	3.80E-03	9.76E-05	1.47E-05	-	-	-	-	-	-	-	1.88E-05	2.03E-04	7.28E-05	1.13E-06	-1.61E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	4.77E-01	1.12E-03	4.59E-05	-	-	-	-	-	-	-	2.48E-05	1.14E-04	1.26E-03	1.35E-04	-3.46E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	1.29E-03	7.23E-07	8.92E-09	-	-	-	-	-	-	-	2.07E-09	1.22E-07	5.06E-07	9.88E-10	-1.42E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	1.16E+01	4.00E-01	1.97E-02	-	-	-	-	-	-	-	1.86E-02	2.68E-01	1.15E-01	3.02E-03	-3.96E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 16 - LCA results of potential environmental impact referred to 1 m of Z U 15x30x0.6 mm steel profile.

Prof Z U 15x30x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	6.69E-01	2.00E-02	1.43E-03	-	-	-	-	-	-	-	1.01E-03	1.52E-02	6.32E-03	8.09E-05	-2.48E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	6.67E-01	2.00E-02	1.23E-03	-	-	-	-	-	-	-	1.01E-03	1.52E-02	6.28E-03	8.08E-05	-2.47E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	1.55E-03	7.32E-06	2.02E-04	-	-	-	-	-	-	-	1.69E-07	1.74E-06	2.64E-05	4.73E-08	-2.70E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	3.68E-04	7.10E-06	1.13E-07	-	-	-	-	-	-	-	7.95E-08	1.26E-06	7.57E-06	2.25E-08	-1.29E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	7.69E-08	4.54E-09	2.60E-10	-	-	-	-	-	-	-	2.18E-10	3.22E-09	8.43E-10	3.33E-11	-1.45E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	4.37E-02	7.68E-05	7.42E-06	-	-	-	-	-	-	-	1.06E-05	9.20E-05	8.15E-05	7.67E-07	1.13E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	8.24E-05	4.86E-07	9.13E-09	-	-	-	-	-	-	-	1.13E-08	9.20E-08	1.47E-06	2.78E-09	-4.10E-05
Eutrophication marine Potential (EP) - kg N eq. / DU	1.82E-03	2.09E-05	3.24E-06	-	-	-	-	-	-	-	4.66E-06	3.93E-05	1.71E-05	2.64E-07	-2.19E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	1.88E-01	2.32E-04	3.45E-05	-	-	-	-	-	-	-	5.11E-05	4.32E-04	2.00E-04	2.91E-06	-2.43E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z U 15x30x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	2.85E-03	7.35E-05	1.21E-05	-	-	-	-	-	-	-	1.41E-05	1.52E-04	5.45E-05	8.45E-07	-1.21E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	3.58E-01	8.46E-04	4.20E-05	-	-	-	-	-	-	-	1.86E-05	8.55E-05	9.47E-04	1.01E-04	-2.62E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	9.68E-04	5.45E-07	7.39E-09	-	-	-	-	-	-	-	1.55E-09	9.10E-08	3.79E-07	7.40E-10	-1.07E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	8.69E+00	3.02E-01	1.63E-02	-	-	-	-	-	-	-	1.39E-02	2.00E-01	8.63E-02	2.26E-03	-2.98E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 17 - LCA results of potential environmental impact referred to 1 m of Z C 100x50x0.6 mm and MgZ C 100x50x0.6 mm steel profiles.

Prof Z C 100x50x0.6 mm, MgZ C 100x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	2.05E+00	5.78E-02	2.89E-03	-	-	-	-	-	-	-	2.97E-03	4.46E-02	1.86E-02	2.38E-04	-7.26E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.04E+00	5.78E-02	2.69E-03	-	-	-	-	-	-	-	2.97E-03	4.46E-02	1.85E-02	2.37E-04	-7.25E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	4.88E-03	2.12E-05	2.02E-04	-	-	-	-	-	-	-	4.97E-07	5.10E-06	7.76E-05	1.39E-07	-8.26E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.16E-03	2.06E-05	2.37E-07	-	-	-	-	-	-	-	2.34E-07	3.72E-06	2.22E-05	6.62E-08	-3.56E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	2.43E-07	1.32E-08	5.72E-10	-	-	-	-	-	-	-	6.40E-10	9.45E-09	2.48E-09	9.78E-11	-4.25E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.44E-01	2.22E-04	1.63E-05	-	-	-	-	-	-	-	3.10E-05	2.70E-04	2.39E-04	2.25E-06	-3.31E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	2.53E-04	1.41E-06	1.83E-08	-	-	-	-	-	-	-	3.31E-08	2.70E-07	4.32E-06	8.17E-09	-1.20E-04
Eutrophication marine Potential (EP) - kg N eq. / DU	5.86E-03	6.06E-05	7.03E-06	-	-	-	-	-	-	-	1.37E-05	1.15E-04	5.04E-05	7.75E-07	-6.43E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	6.22E-01	6.71E-04	7.61E-05	-	-	-	-	-	-	-	1.50E-04	1.27E-03	5.88E-04	8.55E-06	-7.12E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C 100x50x0.6 mm, MgZ C 100x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	8.62E-03	2.13E-04	2.67E-05	-	-	-	-	-	-	-	4.13E-05	4.46E-04	1.60E-04	2.48E-06	-3.54E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	1.10E+00	2.45E-03	6.49E-05	-	-	-	-	-	-	-	5.47E-05	2.51E-04	2.78E-03	2.98E-04	-7.55E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	3.20E-03	1.58E-06	1.62E-08	-	-	-	-	-	-	-	4.55E-09	2.67E-07	1.11E-06	2.17E-09	-3.11E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.70E+01	8.74E-01	3.58E-02	-	-	-	-	-	-	-	4.08E-02	5.89E-01	2.54E-01	6.64E-03	-8.71E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 18 - LCA results of potential environmental impact referred to 1 m of Z U 100x40x0.6 mm and MgZ U 100x40x0.6 mm steel profiles.

Prof Z U 100x40x0.6 mm, MgZ U 100x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	1.95E+00	5.69E-02	2.86E-03	-	-	-	-	-	-	-	2.93E-03	4.40E-02	1.83E-02	2.35E-04	-7.11E-01
	Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.95E+00	5.68E-02	2.66E-03	-	-	-	-	-	-	-	2.93E-03	4.40E-02	1.82E-02	2.34E-04	-7.10E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	4.53E-03	2.08E-05	2.02E-04	-	-	-	-	-	-	-	4.91E-07	5.04E-06	7.65E-05	1.37E-07	-8.09E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.07E-03	2.02E-05	2.34E-07	-	-	-	-	-	-	-	2.31E-07	3.67E-06	2.19E-05	6.53E-08	-3.49E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	2.27E-07	1.29E-08	5.66E-10	-	-	-	-	-	-	-	6.32E-10	9.32E-09	2.44E-09	9.65E-11	-4.16E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.30E-01	2.19E-04	1.61E-05	-	-	-	-	-	-	-	3.06E-05	2.67E-04	2.36E-04	2.22E-06	-3.24E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	2.40E-04	1.38E-06	1.81E-08	-	-	-	-	-	-	-	3.27E-08	2.67E-07	4.26E-06	8.06E-09	-1.17E-04
Eutrophication marine Potential (EP) - kg N eq. / DU	5.37E-03	5.95E-05	6.95E-06	-	-	-	-	-	-	-	1.35E-05	1.14E-04	4.97E-05	7.65E-07	-6.29E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	5.59E-01	6.60E-04	7.53E-05	-	-	-	-	-	-	-	1.48E-04	1.25E-03	5.80E-04	8.44E-06	-6.97E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z U 100x40x0.6 mm, MgZ U 100x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP)- kg NMVOC /DU	8.32E-03	2.09E-04	2.64E-05	-	-	-	-	-	-	-	4.08E-05	4.40E-04	1.58E-04	2.45E-06	-3.46E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	1.04E+00	2.41E-03	6.44E-05	-	-	-	-	-	-	-	5.39E-05	2.48E-04	2.75E-03	2.94E-04	-7.40E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	2.87E-03	1.55E-06	1.60E-08	-	-	-	-	-	-	-	4.49E-09	2.64E-07	1.10E-06	2.14E-09	-3.05E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.55E+01	8.59E-01	3.54E-02	-	-	-	-	-	-	-	4.03E-02	5.81E-01	2.50E-01	6.55E-03	-8.53E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 19 - LCA results of potential environmental impact referred to 1 m of Z C 150x50x0.6 mm and MgZ C 150x50x0.6 mm steel profiles.

Prof Z C 150x50x0.6 mm, MgZ C 150x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	2.54E+00	7.16E-02	3.42E-03	-	-	-	-	-	-	-	3.68E-03	5.53E-02	2.30E-02	2.95E-04	-9.00E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.54E+00	7.15E-02	3.22E-03	-	-	-	-	-	-	-	3.68E-03	5.53E-02	2.29E-02	2.94E-04	-8.98E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	6.08E-03	2.62E-05	2.02E-04	-	-	-	-	-	-	-	6.17E-07	6.33E-06	9.61E-05	1.72E-07	-1.03E-03
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.44E-03	2.54E-05	2.82E-07	-	-	-	-	-	-	-	2.90E-07	4.61E-06	2.76E-05	8.21E-08	-4.39E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	3.02E-07	1.63E-08	6.85E-10	-	-	-	-	-	-	-	7.94E-10	1.17E-08	3.07E-09	1.21E-10	-5.26E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.80E-01	2.75E-04	1.95E-05	-	-	-	-	-	-	-	3.84E-05	3.35E-04	2.97E-04	2.79E-06	-4.10E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^{3-} eq. /DU	3.14E-04	1.74E-06	2.16E-08	-	-	-	-	-	-	-	4.11E-08	3.35E-07	5.35E-06	1.01E-08	-1.48E-04
Eutrophication marine Potential (EP) - kg N eq. / DU	7.31E-03	7.50E-05	8.40E-06	-	-	-	-	-	-	-	1.70E-05	1.43E-04	6.24E-05	9.61E-07	-7.96E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	7.77E-01	8.31E-04	9.12E-05	-	-	-	-	-	-	-	1.86E-04	1.57E-03	7.29E-04	1.06E-05	-8.82E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z C 150x50x0.6 mm, MgZ C 150x50x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP) - kg NMVOC /DU	1.07E-02	2.64E-04	3.20E-05	-	-	-	-	-	-	-	5.12E-05	5.53E-04	1.98E-04	3.08E-06	-4.38E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	1.37E+00	3.03E-03	7.32E-05	-	-	-	-	-	-	-	6.78E-05	3.11E-04	3.45E-03	3.69E-04	-9.34E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	4.00E-03	1.95E-06	1.94E-08	-	-	-	-	-	-	-	5.64E-09	3.31E-07	1.38E-06	2.69E-09	-3.86E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	3.35E+01	1.08E+00	4.28E-02	-	-	-	-	-	-	-	5.06E-02	7.29E-01	3.14E-01	8.23E-03	-1.08E+01
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 20 - LCA results of potential environmental impact referred to 1 m of Z U 150x40x0.6 mm and MgZ U 150x40x0.6 mm steel profiles.

Prof Z U 150x40x0.6 mm, MgZ U 150x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./ DU	2.25E+00	6.23E-02	3.06E-03	-	-	-	-	-	-	-	3.19E-03	4.80E-02	2.00E-02	2.56E-04	-7.82E-01
	Global Warming Potential = Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.														
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.24E+00	6.23E-02	2.86E-03	-	-	-	-	-	-	-	3.19E-03	4.80E-02	1.99E-02	2.56E-04	-7.81E-01
	GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	5.48E-03	2.28E-05	2.02E-04	-	-	-	-	-	-	-	5.35E-07	5.49E-06	8.35E-05	1.49E-07	-8.92E-04
	GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.														
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.30E-03	2.21E-05	2.51E-07	-	-	-	-	-	-	-	2.52E-07	4.00E-06	2.39E-05	7.13E-08	-3.83E-04
	GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).														
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	2.71E-07	1.42E-08	6.08E-10	-	-	-	-	-	-	-	6.89E-10	1.02E-08	2.67E-09	1.05E-10	-4.57E-08
	Ozone Depletion Potential = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.														
Acidification Potential (AP) - kg mol H+/DU	1.65E-01	2.39E-04	1.73E-05	-	-	-	-	-	-	-	3.34E-05	2.91E-04	2.58E-04	2.43E-06	-3.56E-03
	Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.														
Eutrophication freshwater Potential (EP) - kg PO_4^3 - eq. /DU	2.79E-04	1.51E-06	1.94E-08	-	-	-	-	-	-	-	3.57E-08	2.91E-07	4.65E-06	8.80E-09	-1.29E-04
Eutrophication marine Potential (EP) - kg N eq. / DU	6.63E-03	6.52E-05	7.46E-06	-	-	-	-	-	-	-	1.47E-05	1.24E-04	5.42E-05	8.35E-07	-6.92E-04
Eutrophication terrestrial Potential (EP) - mol N eq. /DU	7.15E-01	7.23E-04	8.10E-05	-	-	-	-	-	-	-	1.62E-04	1.37E-03	6.33E-04	9.20E-06	-7.67E-03
	Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.														

Prof Z U 150x40x0.6 mm, MgZ U 150x40x0.6 mm - ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Creation Potential (POCP) - kg NMVOC /DU	9.38E-03	2.29E-04	2.84E-05	-	-	-	-	-	-	-	4.45E-05	4.80E-04	1.72E-04	2.67E-06	-3.81E-03
	Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use Deprivation Potential, m^3 depriv/DU	1.22E+00	2.64E-03	6.75E-05	-	-	-	-	-	-	-	5.88E-05	2.71E-04	3.00E-03	3.20E-04	-8.13E-02
	Water use = It is based on the available water remaining per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met.														
Resource use, minerals and metals, kg Sb eq. /DU	3.68E-03	1.70E-06	1.72E-08	-	-	-	-	-	-	-	4.90E-09	2.88E-07	1.20E-06	2.34E-09	-3.35E-06
	Resource use, minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Resource use, fossils, MJ, net calorific value/DU	2.98E+01	9.41E-01	3.80E-02	-	-	-	-	-	-	-	4.39E-02	6.34E-01	2.73E-01	7.15E-03	-9.38E+00
	Resource use, fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

Table 21 - LCA results of use of resources referred to 1 m of Z C Plus 50x27x0.6 mm and MgZ C Plus 50x27x0.6 mm steel profiles.

Prof Z C Plus 50x27x0.6 mm, MgZ C Plus 50x27x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.03E+00	6.84E-03	1.28E-04	-	-	-	-	-	-	-	1.24E-04	1.69E-03	2.53E-02	3.01E-05	-3.42E-01
Use of renewable primary energy used as raw materials MJ/DU	2.16E-04	1.83E-06	2.86E-08	-	-	-	-	-	-	-	2.81E-08	3.81E-07	2.53E-06	7.46E-09	-8.59E-05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.03E+00	6.84E-03	1.28E-04	-	-	-	-	-	-	-	1.24E-04	1.69E-03	2.53E-02	3.01E-05	-3.42E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.46E+01	4.81E-01	2.28E-02	-	-	-	-	-	-	-	2.28E-02	3.30E-01	1.42E-01	3.72E-03	-4.89E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.46E+01	4.81E-01	2.28E-02	-	-	-	-	-	-	-	2.28E-02	3.30E-01	1.42E-01	3.72E-03	-4.89E+00
Use of secondary material kg/DU	2.70E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renew-able secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	1.45E-02	4.54E-05	3.80E-06	-	-	-	-	-	-	-	1.22E-06	4.23E-05	6.29E-05	3.94E-06	-1.42E-03

Table 22 - LCA results of use of resources referred to 1 m of Z U 27x30x0.6 mm and MgZ U 27x30x0.6 mm steel profiles.

Prof Z U 27x30x0.6 mm, MgZ U 27x30x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	8.35E-01	4.98E-03	1.03E-04	-	-	-	-	-	-	-	8.77E-05	1.20E-03	1.79E-02	2.13E-05	-2.68E-01
Use of renewable primary energy used as raw materials MJ/DU	1.66E-04	1.33E-06	2.30E-08	-	-	-	-	-	-	-	1.99E-08	2.70E-07	1.79E-06	5.29E-09	-6.09E-05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	8.35E-01	4.98E-03	1.03E-04	-	-	-	-	-	-	-	8.77E-05	1.20E-03	1.79E-02	2.13E-05	-2.68E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.13E+01	3.51E-01	1.80E-02	-	-	-	-	-	-	-	1.62E-02	2.34E-01	1.01E-01	2.64E-03	-3.47E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.13E+01	3.51E-01	1.80E-02	-	-	-	-	-	-	-	1.62E-02	2.34E-01	1.01E-01	2.64E-03	-3.47E+00
Use of secondary material kg/DU	1.91E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	1.10E-02	3.31E-05	3.11E-06	-	-	-	-	-	-	-	8.64E-07	3.00E-05	4.46E-05	2.79E-06	-1.01E-03

Table 23 - LCA results of use of resources referred to 1 m of Z C 75x50x0.6 mm and MgZ C 75x50x0.6 mm steel profiles.

Prof Z C 75x50x0.6 mm, MgZ C 75x50x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.58E+00	1.09E-02	1.77E-04	-	-	-	-	-	-	-	1.94E-04	2.66E-03	3.98E-02	4.73E-05	-4.86E-01
Use of renewable primary energy used as raw materials MJ/DU	3.50E-04	2.93E-06	3.96E-08	-	-	-	-	-	-	-	4.42E-08	5.99E-07	3.98E-06	1.17E-08	-1.34E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.58E+00	1.09E-02	1.77E-04	-	-	-	-	-	-	-	1.94E-04	2.66E-03	3.98E-02	4.73E-05	-4.86E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.36E+01	7.70E-01	3.23E-02	-	-	-	-	-	-	-	3.59E-02	5.18E-01	2.23E-01	5.84E-03	-7.66E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.36E+01	7.70E-01	3.23E-02	-	-	-	-	-	-	-	3.59E-02	5.18E-01	2.23E-01	5.84E-03	-7.66E+00
Use of secondary material kg/DU	4.25E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	2.34E-02	7.26E-05	5.16E-06	-	-	-	-	-	-	-	1.92E-06	6.65E-05	9.90E-05	6.20E-06	-2.22E-03

Table 24 - LCA results of use of resources referred to 1 m of Z U 75x40x0.6 mm and MgZ U 75x40x0.6 mm steel profiles.

Prof Z U 75x40x0.6 mm, MgZ U 75x40x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.39E+00	8.95E-03	1.52E-04	-	-	-	-	-	-	-	1.59E-04	2.17E-03	3.25E-02	3.86E-05	-4.13E-01
Use of renewable primary energy used as raw materials MJ/DU	3.03E-04	2.39E-06	3.40E-08	-	-	-	-	-	-	-	3.61E-08	4.89E-07	3.24E-06	9.58E-09	-1.10E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.39E+00	8.95E-03	1.52E-04	-	-	-	-	-	-	-	1.59E-04	2.17E-03	3.25E-02	3.86E-05	-4.14E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.07E+01	6.30E-01	2.75E-02	-	-	-	-	-	-	-	2.93E-02	4.23E-01	1.82E-01	4.77E-03	-6.27E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.07E+01	6.30E-01	2.75E-02	-	-	-	-	-	-	-	2.93E-02	4.23E-01	1.82E-01	4.77E-03	-6.27E+00
Use of secondary material kg/DU	3.47E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	1.99E-02	5.94E-05	4.47E-06	-	-	-	-	-	-	-	1.56E-06	5.43E-05	8.08E-05	5.06E-06	-1.81E-03

Table 25 - LCA results of use of resources referred to 1 m of Z C 50x50x0.6 mm and MgZ C 50x50x0.6 mm steel profiles.

Prof Z C 50x50x0.6 mm, MgZ C 50x50x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.38E+00	9.47E-03	1.59E-04	-	-	-	-	-	-	-	1.68E-04	2.29E-03	3.44E-02	4.09E-05	-4.33E-01
Use of renewable primary energy used as raw materials MJ/DU	3.01E-04	2.53E-06	3.55E-08	-	-	-	-	-	-	-	3.82E-08	5.18E-07	3.44E-06	1.01E-08	-1.16E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.38E+00	9.47E-03	1.59E-04	-	-	-	-	-	-	-	1.68E-04	2.30E-03	3.44E-02	4.09E-05	-4.33E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.04E+01	6.66E-01	2.87E-02	-	-	-	-	-	-	-	3.10E-02	4.48E-01	1.93E-01	5.05E-03	-6.63E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.04E+01	6.66E-01	2.87E-02	-	-	-	-	-	-	-	3.10E-02	4.48E-01	1.93E-01	5.05E-03	-6.63E+00
Use of secondary material kg/DU	3.67E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	2.02E-02	6.29E-05	4.65E-06	-	-	-	-	-	-	-	1.66E-06	5.75E-05	8.55E-05	5.36E-06	-1.92E-03

Table 26 - LCA results of use of resources referred to 1 m of Z U 50x40x0.6 mm and MgZ U 50x40x0.6 mm steel profiles.

Prof Z U 50x40x0.6 mm, MgZ U 50x40x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.17E+00	7.47E-03	1.34E-04	-	-	-	-	-	-	-	1.32E-04	1.81E-03	2.71E-02	3.22E-05	-3.59E-01
Use of renewable primary energy used as raw materials MJ/DU	2.49E-04	2.00E-06	2.99E-08	-	-	-	-	-	-	-	3.82E-08	4.08E-07	2.70E-06	7.98E-09	-9.15E-05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.17E+00	7.47E-03	1.34E-04	-	-	-	-	-	-	-	1.32E-04	1.81E-03	2.71E-02	3.22E-05	-3.59E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.68E+01	5.25E-01	2.40E-02	-	-	-	-	-	-	-	2.44E-02	3.52E-01	1.52E-01	3.97E-03	-5.22E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.68E+01	5.25E-01	2.40E-02	-	-	-	-	-	-	-	2.44E-02	3.52E-01	1.52E-01	3.97E-03	-5.22E+00
Use of secondary material kg/DU	2.89E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	1.66E-02	4.96E-05	3.96E-06	-	-	-	-	-	-	-	1.30E-06	4.53E-05	6.73E-05	4.22E-06	-1.51E-03

Table 27 - LCA results of use of resources referred to 1 m of Z C Plus 50x15x0.6 mm and MgZ C Plus 50x15x0.6 mm steel profiles.

Prof Z C Plus 50x15x0.6 mm, MgZ C Plus 50x15x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	8.39E-01	5.69E-03	1.12E-04	-	-	-	-	-	-	-	1.00E-04	1.37E-03	2.06E-02	2.44E- 05	-2.94E-01
Use of renewable primary energy used as raw materials MJ/DU	1.71E-04	1.52E-06	2.49E-08	-	-	-	-	-	-	-	2.28E-08	3.09E-07	2.05E-06	6.06E- 09	-6.96E-05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	8.39E-01	5.69E-03	1.12E-04	-	-	-	-	-	-	-	1.00E-04	1.37E-03	2.06E-02	2.44E- 05	-2.94E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.16E+01	4.00E-01	1.97E-02	-	-	-	-	-	-	-	1.86E-02	2.68E-01	1.15E-01	3.02E- 03	-3.96E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.16E+01	4.00E-01	1.97E-02	-	-	-	-	-	-	-	1.86E-02	2.68E-01	1.15E-01	3.02E- 03	-3.96E+00
Use of secondary material kg/DU	2.19E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renew-able secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	1.15E-02	3.78E-05	3.35E-06	-	-	-	-	-	-	-	9.89E-07	3.44E-05	5.11E-05	3.20E- 06	1.15E-02

Table 28 - LCA results of use of resources referred to 1 m of Z U 15x30x0.6 mm steel profile.

Prof Z U 15x30x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	6.68E-01	4.29E-03	9.46E-05	-	-	-	-	-	-	-	7.52E-05	1.03E-03	1.54E-02	1.83E-05	-2.42E-01
Use of renewable primary energy used as raw materials MJ/DU	1.29E-04	1.15E-06	2.10E-08	-	-	-	-	-	-	-	1.71E-08	2.32E-07	1.54E-06	4.54E- 09	-5.23E-05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	6.68E-01	4.29E-03	9.47E-05	-	-	-	-	-	-	-	7.52E-05	1.03E-03	1.54E-02	1.83E- 05	-2.42E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	8.69E+00	3.02E-01	1.63E-02	-	-	-	-	-	-	-	1.39E-02	2.00E-01	8.63E-02	2.26E- 03	-2.98E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	8.69E+00	3.02E-01	1.63E-02	-	-	-	-	-	-	-	1.39E-02	2.00E-01	8.63E-02	2.26E- 03	-2.98E+00
Use of secondary material kg/DU	1.64E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	8.67E-03	2.85E-05	2.87E-06	-	-	-	-	-	-	-	7.41E-07	2.57E-05	3.83E-05	2.40E- 06	-8.67E-04

Table 29 - LCA results of use of resources referred to 1 m of Z U 100x50x0.6 mm and MgZ U 100x50x0.6 mm steel profiles.

Prof Z U 100x50x0.6 mm, MgZ U 100x50x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.78E+00	1.24E-02	1.95E-04	-	-	-	-	-	-	-	2.21E-04	3.02E-03	4.52E-02	5.37E-05	-5.41E-01
Use of renewable primary energy used as raw materials MJ/DU	3.99E-04	3.32E-06	4.38E-08	-	-	-	-	-	-	-	5.03E-08	6.81E-07	4.52E-06	1.33E-08	-1.53E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.78E+00	1.24E-02	1.95E-04	-	-	-	-	-	-	-	2.21E-04	3.02E-03	4.52E-02	5.37E-05	-5.41E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.70E+01	8.74E-01	3.58E-02	-	-	-	-	-	-	-	4.08E-02	5.89E-01	2.54E-01	6.64E-03	-8.71E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.70E+01	8.74E-01	3.58E-02	-	-	-	-	-	-	-	4.08E-02	5.89E-01	2.54E-01	6.64E-03	-8.71E+00
Use of secondary material kg/DU	4.82E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	2.67E-02	8.24E-05	5.67E-06	-	-	-	-	-	-	-	2.18E-06	7.56E-05	1.12E-04	7.04E-06	-2.52E-03

Table 30 - LCA results of use of resources referred to 1 m of Z U 100x40x0.6 mm and MgZ 100x40x0.6 mm steel profiles.

Prof Z U 100x40x0.6 mm, MgZ 100x40x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.67E+00	1.22E-02	1.93E-04	-	-	-	-	-	-	-	2.18E-04	2.98E-03	4.46E-02	5.30E- 05	-5.32E-01
Use of renewable primary energy used as raw materials MJ/DU	3.76E-04	3.26E-06	4.33E-08	-	-	-	-	-	-	-	4.96E-08	6.72E-07	4.46E-06	1.32E- 08	-1.50E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.67E+00	1.22E-02	1.93E-04	-	-	-	-	-	-	-	2.18E-04	2.98E-03	4.46E-02	5.30E- 05	-5.32E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.55E+01	8.59E-01	3.54E-02	-	-	-	-	-	-	-	4.03E-02	5.81E-01	2.50E-01	6.55E-03	-8.53E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.55E+01	8.59E-01	3.54E-02	-	-	-	-	-	-	-	4.03E-02	5.81E-01	2.50E-01	6.55E-03	-8.53E+00
Use of secondary material kg/DU	4.76E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	2.53E-02	8.10E-05	5.61E-06	-	-	-	-	-	-	-	2.15E-06	7.46E-05	1.11E-04	6.95E-06	-2.47E-03

Table 31 - LCA results of use of resources referred to 1 m of Z C 150x50x0.6 mm and MgZ C 150x50x0.6 mm steel profiles.

Prof Z C 150x50x0.6 mm, MgZ C 150x50x0.6 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.18E+00	1.54E-02	2.32E-04	-	-	-	-	-	-	-	2.74E-04	3.74E-03	5.60E-02	6.66E-05	-6.49E-01
Use of renewable primary energy used as raw materials MJ/DU	4.96E-04	4.11E-06	5.20E-08	-	-	-	-	-	-	-	6.23E-08	8.44E-07	5.60E-06	1.65E-08	-1.89E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.18E+00	1.54E-02	2.32E-04	-	-	-	-	-	-	-	2.74E-04	3.74E-03	5.60E-02	6.66E-05	-6.49E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	3.35E+01	1.08E-00	4.28E-02	-	-	-	-	-	-	-	5.06E-02	7.29E-01	3.14E-01	8.23E-03	-1.08E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	3.35E+01	1.08E-00	4.28E-02	-	-	-	-	-	-	-	5.06E-02	7.29E-01	3.14E-01	8.23E-03	-1.08E+01
Use of secondary material kg/DU	5.98E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	3.32E-02	1.02E-04	6.69E-06	-	-	-	-	-	-	-	2.70E-06	9.37E-05	1.39E-04	8.73E-06	-3.12E-03

Table 32 - LCA results of use of resources referred to 1 m of Z U 150x40x0.6 mm and MgZ U 150x40x0.6 mm steel profiles.

Prof Z U 150x40x0.6 mm, MgZ U 150x40x0.6 - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	1.97E+00	1.34E-02	2.07E-04	-	-	-	-	-	-	-	2.38E-04	3.25E-03	4.87E-02	5.78E-05	-5.76E-01
Use of renewable primary energy used as raw materials MJ/DU	4.42E-04	3.58E-06	4.64E-08	-	-	-	-	-	-	-	5.41E-08	7.33E-07	4.86E-06	1.43E-08	-1.65E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	1.97E+00	1.34E-02	2.07E-04	-	-	-	-	-	-	-	2.38E-04	3.25E-03	4.87E-02	5.78E-05	-5.76E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.98E+01	9.41E-01	3.80E-02	-	-	-	-	-	-	-	4.39E-02	6.34E-01	2.73E-01	7.15E- 03	-9.38E+00
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.98E+01	9.41E-01	3.80E-02	-	-	-	-	-	-	-	4.39E-02	6.34E-01	2.73E-01	7.15E- 03	-9.38E+00
Use of secondary material kg/DU	5.19E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Use of net fresh water m^3/DU	2.96E-02	8.88E-05	5.99E-06	-	-	-	-	-	-	-	2.34E-06	8.14E-05	1.21E-04	7.58E- 06	-2.71E-03

Table 33 - LCA results of waste categories referred to 1 m of Z C Plus 50x27x0.6 mm and MgZ C Plus 50x27x0.6 mm steel profiles.

Prof Z C Plus 50x27x0.6 mm, MgZ C Plus 50x27x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	2.70E-04	1.26E-06	9.27E-09	-	-	-	-	-	-	-	6.22E-08	1.18E-07	4.38E-07	5.55E-09	-3.36E-05
Non-hazardous (excluding inert) waste disposed kg/DU	1.70E-01	2.31E-02	4.77E-03	-	-	-	-	-	-	-	2.71E-05	1.59E-03	3.55E-03	2.52E-02	-6.41E-02
Radioactive waste disposed kg/DU	3.92E-05	3.28E-06	1.62E-07	-	-	-	-	-	-	-	1.59E-07	2.35E-06	8.30E-07	2.44E-08	-1.28E-05

Table 34 - LCA results of waste categories referred to 1 m of Z U 27x30x0.6 mm and MgZ U 27x30x0.6 mm steel profiles.

Prof Z U 27x30x0.6 mm, MgZ U 27x30x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	2.19E-04	9.16E-07	7.46E-09	-	-	-	-	-	-	-	4.41E-08	8.35E-08	3.11E-07	3.94E-09	-2.38E-05
Non-hazardous (excluding inert) waste disposed kg/DU	1.24E-01	1.68E-02	4.19E-03	-	-	-	-	-	-	-	1.92E-05	1.13E-03	2.52E-03	1.79E-02	-4.53E-02
Radioactive waste disposed kg/DU	3.06E-05	2.39E-06	1.28E-07	-	-	-	-	-	-	-	1.12E-07	1.67E-06	5.88E-07	1.73E-08	-9.08E-06

Table 35 - LCA results of waste categories referred to 1 m of Z C 75x50x0.6 mm and MgZ C 75x50x0.6 mm steel profiless.

Prof Z C 75x50x0.6 mm, MgZ C 75x50x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	4.47E-04	2.01E-06	1.28E-08	-	-	-	-	-	-	-	9.78E-08	1.85E-07	6.89E-07	8.73E-09	-5.27E-05
Non-hazardous (excluding inert) waste disposed kg/DU	2.69E-01	3.70E-02	5.90E-03	-	-	-	-	-	-	-	4.25E-05	2.51E-03	5.58E-03	3.97E-02	-1.01E-01
Radioactive waste disposed kg/DU	6.37E-05	5.25E-06	2.29E-07	-	-	-	-	-	-	-	2.49E-07	3.70E-06	1.30E-06	3.84E-08	-2.01E-05

Table 36 - LCA results of waste categories referred to 1 m of Z U 75x40x0.6 mm and MgZ U 75x40x0.6 mm steel profiles.

Prof Z U 75x40x0.6 mm, MgZ U 75x40x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	3.92E-04	1.65E-06	1.10E-08	-	-	-	-	-	-	-	7.99E-08	1.51E-07	5.62E-07	7.13E-09	-4.30E-05
Non-hazardous (excluding inert) waste disposed kg/DU	2.24E-01	3.03E-02	5.33E-03	-	-	-	-	-	-	-	3.47E-05	2.05E-03	4.56E-03	3.24E-02	-8.21E-02
Radioactive waste disposed kg/DU	5.62E-05	4.29E-06	1.95E-07	-	-	-	-	-	-	-	2.04E-07	3.02E-06	1.06E-06	3.13E-08	-1.64E-05

Table 37 - LCA results of waste categories referred to 1 m of Z C 50x50x0.6 mm and MgZ C 50x50x0.6 mm steel profiles.

Prof Z C 50x50x0.6 mm, MgZ C 50x50x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	3.92E-04	1.65E-06	1.10E-08	-	-	-	-	-	-	-	7.99E-08	1.51E-07	5.62E-07	7.13E-09	-4.30E-05
Non-hazardous (excluding inert) waste disposed kg/DU	2.24E-01	3.03E-02	5.33E-03	-	-	-	-	-	-	-	3.47E-05	2.05E-03	4.56E-03	3.24E-02	-8.21E-02
Radioactive waste disposed kg/DU	5.62E-05	4.29E-06	1.95E-07	-	-	-	-	-	-	-	2.04E-07	3.02E-06	1.06E-06	3.13E-08	-1.64E-05

Table 38 - LCA results of waste categories referred to 1 m of Z U 50x40x0.6 mm and MgZ U 50x40x0.6 mm steel profiles.

Prof Z U 50x40x0.6 mm, MgZ U 50x40x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	3.27E-04	1.37E-06	9.70E-09	-	-	-	-	-	-	-	6.65E-08	1.26E-07	4.69E-07	5.94E-09	-3.58E-05
Non-hazardous (excluding inert) waste disposed kg/DU	1.86E-01	2.52E-02	4.90E-03	-	-	-	-	-	-	-	2.89E-05	1.71E-03	3.80E-03	2.70E-02	-6.83E-02
Radioactive waste disposed kg/DU	4.57E-05	3.58E-06	1.70E-07	-	-	-	-	-	-	-	1.70E-07	2.51E-06	8.87E-07	2.61E-08	-1.37E-05

Table 39 - LCA results of waste categories referred to 1 m of Z C Plus 50x15x0.6 mm and MgZ C Plus 50x15x0.6 mm steel profiles.

Prof Z C Plus 50x15x0.6 mm, MgZ C Plus 50x15x0.6 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	2.10E-04	1.05E-06	8.10E-09	-	-	-	-	-	-	-	5.05E-08	9.56E-08	3.56E-07	4.51E-09	-2.72E-05
Non-hazardous (excluding inert) waste disposed kg/DU	1.36E-01	1.92E-02	4.40E-03	-	-	-	-	-	-	-	2.20E-05	1.29E-03	2.88E-03	2.05E-02	-5.18E-02
Radioactive waste disposed kg/DU	3.09E-05	2.73E-06	1.40E-07	-	-	-	-	-	-	-	1.29E-07	1.91E-06	6.74E-07	1.98E-08	-1.04E-05

Table 40 - LCA results of waste categories referred to 1 m of Z U 15x30x0.6 mm steel profile.

Prof Z U 15x30x0.6 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	1.58E-04	7.89E-07	6.83E-09	-	-	-	-	-	-	-	3.78E-08	7.16E-08	2.66E-07	3.38E-09	-2.04E-05
Non-hazardous (excluding inert) waste disposed kg/DU	1.02E-01	1.45E-02	4.00E-03	-	-	-	-	-	-	-	1.64E-05	9.69E-04	2.16E-03	1.53E-02	-3.89E-02
Radioactive waste disposed kg/DU	2.33E-05	2.06E-06	1.16E-07	-	-	-	-	-	-	-	9.64E-08	1.43E-06	5.04E-07	1.48E-08	-7.80E-06

Table 41 - LCA results of waste categories referred to 1 m of Z C 100x50x0.6 mm and MgZ C 100x50x0.6 mm steel profiles.

Prof Z C 100x50x0.6 mm, MgZ C 100x50x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	5.11E-04	2.28E-06	1.41E-08	-	-	-	-	-	-	-	1.11E-07	2.10E-07	7.83E-07	9.92E-09	-5.99E-05
Non-hazardous (excluding inert) waste disposed kg/DU	3.06E-01	4.20E-02	6.32E-03	-	-	-	-	-	-	-	4.83E-05	2.85E-03	6.34E-03	4.51E-02	-1.14E-01
Radioactive waste disposed kg/DU	7.27E-05	5.96E-06	2.54E-07	-	-	-	-	-	-	-	2.83E-07	4.20E-06	1.48E-06	4.36E-08	-2.28E-05

Table 42 - LCA results of waste categories referred to 1 m of Z U 100x40x0.6 mm and MgZ U 100x40x0.6 mm steel profiles.

Prof Z U 100x40x0.6 mm, MgZ U 100x40x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	4.66E-04	2.25E-06	1.40E-08	-	-	-	-	-	-	-	1.10E-07	2.08E-07	7.72E-07	9.79E-09	-5.86E-05
Non-hazardous (excluding inert) waste disposed kg/DU	2.96E-01	4.13E-02	6.27E-03	-	-	-	-	-	-	-	4.77E-05	2.81E-03	6.26E-03	4.45E-02	-1.12E-01
Radioactive waste disposed kg/DU	6.82E-05	5.85E-06	2.51E-07	-	-	-	-	-	-	-	2.80E-07	4.14E-06	1.46E-06	4.30E-08	-2.24E-05

Table 43 - LCA results of waste categories referred to 1 m of Z C 150x50x0.6 mm and MgZ C 150x50x0.6 mm steel profiles.

Prof Z C 150x50x0.6 mm, MgZ C 150x50x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	6.37E-04	2.83E-06	1.68E-08	-	-	-	-	-	-	-	1.38E-07	2.61E-07	9.70E-07	1.23E-08	-7.42E-05
Non-hazardous (excluding inert) waste disposed kg/DU	3.80E-01	5.20E-02	7.16E-03	-	-	-	-	-	-	-	5.99E-05	3.53E-03	7.86E-03	5.59E-02	-1.42E-01
Radioactive waste disposed kg/DU	9.05E-05	7.37E-06	3.04E-07	-	-	-	-	-	-	-	3.51E-07	5.20E-06	1.84E-06	5.40E-08	-2.83E-05

Table 44 - LCA results of waste categories referred to 1 m of Z U 150x40x0.6 mm and MgZ U 150x40x0.6 mm steel profiles.

Prof Z U 150x40x0.6 mm, MgZ U 150x40x0.6 mm - WASTE CATEGORIES														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	5.81E-04	2.46E-06	1.50E-08	-	-	-	-	-	-	-	1.20E-07	2.26E-07	8.42E-07	1.07E-08	-6.45E-05
Non-hazardous (excluding inert) waste disposed kg/DU	3.34E-01	4.52E-02	6.59E-03	-	-	-	-	-	-	-	5.20E-05	3.07E-03	6.83E-03	4.85E-02	-1.23E-01
Radioactive waste disposed kg/DU	8.09E-05	6.41E-06	2.70E-07	-	-	-	-	-	-	-	3.05E-07	4.52E-06	1.60E-06	4.69E-08	-2.46E-05

Table 45 - LCA results of output flows referred to 1 m of Z C Plus 50x27x0.6 mm and MgZ C Plus 50x27x0.6 mm steel profiles.

Prof Z C Plus 50x27x0.6 mm, MgZ C Plus 50x27x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.14E-02	0	4.04E-02	-	-	-	-	-	-	-	0	0	4.80E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 46 - LCA results of output flows referred to 1 m of Z U 27x30x0.6 mm and MgZ U 27x30x0.6 mm steel profiles.

Prof Z U 27x30x0.6 mm, MgZ U 27x30x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	7.60E-03	0	2.99E-02	-	-	-	-	-	-	-	0	0	3.40E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 47 - LCA results of output flows referred to 1 m of Z C 75x50x0.6 mm and MgZ C 75x50x0.6 mm steel profiles.

Prof Z C 75x50x0.6 mm, MgZ C 75x50x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.71E-02	0	6.10E-02	-	-	-	-	-	-	-	0	0	7.54E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 48 - LCA results of output flows referred to 1 m of Z U 75x40x0.6 mm and MgZ U 75x40x0.6 mm steel profiles.

Prof Z U 75x40x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.43E-02	0	5.06E-02	-	-	-	-	-	-	-	0	0	6.16E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 49 - LCA results of output flows referred to 1 m of Z C 50x50x0.6 mm and MgZ C 50x50x0.6 mm steel profiles.

Prof Z C 50x50x0.6 mm, MgZ C 50x50x0.6 mm - OUTPUT FLOWS														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.52E-02	0	5.33E-02	-	-	-	-	-	-	-	0	0	6.52E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 50 - LCA results of output flows referred to 1 m of Z U 50x40x0.6 mm and MgZ U 50x40x0.6 mm steel profiles.

Prof Z C 50x40x0.6 mm, MgZ C 50x40x0.6 mm - OUTPUT FLOWS														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.14E-02	0	4.29E-02	-	-	-	-	-	-	-	0	0	5.13E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 51 - LCA results of output flows referred to 1 m of Z C Plus 50x15x0.6 mm and MgZ C Plus 50x15x0.6 mm steel profiles.

Prof Z C Plus 50x15x0.6 mm, MgZ C Plus 50x15x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	8.55E-03	0	3.36E-02	-	-	-	-	-	-	-	0	0	3.90E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 52 - LCA results of output flows referred to 1 m of Z U 15x30x0.6 mm steel profile.

Prof Z U 15x30x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	6.65E-03	0	2.63E-02	-	-	-	-	-	-	-	0	0	2.92E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 53 - LCA results of output flows referred to 1 m of Z C 100x50x0.6 mm and MgZ C 100x50x0.6 mm steel profiles.

Prof Z C 100x50x0.6 mm, MgZ C 100x50x0.6 mm - OUTPUT FLOWS														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	2.00E-02	0	6.87E-02	-	-	-	-	-	-	-	0	0	8.57E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 54 - LCA results of output flows referred to 1 m of Z U 100x40x0.6 mm and MgZ U 100x40x0.6 mm steel profiles.

Prof Z U 100x40x0.6 mm, MgZ U 100x40x0.6 mm - OUTPUT FLOWS														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	1.62E-02	0	6.78E-02	-	-	-	-	-	-	-	0	0	8.46E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

Table 55 - LCA results of output flows referred to 1 m of Z C 150x50x0.6 mm and MgZ C 150x50x0.6 mm steel profiles.

Prof Z C 150x50x0.6 mm, MgZ C 150x50x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	2.47E-02	0	8.41E-02	-	-	-	-	-	-	-	0	0	1.06E+00	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

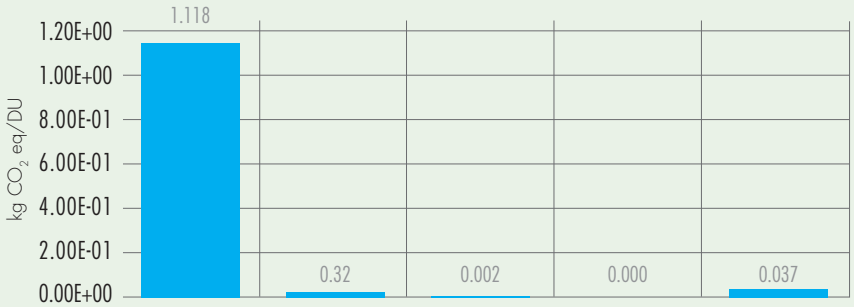
Table 56 - LCA results of output flows referred to 1 m of Z U 150x40x0.6 mm and MgZ U 150x40x0.6 mm steel profiles.

Prof Z U 150x40x0.6 mm, MgZ U 150x40x0.6 mm - OUTPUT FLOWS															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Materials for recycling kg/DU	2.19E-02	0	7.36E-02	-	-	-	-	-	-	-	0	0	9.22E-01	0	0
Materials for energy recovery kg/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0
Exported energy MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	0

The images below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of Knauf steel profiles.

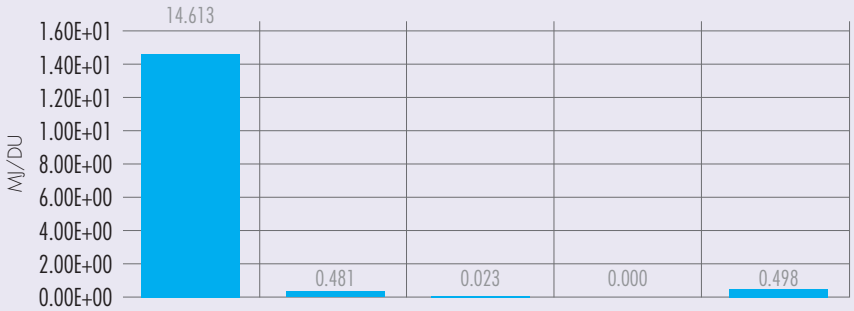
Z C Plus 50x27x0.6 mm MgZ Plus 50x27x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



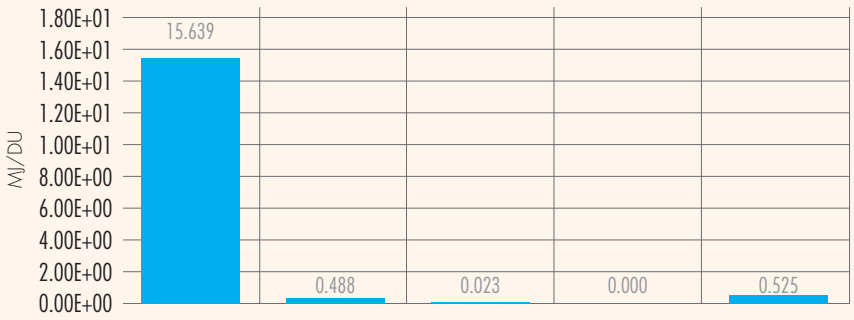
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



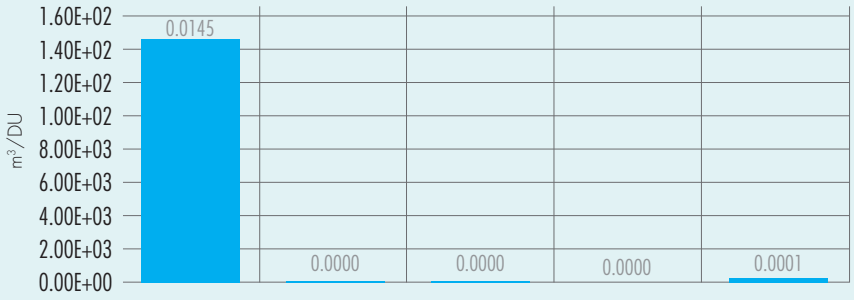
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



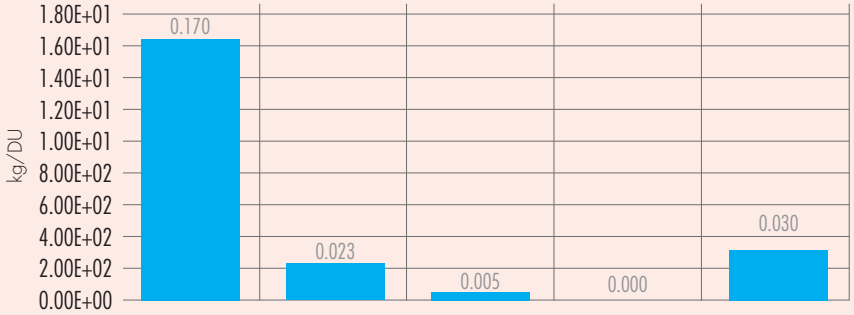
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



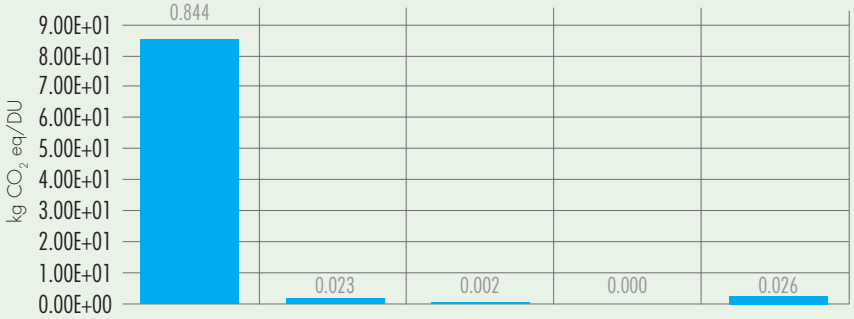
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



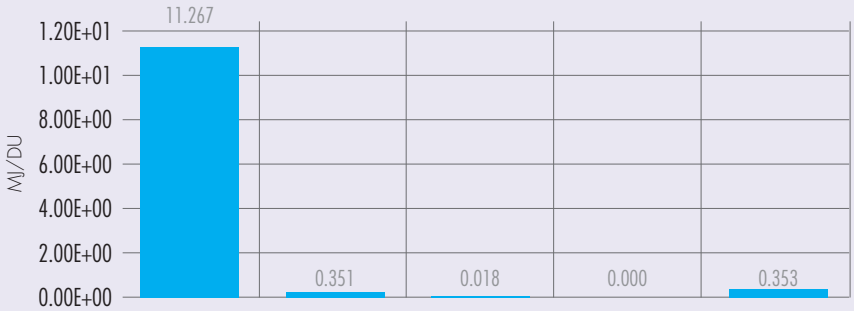
Z U 27x30x0.6 mm MgZ 27x30x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



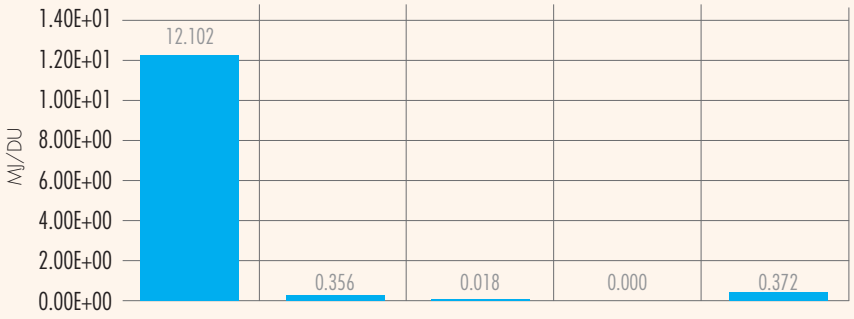
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



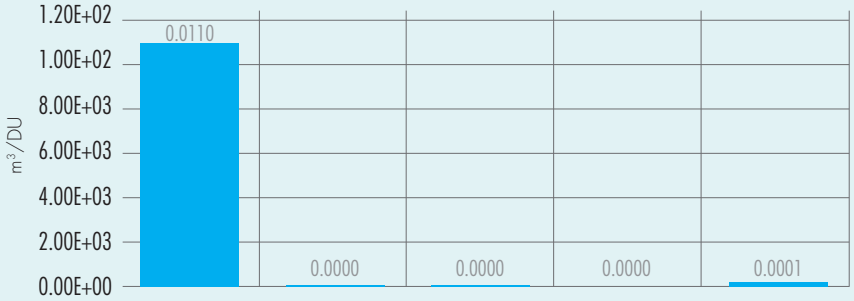
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



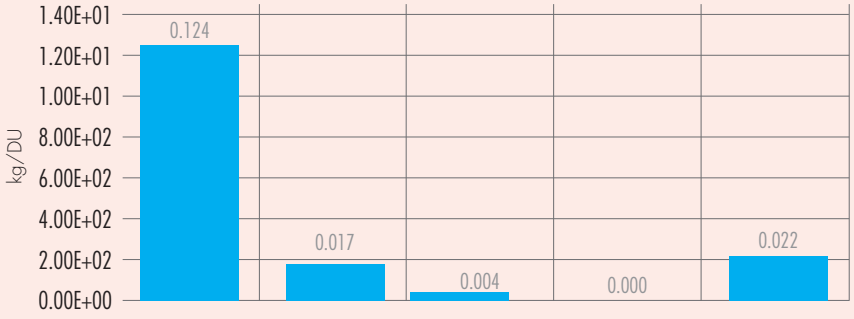
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



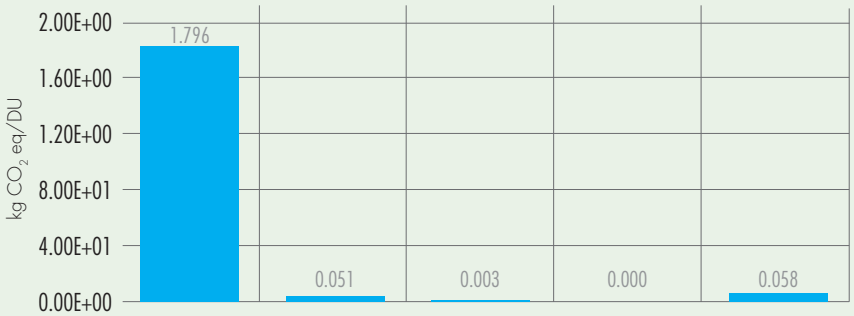
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



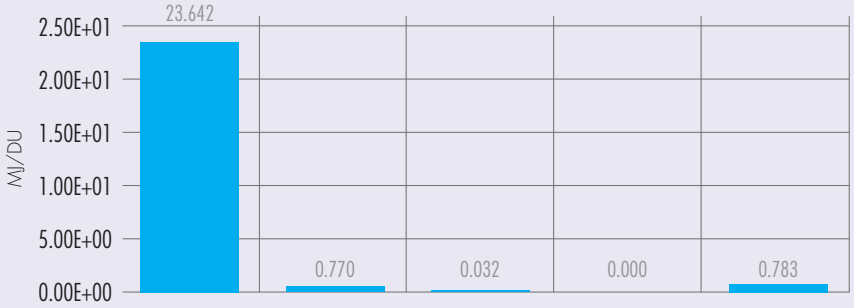
Z C 75x50x0.6 mm MgZ C 75x50x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



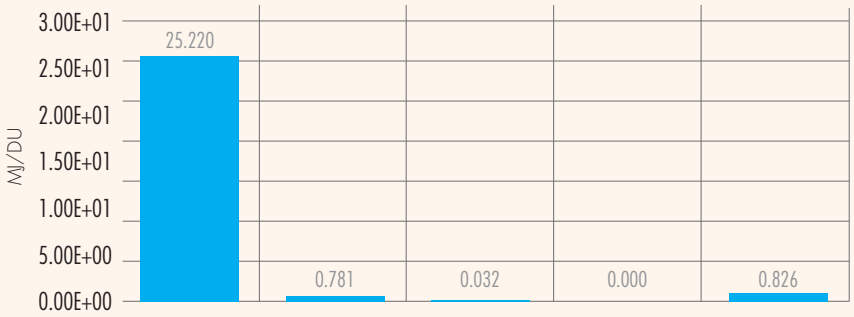
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



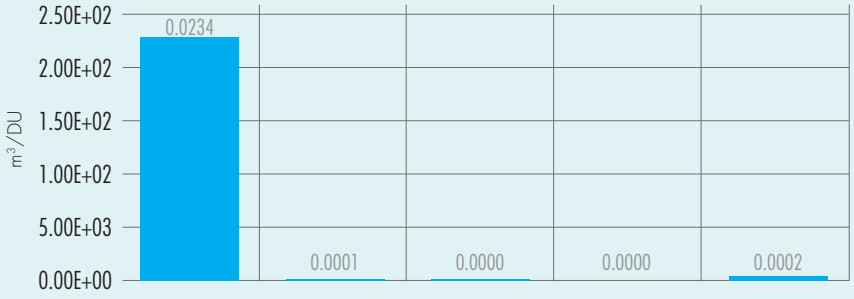
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



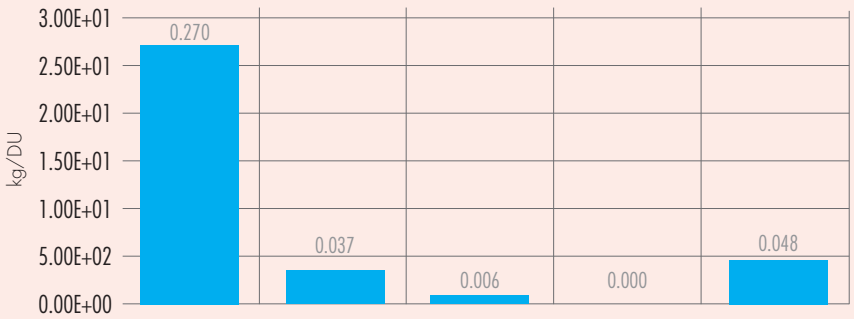
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



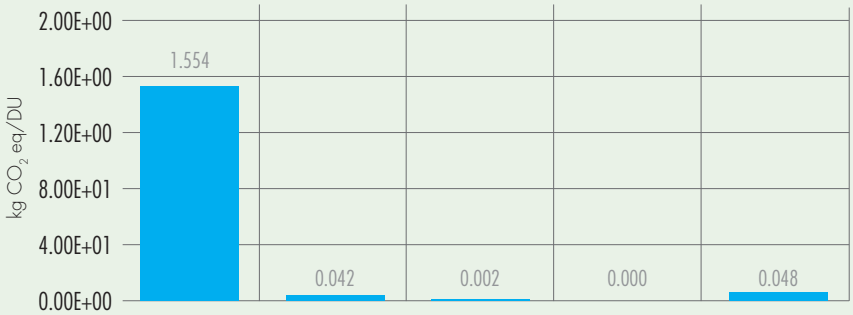
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



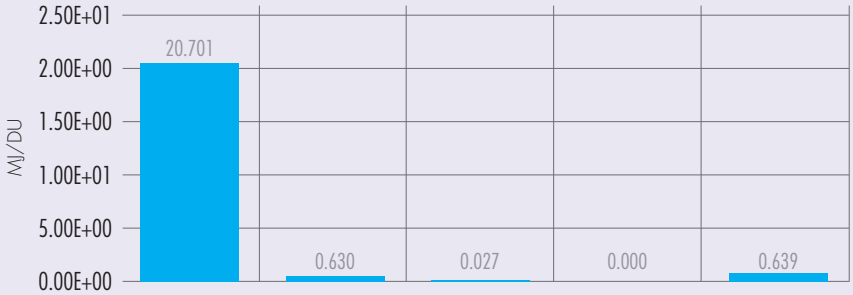
Z U 75x40x0.6 mm MgZ U 75x40x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



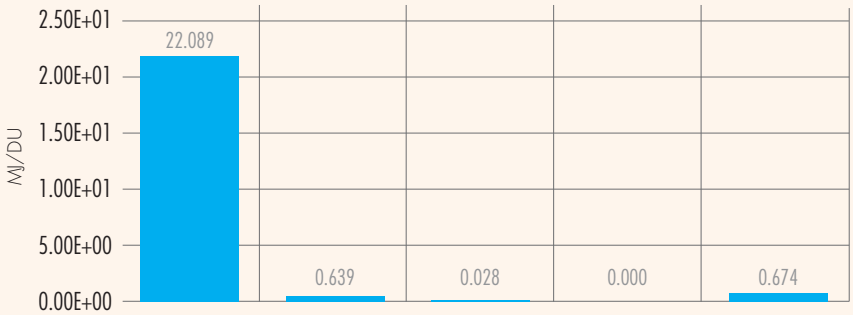
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



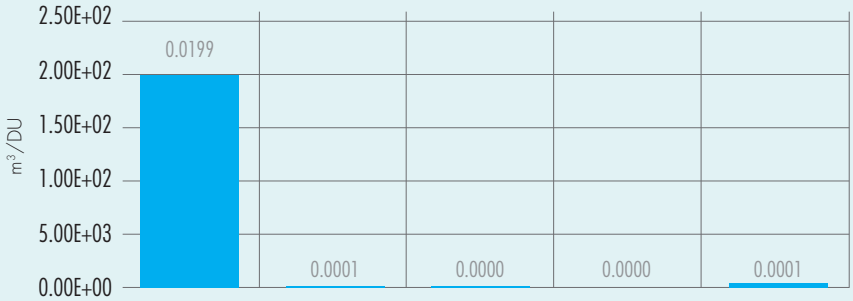
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



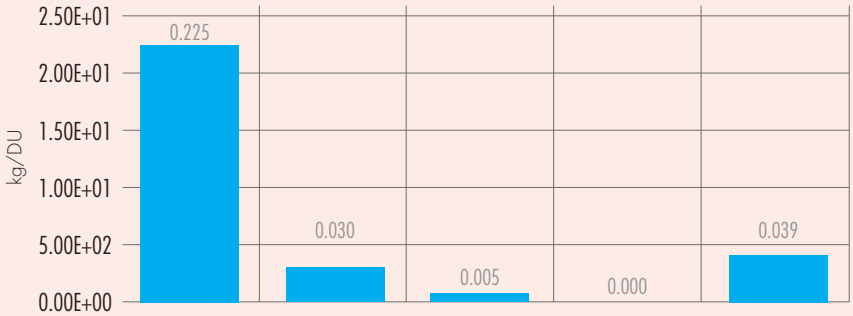
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



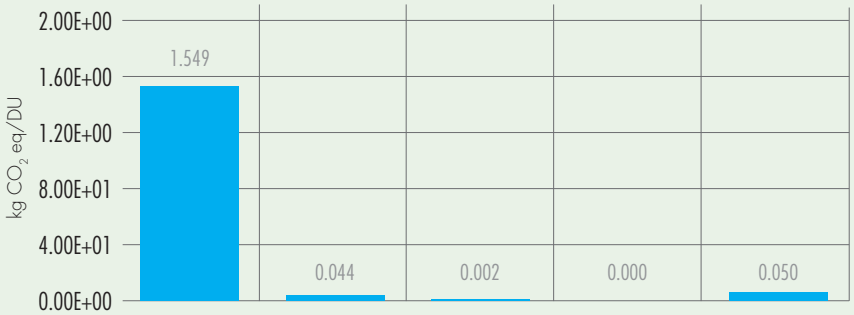
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



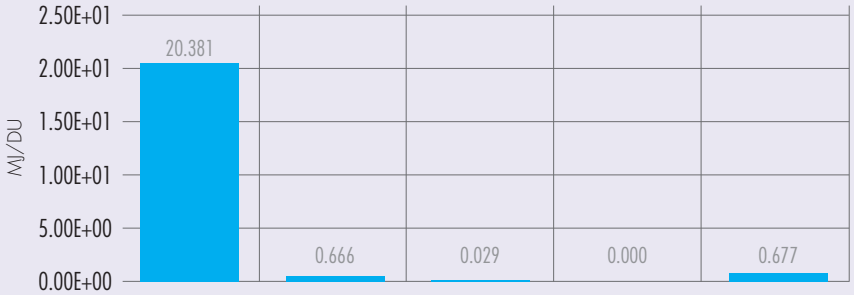
Z C 50x50x0.6 mm MgZ C 50x50x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



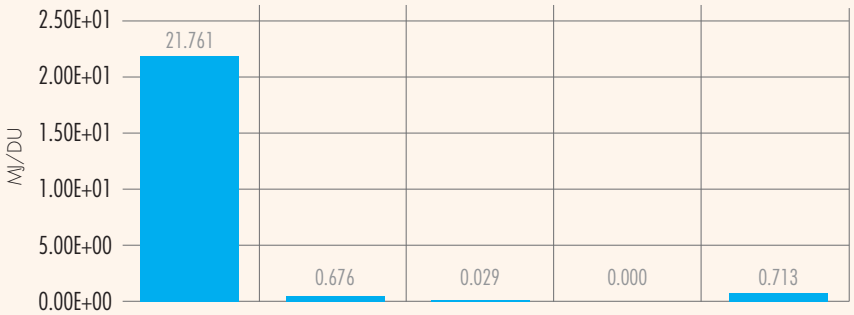
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



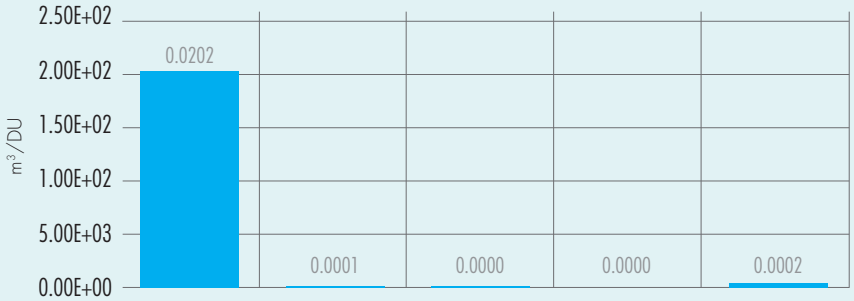
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



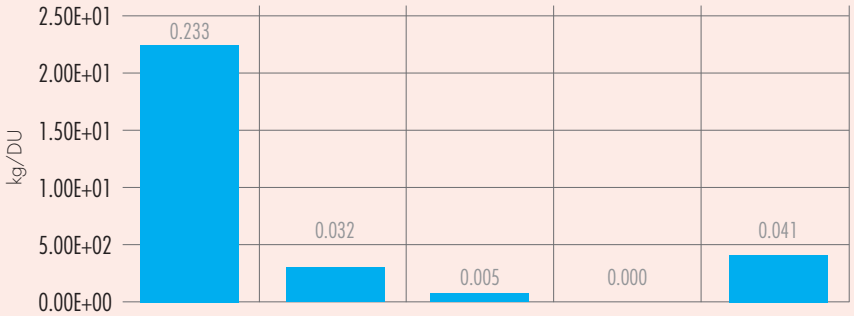
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



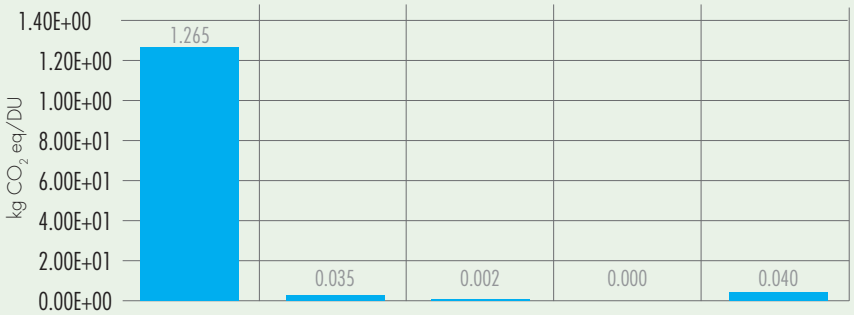
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



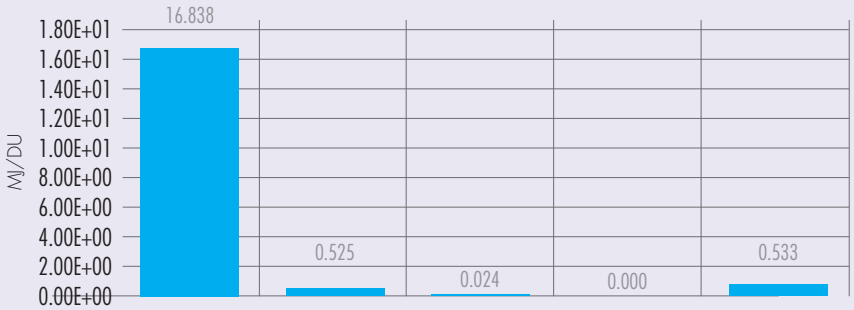
Z U 50x40x0.6 mm MgZ U 50x40x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



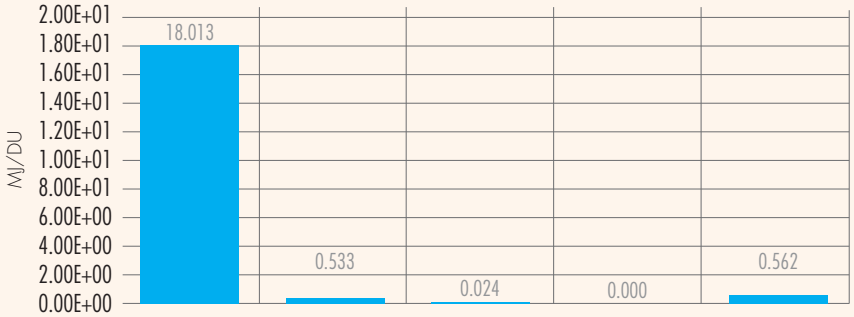
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



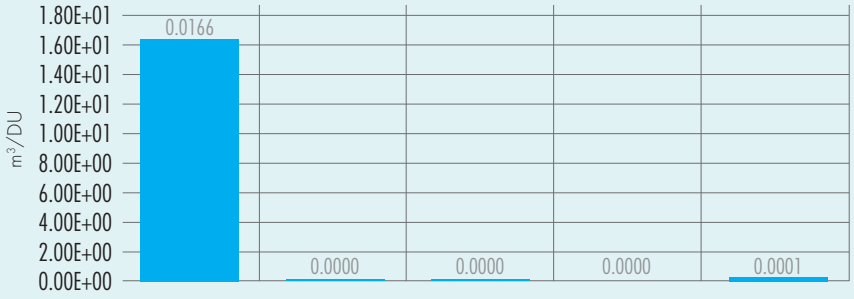
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



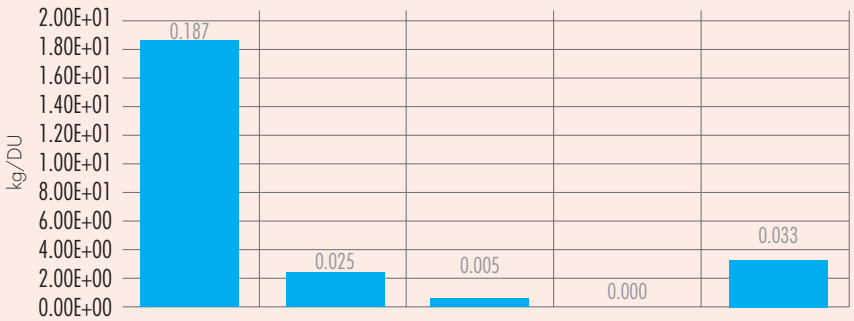
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



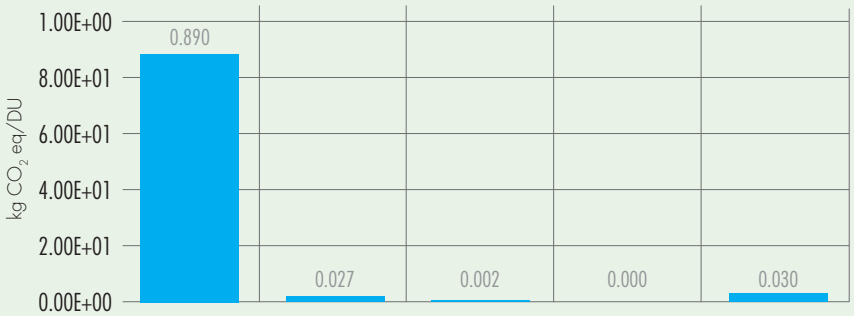
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



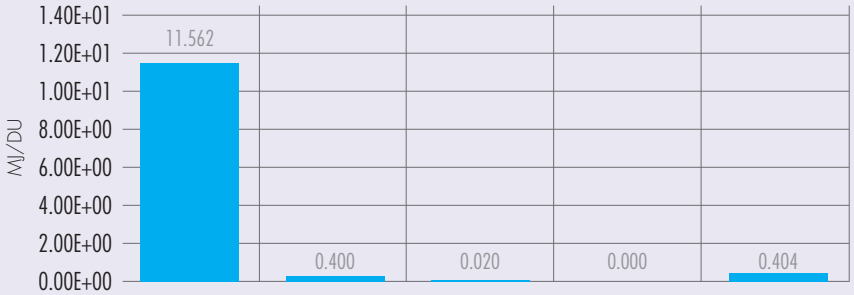
Z C Plus 50x15x0.6 mm MgZ C Plus 50x15x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



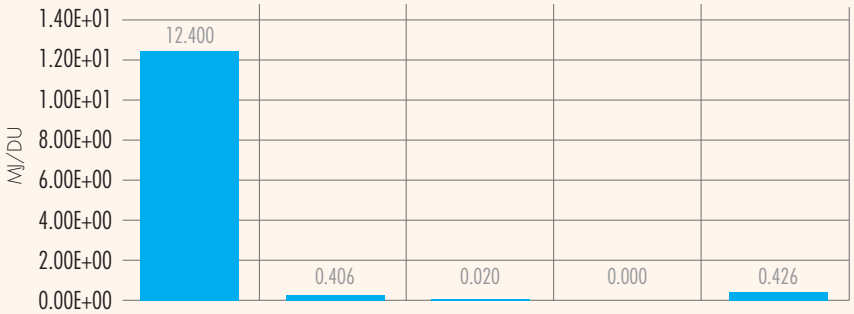
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



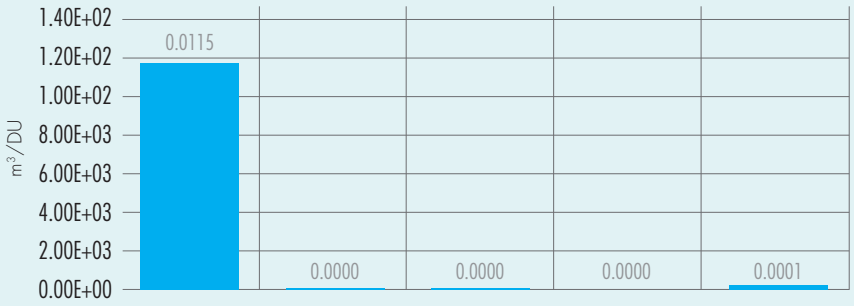
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



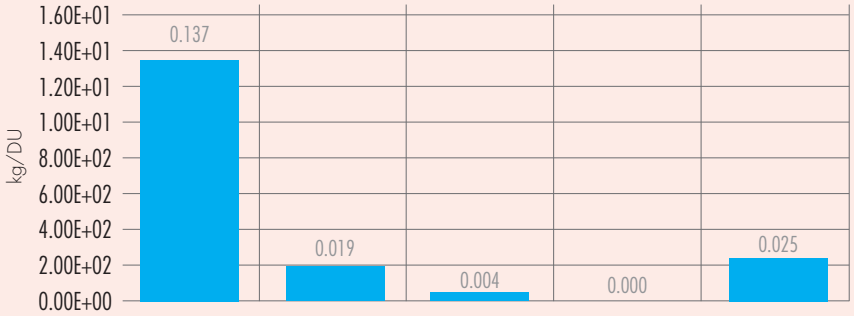
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



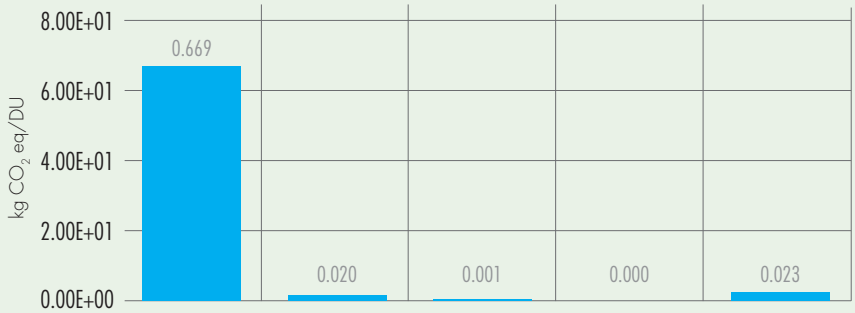
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



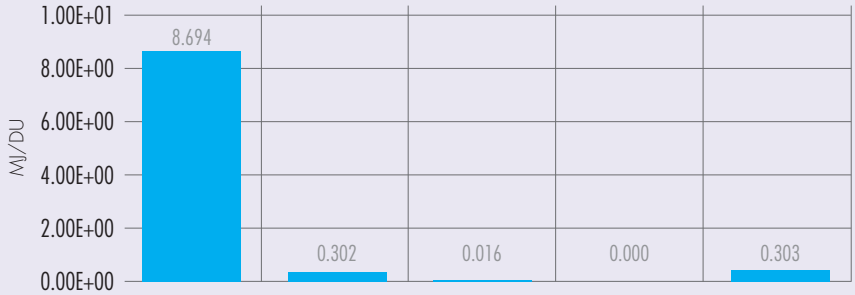
Z U 15x30x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



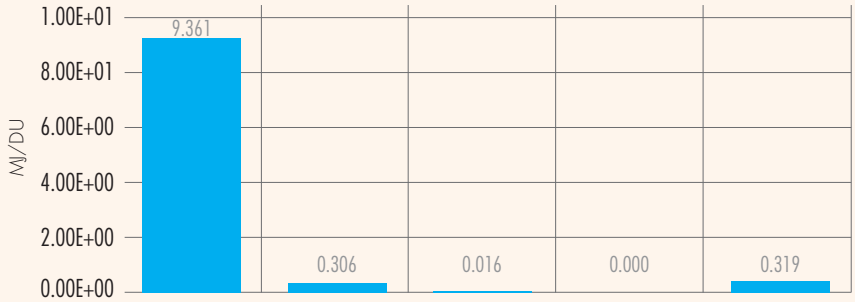
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



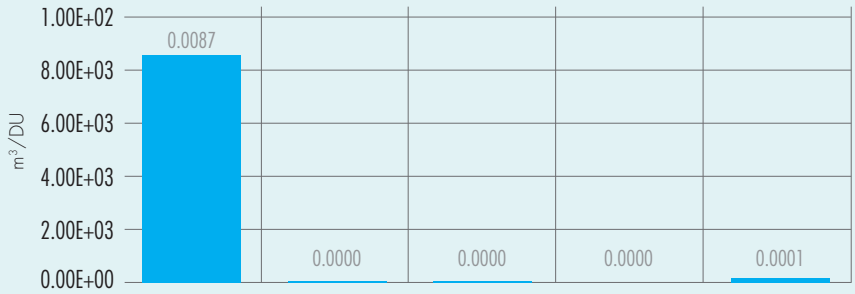
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



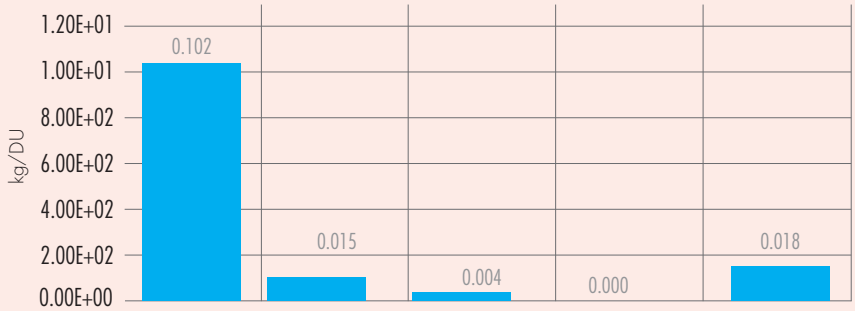
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



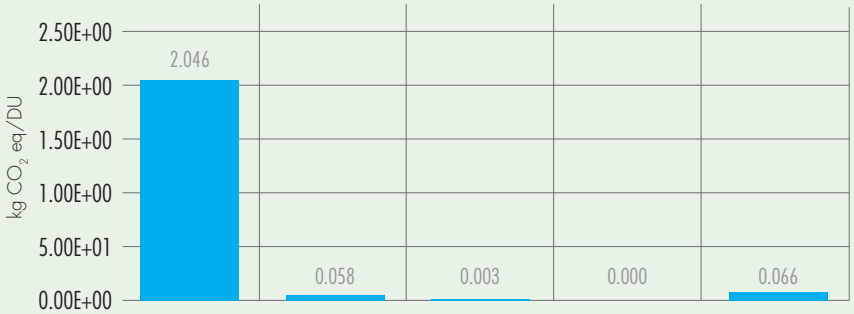
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



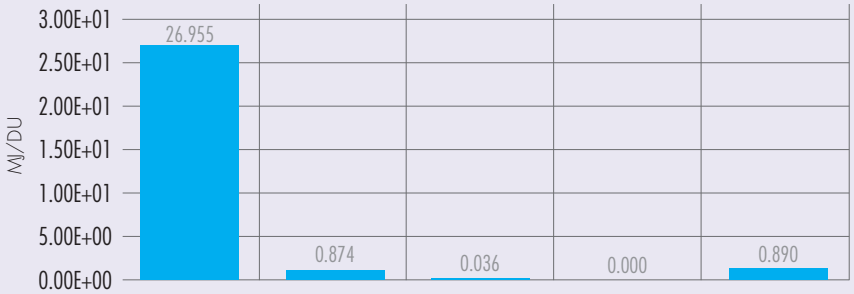
Z C 100x50x0.6 mm MgZ 100x50x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



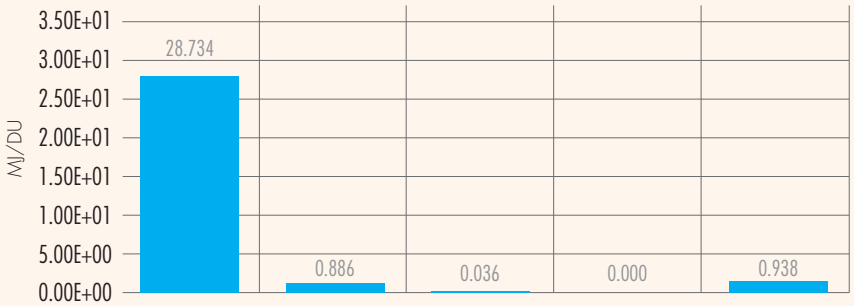
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



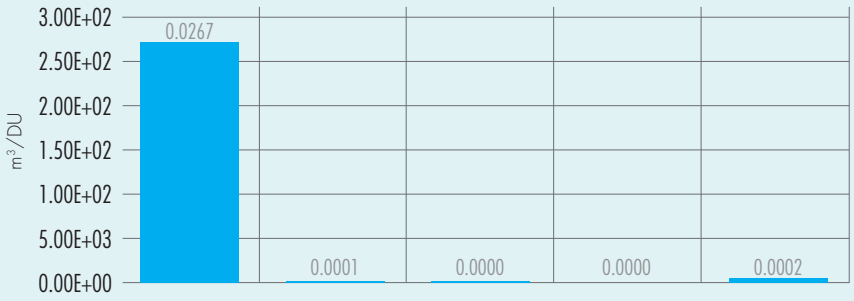
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



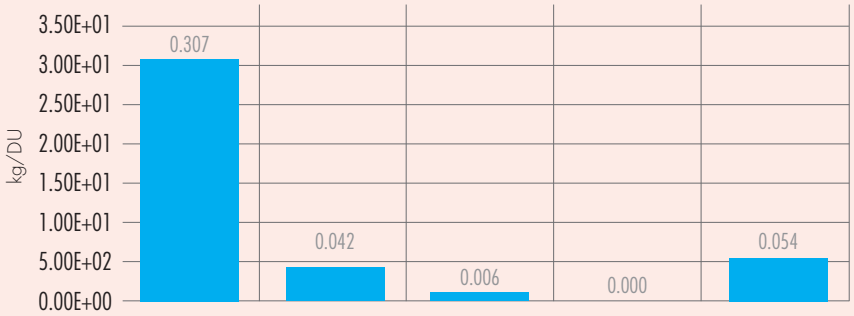
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



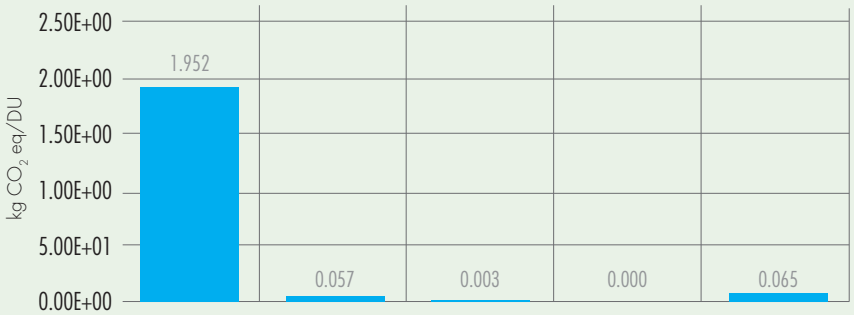
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



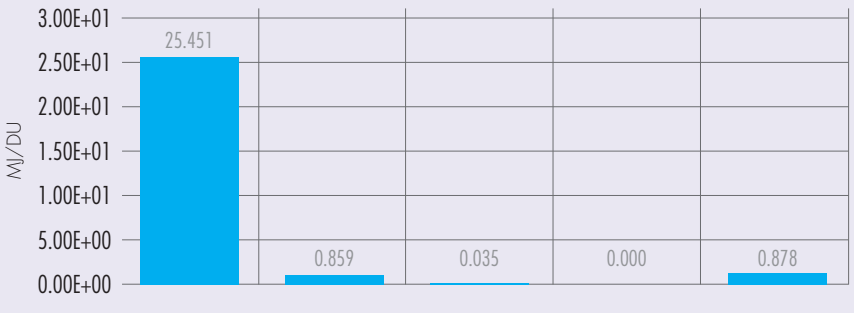
Z U 100x40x0.6 mm MgZ U 100x40x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



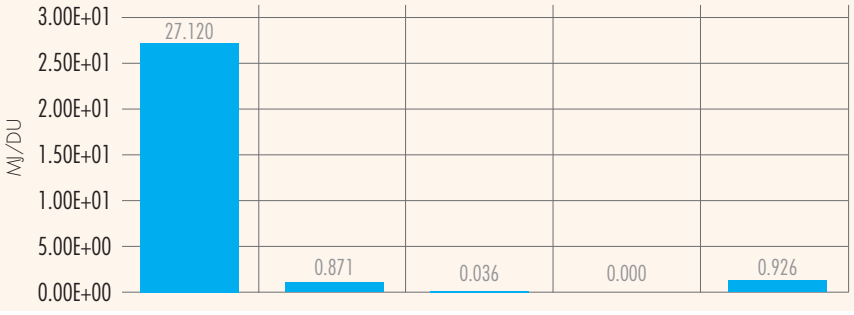
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



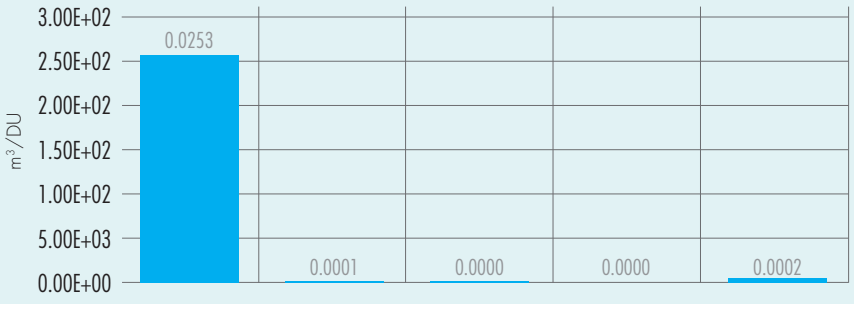
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



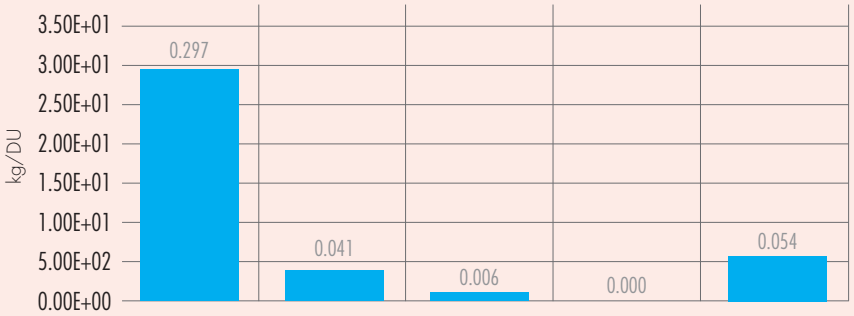
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



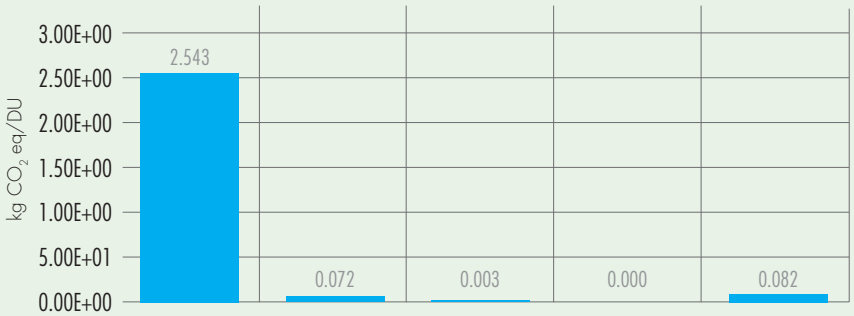
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



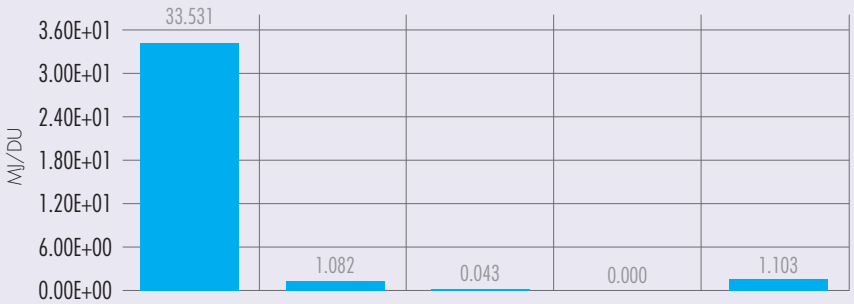
Z C 150x50x0.6 mm MgZ 150x50x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



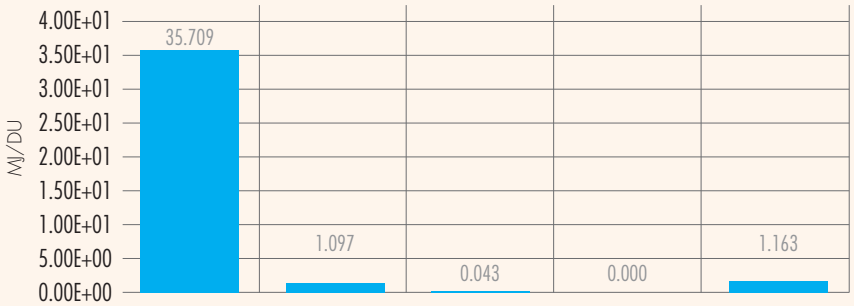
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



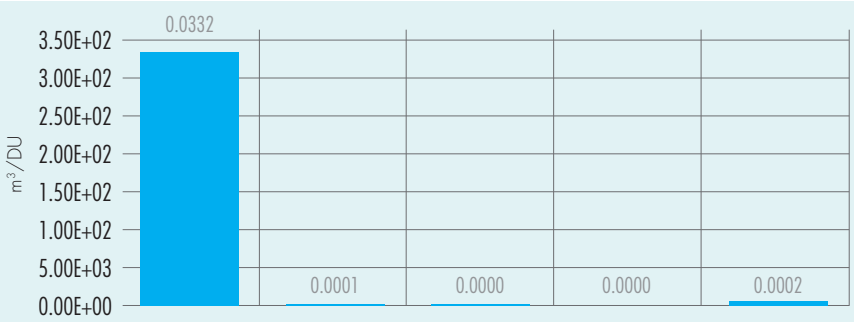
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



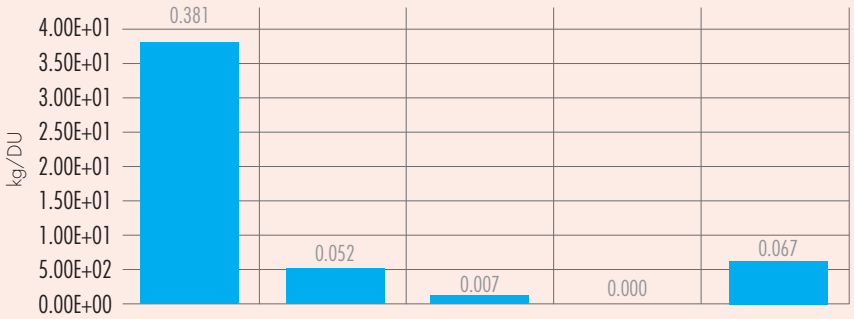
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



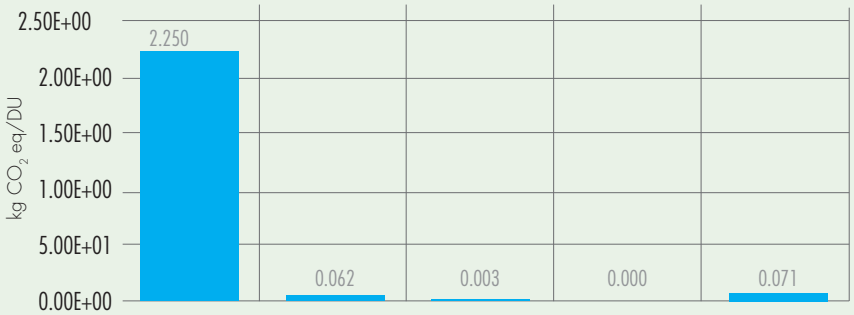
WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



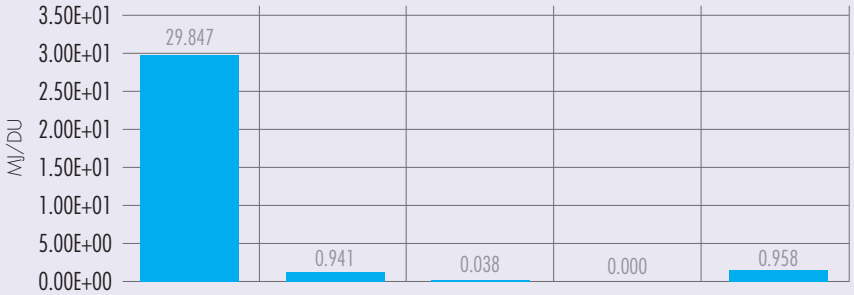
Z U 150x40x0.6 mm MgZ U 150x40x0.6 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



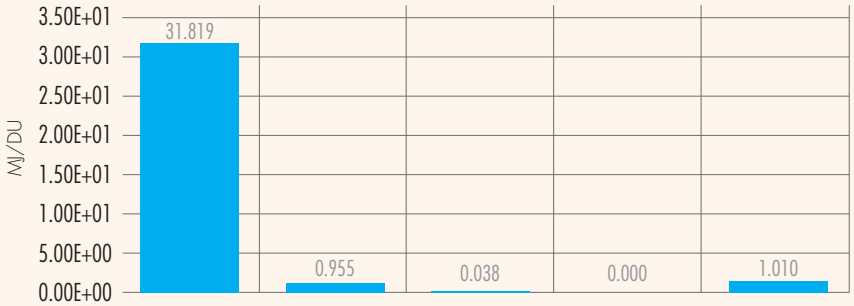
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



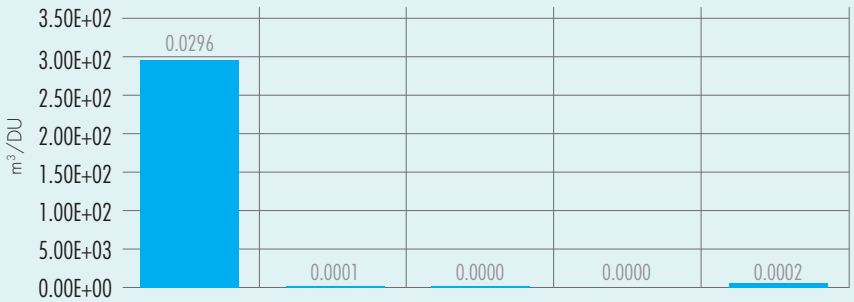
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



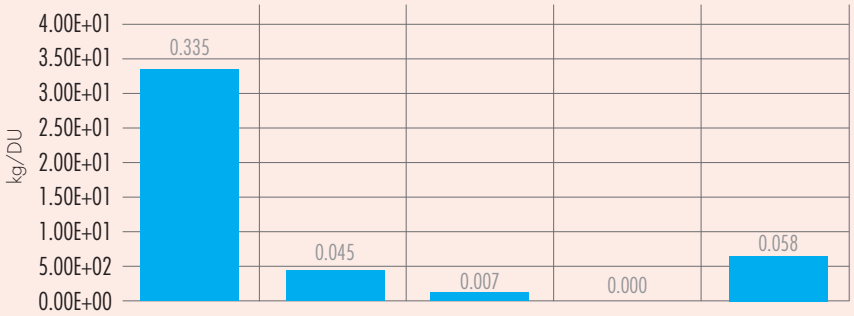
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



8. REFERENCES

Ecoinvent, 2019
Swiss Centre for Life Cycle Assessment, supplier of Ecoinvent v3.6 database (www.ecoinvent.ch).

General principles
EPD International (2019) General Programme Instructions for the International EPD® System. Version 3.01.

LCA study
Life Cycle Assessment dei profili in acciaio prodotti da Knauf di Knauf S.r.l. S.a.s. Castellina Marittima (PI), Italia (07/02/2022).

PCR
PCR 2019:14 version 1.11 for Construction Products and construction services.
IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä. Swedish Wood Preservation Institute, Swedisol, SCDA. Svenskt Limträ AB. SSAB (2019).

Standards:
EN 15804:2019+A2 "Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products"
ISO 14025:2011-10. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.
BS:OHSAS 18001:2007- ISO 45001:2018. Occupational Health and Safety Management
ISO 14001:2015. Environmental management systems - Requirements with guidance for use
ISO 9001:2015. Quality management systems - Requirements
ISO 14040:2006. Environmental management - Life cycle assessment - Principles and framework
ISO 14044:2018. Environmental management - Life cycle assessment - Requirements and guidelines

Contacts for environmental product declaration:
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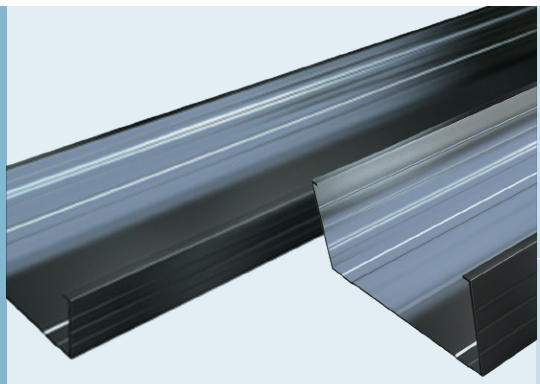
e-mail: francesco.bucci@knauf.com
Francesco Testa - Ergo S.r.l.
e-mail: francesco.testa@ergosrl.net; f.testa@sssup.it

For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Castellina Marittima manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo S.r.l., spin off company of the Scuola Superiore Sant'Anna di Pisa, coordinated by Prof. Francesco Testa and composed of Andrea Fontanella and Fabiana Corcelli.



Le nostre certificazioni

www.knauf.it

knauf@knauf.it

03/2022

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Tel. 050 69211

Volpiano (TO), lì 25/01/2021

Oggetto: dichiarazione rispondenza CAM (Criteri Ambientali Minimi) pannelli isolanti in lana minerale di roccia con Ecose Technology® Knauf Insulation **NaturBoard**

Gentile cliente/progettista,

facciamo seguito alla sua cortese richiesta per attestare la rispondenza dei nostri prodotti in lana minerale di roccia con Ecose® Technology con la denominazione commerciale **Knauf Insulation NaturBoard** (comprendente le versioni **Partition, Partition Comfort, Timber, Silence, Silence Alu/B/K, Timber Comfort, TP, Forte, Walls)** ai requisiti definiti all'interno dell'ultima versione dei CAM – Criteri Ambientali Minimi (D.M. 11 ottobre 2017).

Al paragrafo 2.4.2.9, del D.M. sopra indicato, è presente un elenco di criteri che devono essere rispettati dai materiali utilizzati per l'isolamento termico e acustico. Riferendoci a tale elenco, la lana di roccia con Ecose® Technology Knauf Insulation rispetta pienamente le richieste, alla luce di quanto di seguito dichiarato:

- Non prevede l'utilizzo di ritardanti di fiamma di alcun tipo;
- Non prevede l'utilizzo di alcun tipo di agente espandente in fase di produzione;
- Non prevede l'utilizzo di alcun tipo di catalizzatori al piombo;
- Le lane minerali Knauf Insulation sono conformi alla nota "Q" come da regolamento CE n. 1272/2008 (CLP) e sono inoltre certificate EUCEB (in allegato)

In merito al contenuto di riciclato si allega alla presente asserzione ambientale auto dichiarata in conformità alla UNI EN ISO 14021 e relativo certificato di convalida n. 20.18807 rilasciato da **SGS Italia S.p.A.** (Organismo notificato n. 1381), valida per la gamma di prodotti NaturBoard sopra citati.

Come da tabella riportata all'interno del paragrafo 2.4.2.9 del decreto il valore di materia prima riciclata deve essere, per pannelli in lana di roccia, pari almeno al 15%.

Il valore percentuale, indicato nella tabella a pagina 1 dell'asserzione ambientale auto dichiarata allegata, è **superiore al 20%**. Questo soddisfa il requisito minimo richiesto dal decreto (15%) e rende quindi il prodotto in oggetto **conforme a quanto richiesto dai CAM.**

KNAUF INSULATION S.p.A.
Socio Unico, direzione e coordinamento
Knauf Insulation Holding GmbH,
con sede in Iphofen (Germania), Am Bahnhof 7
Cap. Sociale € 3.578.057,00 int.vers
Iscr Reg. Imprese Torino
Cod. Fisc. e Part. IVA 00258250059
Cod. Ident. CEE (IT) 00258250059

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14018 CANTARANA D'ASTI (AT) – Reg. Bricco Grosso, 5
Tel. +39.0141.94.31.32 – Fax +39.0141.94.39.17

A supporto di quanto sopra descritto, si allega alla presente la documentazione di seguito elencata:

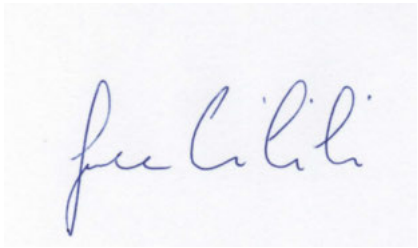
- Certificato di convalida n. 20.18807 rilasciato da SGS Italia S.p.A. (Organismo notificato n. 1381) – validità 19.11.2023
- Asserzione ambientale auto dichiarata in conformità alla UNI EN ISO 14021
- Scheda informativa sicurezza relativa alla gamma lana di roccia con Ecose® Technology Knauf Insulation
- Certificati Euceb stabilimento Novi Marof (Croazia)

Restiamo a disposizione per qualsiasi ulteriore chiarimento si rendesse necessario.

Cordiali saluti

Ing. Francesco Cavicchioli

Technical Marketing Manager
Knauf Insulation Spa



KNAUF INSULATION

ENVIRONMENTAL PRODUCT DECLARATION

Naturboard Partition

In accordance with: ISO 14025, ISO 21930, EN15804+A2:2019/AC:2021

Program:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0014243
Publication date:	2024-06-19
Validity date:	2029-06-19

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

Knauf Insulation EPDs could cover one or several products (multi-products). In the case the EPD covers multiple products, the results are based on worst-case results.

Build on us.

EPD®

ECO PLATFORM EPD VERIFIED

Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number:	EPD-IES-0014243
Published:	2024-06-19
Valid until:	2029-06-19
EPD owner	Knauf Insulation Sprl Rue de Maestricht 95 4600 Visé (Belgium)
Product Category Rules:	PCR 2019:14. Construction products (EN 15804+A2) Version 1.3.2 Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20
Product group classification:	UN CPC 37
Reference year for plant data:	2023
Geographical application scope:	Europe

CEN standard EN 15804+A2 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14. Construction products (EN 15804+A2) Version 1.3.2 Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20
PCR review was conducted by: The Technical Committee of the International EPD@ System
Independent third-party verification of the declaration and data, according to ISO 14025:2006. ☒ EPD verification by EPD Process Certification* Third-party verification: *Viktor Hakkarainen, Bureau Veritas (Certificate number: SE008541-1)* an approved certification body accountable for third-party verification. Third-party verifier is accredited by: *SWEDAC - Sverige AB 1236* *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see the GPI.
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

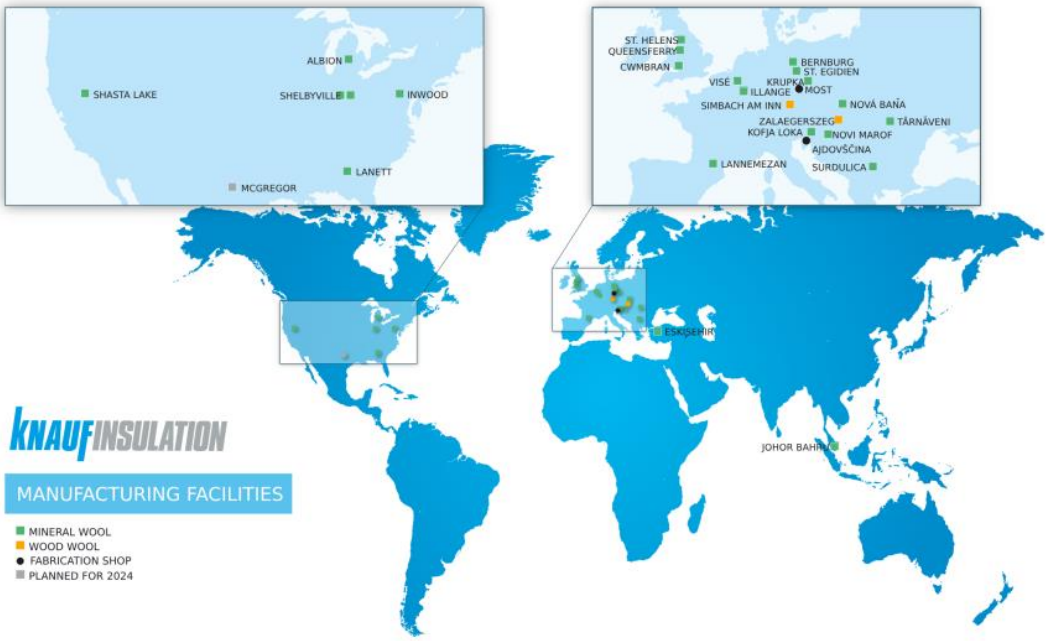
General information

Information about the company

Description of the organisation:
Knauf Insulation is a leading provider of glass and rock mineral wool, as well as wood wool insulation solutions. With more than 40 years of experience in the insulation industry, it is one of the most respected names in insulation worldwide.

As part of the Knauf Group, a €15.4bn turnover family-owned global manufacturer of building materials and construction systems, Knauf Insulation employs more than 6,000 employees and has 28 manufacturing sites in 15 countries, with a turnover of €2.5bn.

Knauf Insulation's mission is to challenge conventional thinking and create innovative insulation solutions that shape the way we live and build in the future, with care for the people who make them, the people who use them and the world we all depend on. Its vision is to lead the change in smarter insulation solutions for a better world.



The Headquarters are located in Visé, in Belgium.

Product-related or management system-related certifications:
All Knauf Insulation sites which are covered by EPD process certification system, including the sites considered for this EPD, are ISO 9001, ISO 14001, ISO 50001 and ISO 45001 certified under the scope "Design, Development and Production of Insulation Materials and Systems".

Knauf Insulation supports the Ten Principles of the United Nations Global Compact on human rights, labor, environment and anti-corruption.

Name and location of production site:
The intended application of this product in the construction industry is within Europe. The data used for the production stage life cycle assessment is related to production plant located in Novi Marof (Croatia)

Address: Varaždinska ul. 140, 42220, Novi Marof, Croatia

Information about Rock Mineral Wool production

The rock mineral wool (RMW) products for building construction are available in the form of slabs, boards, lamellas and rolls. RMW slabs are used as a thermal, acoustical and fire insulation product.

In general, the density for rock mineral wool products ranges from 20 to 200 kg/m³. In terms of composition, the inorganic part (92-98%) is composed of volcanic rocks, typically basalt, and some dolomite and with an increasing proportion of recycled material like slags from steel industry or in the form of briquettes, a mix of stone wool scrap, other secondary materials and cement.

For the considered products, the remaining fraction is made of bio-based binder components through the ECOSE Technology® binder process.

Product information

Product name: Naturboard Partition

Product identification: The declared insulation Naturboard Partition is a rock mineral wool, uncoated, unfaced slab of 1m^2 (considered for this EPD).
For the placement of the products on the construction market in the European Union/ EFTA (with exception of Switzerland and UK), the Regulation/ (EU) No 305/2011/ applies. The products concerned need Declarations of Performance / DoP R4305JPCPR taking into consideration the harmonized product standard EN 13162 and the CE-mark.

Product description: The main application for Naturboard Partition is partition walls.

UN CPC code:
37990: Non-metallic mineral products (including mineral wool, expanded mineral materials, worked mica, articles of mica, non-electrical articles of graphite or other carbon and articles of peat).

Geographical scope: The product is manufactured in Novi Marof (Croatia) Energy-related information is described in the next section. Regarding the market area, the product is mainly marketed in Europe.

Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN 12667	0.037 W/(mK) at 10°C
Water vapor diffusion resistance (EN 12086)	1
Thermal Resistance (ISO 8301)	2.70 m^{2}K/W
Declared density range/ EN 1602	40 kg/m^3 (+/-10%)
Melting point of fibers DIN 4102-17	≥ 1000°C

LCA information

Functional unit / declared unit
The declared unit is 1m^2 of unfaced, uncoated rock mineral wool Naturboard Partition with R-value of 2.70 m^{2}K/W (for a thickness of 100 mm and a declared lambda of 0.037 W/mK).

Reference service life: The RSL or durability of Naturboard Partition is as long as the lifetime of the building equipment in which it is used (at least 60 years).

Time representativeness & Information on Specific Data:
The complete reference year used for the plant production data is 2023. The product group/s considered in this EPD is produced in one single manufacturing plant; therefore, variations issue for sites is not relevant.
The data which is used to carry out the LCA calculations contains >90% specific data and less than 10% generic data. Data quality information used in this EPD is compliant with EN 15941.

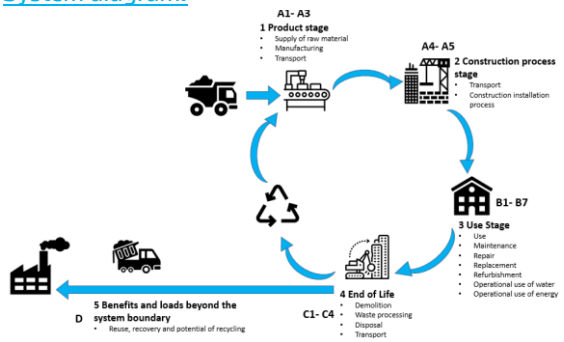
Database(s) and LCA software used:
The LCA model, the data aggregation and environmental impacts are calculated with the software LCA for Experts (GaBi) 10.8 and its content version 2024.1. The impact models used are those indicated in EN 15804:2012+A2:2019.

Gas information
Gas input (reference year: 2020) from Croatia is selected for Novi Marof, Croatia.

Electricity information

Plants (countries)	Electricity mixes	Locations (electricity)	Dataset Reference Year	Impact (kg CO_2/kwh)
Novi Marof (Croatia)	Renewable Energy Certificates	Croatia	2021	0.006

System diagram:



Description of system boundaries:

The system boundary of the EPD follows the modularity approach defined by the EN 15804:2012+A2:2019.

The type of EPD is cradle-to-grave.

For a comprehensive assessment, it is strongly recommended to consider the results from all the modules. Relying exclusively on Modules A1-A3 may lead to incomplete conclusions.

A comprehensive list and detailed explanations of each stage within the EPD are available as follows.

The product stage (A1-A3) includes:
- A1 – raw material extraction and processing, processing of secondary material input (e.g. recycling processes),
- A2 – transport to the manufacturer and
- A3 – manufacturing.

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage.

The LCA results are presented in an aggregated format for the product stage, where modules A1, A2, and A3 are consolidated into a single module, denoted as A1-A3.

Product Parameters	Value
Rock mineral wool weight	4 kg
Area	1m²
Thickness	100 mm
Volume	0.10 m^3
Packaging – PE film	0.08 kg
Packaging - Wooden pallet	0.69 kg

The construction process stage includes:
- A4 - transport to the construction site and
- A5 - installation into the building.

The transport to the building site (A4) and installation (A5) included in this LCA use the following parameters:

Parameter	Value
Average transport distance	600 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck Euro 6 (28 – 32 t / 22 t payload).
Truck capacity utilisation (including 30% of empty returns)	25.13% of the weight capacity
Loss of materials on site	2%
Packaging – PE film	40% recycled, 60% incinerated
Packaging – Wooden pallet	40% recycled, 60% incinerated

The treatment and the transport of the packaging waste after the installation of the product (A5) has been considered.

The Use stage (B1-B7) includes:
- B1: Use
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational Energy Use
- B7: Operational Water Use

Once installation is complete, no actions or technical operations are required during the use stages until the end of life. Therefore, the mineral wool has no impact (excluding potential energy savings) on this stage.

The end-of-life stage includes:
- C1 – de-construction, demolition,
- C2 – transport to waste processing,
- C3 – waste processing for reuse, recovery and/or recycling and
- C4 – disposal.

This includes provision of all transport, materials, products and related energy and water use. The common manual dismantling impact of insulation is considered as very small and can be neglected in C1.

Although glass mineral wool products from Knauf Insulation are partly recycled at their end-of-life, an established collection system does not yet exist.

Therefore, the assumption chosen in this study, 100% landfill (C4) after the use phase, is the most conservative approach.

Parameter	Value
Disposal type (mineral wool)	100% landfill
Average transport distance waste (C2)	50 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck-trailer, Euro 6, 34 - 40t gross weight / 27t payload capacity/ 40 L for 100 km. (if 100 % utilization).
Truck capacity utilization	50 % of the weight capacity

Module D includes reuse, recovery and/or recycling potentials. According to EN 15804:2012+A2:2019 any declared benefits and loads from net flows leaving the product system not allocated as co-products and having passed the end-of waste state shall be included in module D. The benefits considered in module D originate from packaging recycling or incineration.

Recycled material

The mineral wool waste generated during the manufacturing process is recycled internally and fed back into the mineral wool production process at multiple stages.

Recycled content average for the considered plant for this product was calculated at 18% in 2023. The calculation is taking into account the % of secondary materials from external supply input into the batch against virgin raw materials supply. The external waste considerations and the calculation methodology applied are also in accordance with the ISO 14021standard.

Additional information:

All raw materials used in the manufacture of the declared product, the required energy, water consumption and the resulting emissions are considered in the LCA. As a result, recipe components with a share of less than 1% are included. All neglected processes contribute less than 5% to the total mass or less than 5% to the total energy consumption. For information, the impact of the glass mineral wool plant construction or manufacturing equipment is not taken into account in the life cycle assessment. Allocation criteria with by-products (mineral wool for ceiling tiles) are based on cost.

Materials required for fixing and installation are not included in the scope of this LCA. The impact of any additional construction products or materials not included in this EPD should be accounted for at building level. Regarding installation, this EPD only includes the environmental impacts relating to the product itself, such as material losses and packaging disposal.

Knauf Insulation adopts a conservative approach in its EPDs.

The conversion factor used in this EPD involves multiplying the results by 0.25 to obtain Environmental Impact Indicator results for 1 kg. An insulation product should always be characterized by its thickness and R-value. Solely considering the product's weight could potentially lead to misinterpretations.

More information:
www.knaufinsulation.com

Name and contact information of LCA practitioner:

Clara del Val
Knauf Insulation Sprl
Rue de Maestricht 95
4600 Visé (Belgium)
Contact : sustainability@knaufinsulation.com

Content Declaration

The product does not contain substances on the "Candidate List of Substances of Very High Concern for Authorisation" under the REACH regulation (if above 0.1% of the mass).

Product components	Weight %	Pre-consumer material, weight - % *(out of total)*	Post- costumer % *(out of total)*	Renewable material, weight- % *(out of total)*
Basalt	55 - 60	0	0	0
Dolomite - Limestone	15 - 20	0	0	0
Recovered metallurgical slags	5 - 20	100	0	0
Bio- based binder	2 – 5	0	0	80
Additives	< 1	0	0	0
Packaging Materials	Weight, kg/ DU or FU	Weight -% (versus the product)		
Packaging – PE film	0.08	1.95%		
Packaging - Wooden Pallet	0.69	17.25%		
TOTAL	0.77	19.20%		

Declared Modules, geography, share of specific data (in GWP-GHG indicator) & data variation

Life cycle stages as defined in the European standard EN 15978 :2011 and the description of the system boundaries for the reference product LCA (X = included in the LCA, MND = module is not declared)

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe
Share of specific data	> 90 %																
Variation* – products	0%																
Variation** – Sites	0%																

*Variation regarding the average EPD result in terms of GWP-GHG indicator

**Variation regarding the average EPD result in terms of GWP-GHG indicator amongst products covered with this EPD

According to PCR 2019:14 v1.3.2 infrastructure should be outside of the system boundary. However, infrastructure impacts could have been considered in some GaBi background datasets.

Environmental performance

Potential environmental impacts: 1m² of rock mineral wool Naturboard Partition with a thickness of 100 mm and the R-value of 2.70 m²K/W.

These results are representative of all the products mentioned in this EPD.

ENVIRONMENTAL IMPACTS										
Parameter	**Unit**	**A1-3*****	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D****
GWP-fossil	kg CO_2 eq.	4.68E+00	4.94E-01	2.51E-01	0.00E+00	0.00E+00	1.55E-02	0.00E+00	6.43E-02	-3.17E-01
GWP-biogenic	kg CO_2 eq.	-1.39E+00	0.00E+00	1.13E+00	0.00E+00	0.00E+00	1.93E-04	0.00E+00	3.13E-01	0.00E+00
GWP-luluc	kg CO_2 eq.	2.16E-03	4.45E-03	2.30E-04	0.00E+00	0.00E+00	1.39E-04	0.00E+00	2.80E-04	-2.95E-05
GWP-total	kg CO_2 eq.	3.29E+00	4.99E-01	1.38E+00	0.00E+00	0.00E+00	1.58E-02	0.00E+00	3.78E-01	-3.17E-01
ODP	kg CFC 11 eq.	6.09E-12	6.25E-14	3.74E-13	0.00E+00	0.00E+00	1.96E-15	0.00E+00	3.69E-14	-2.01E-12
AP	mol H^+ eq.	2.17E-02	5.38E-04	6.10E-04	0.00E+00	0.00E+00	1.61E-05	0.00E+00	4.78E-04	-5.71E-04
EP-freshwater	kg P eq.	2.71E-05	1.76E-06	7.01E-07	0.00E+00	0.00E+00	5.50E-08	0.00E+00	1.37E-06	2.75E-07
EP-marine	kg N eq.	2.59E-03	1.74E-04	1.02E-04	0.00E+00	0.00E+00	5.04E-06	0.00E+00	1.32E-04	-1.98E-04
EP-terrestrial	mol N eq.	2.48E-02	2.08E-03	1.18E-03	0.00E+00	0.00E+00	6.07E-05	0.00E+00	1.40E-03	-2.23E-03
POCP	kg NMVOC eq.	6.86E-03	5.33E-04	2.77E-04	0.00E+00	0.00E+00	1.56E-05	0.00E+00	3.85E-04	-6.14E-04
ADP-minerals&metals*	kg Sb eq.	2.93E-07	3.18E-08	9.43E-09	0.00E+00	0.00E+00	9.98E-10	0.00E+00	6.67E-09	-1.67E-08
ADP-fossil*	MJ	5.01E+01	6.54E+00	1.68E+00	0.00E+00	0.00E+00	2.05E-01	0.00E+00	8.64E-01	-6.84E+00
WDP*	m^3	2.38E-01	5.80E-03	9.25E-02	0.00E+00	0.00E+00	1.82E-04	0.00E+00	4.95E-03	-3.02E-02
Acronyms	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 = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; 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 = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

***: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*

**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Potential environmental impact – additional mandatory and voluntary indicators

Indicator	Unit	Tot.A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG [2]	kg CO_2 eq.	4.72E+00	5.00E-01	2.53E-01	0.00E+00	0.00E+00	1.57E-02	0.00E+00	6.51E-02	-3.23E-01

[2] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of resources: 1m² of rock mineral wool Naturboard Partition with a thickness of 100 mm and the R-value of 2.70 m^2K/W.

These results are representative of all the products mentioned in this EPD.

RESOURCES USE										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D*
PERE [MJ]	MJ	1.28E+01	4.76E-01	-7.15E+00	0.00E+00	0.00E+00	1.49E-02	0.00E+00	1.01E-01	0.00E+00
PERM [MJ]	MJ	1.29E+01	0.00E+00	2.58E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	MJ	2.57E+01	4.76E-01	-6.89E+00	0.00E+00	0.00E+00	1.49E-02	0.00E+00	1.01E-01	0.00E+00
PENRE [MJ]	MJ	4.68E+01	6.56E+00	5.18E+01	0.00E+00	0.00E+00	2.06E-01	0.00E+00	8.64E-01	0.00E+00
PENRM [MJ]	MJ.	3.35E+00	0.00E+00	6.70E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	MJ	5.02E+01	6.56E+00	5.18E+01	0.00E+00	0.00E+00	2.06E-01	0.00E+00	8.64E-01	0.00E+00
SM	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	0.00E+00
RSF	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	0.00E+00
NRSF	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	0.00E+00
FW	m^3	9.66E-03	5.21E-04	2.32E-03	0.00E+00	0.00E+00	1.63E-05	0.00E+00	1.64E-04	-1.23E-03
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*

**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Waste production and output flows: 1m² of rock mineral wool Naturboard Partition with a thickness of 100 mm and the R-value of 2.70 m^2K/W.

These results are representative of all the products mentioned in this EPD.

OUTPUT FLOWS AND WASTE CATEGORIES										
Parameter	**Unit**	**A1-3*****	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
Hazardous waste disposed	kg	1.06E-09	2.03E-11	4.01E-10	0.00E+00	0.00E+00	6.37E-13	0.00E+00	1.37E-08	-3.60E-10
Non-hazardous waste disposed	kg	3.49E-01	1.00E-03	1.27E-01	0.00E+00	0.00E+00	3.14E-05	0.00E+00	4.01E+00	8.79E-04
Radioactive waste disposed	kg	3.93E-04	1.23E-05	4.89E-05	0.00E+00	0.00E+00	3.85E-07	0.00E+00	1.18E-05	-3.65E-04
Components for reuse	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	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	3.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	4.63E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	1.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	2.08E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*
**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Additional impact categories and indicators: 1m² of rock mineral wool Naturboard Partition with a thickness of 100 mm and the R-value of 2.70 m^2K/W.

These results are representative of all the products mentioned in this EPD.

ADDITIONAL IMPACT CATEGORIES AND INDICATORS										
Parameter	**Unit**	**A1-3*** **	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
PM	Disease Incidence	2.90E-07	3.87E-09	7.18E-09	0.00E+00	0.00E+00	1.18E-10	0.00E+00	5.82E-09	-1.12E-08
IRP	kBq U235 eq.	4.49E-02	1.83E-03	7.58E-03	0.00E+00	0.00E+00	5.74E-05	0.00E+00	1.14E-03	-6.07E-02
ETP- fw	CTUe	9.12E+00	4.68E+00	5.33E-01	0.00E+00	0.00E+00	1.47E-01	0.00E+00	5.22E-01	-1.76E+00
HTP-c	CTUh	9.26E-10	9.51E-11	3.55E-11	0.00E+00	0.00E+00	2.98E-12	0.00E+00	6.62E-11	-7.69E-11
HTP- nc	CTUh	6.49E-08	4.23E-09	2.22E-09	0.00E+00	0.00E+00	1.33E-10	0.00E+00	7.02E-09	-1.66E-09
SQP	dimensionless	1.79E+02	2.73E+00	3.82E+00	0.00E+00	0.00E+00	8.57E-02	0.00E+00	2.03E-01	-4.40E+00
Acronyms	PM = Particulate matter emissions; IRP= Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality									

Information on biogenic carbon content

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	**kg C**	**kg CO_2 eq.**
Biogenic carbon content in product	3.73E-02	1.37E-01
Biogenic carbon content in packaging	3.45E-01	1.27E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*
**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories, except the Abiotic Depletion Potential Element and the Ozone Depletion Potential, are dominated by the manufacturing processes. This can be explained by the huge impact of the energy use (electricity, natural gas and coke) for rock mineral wool production.

In almost all impact categories, the transport to installation (module A4) is quite visible because of the transport emissions. The end-of-life of the product has almost no influence as almost no emissions from inert waste occur (modules C2 & C4).

The Global Warming Potential (GWP-total) is dominated by the manufacturing in the cupola, mostly due to CO_2 emissions from raw materials and energy consumption.

The Depletion Potential of the Stratospheric Ozone layer (ODP) is mostly influenced by the manufacturing phase (module A1-A3) and significantly influenced using electricity.

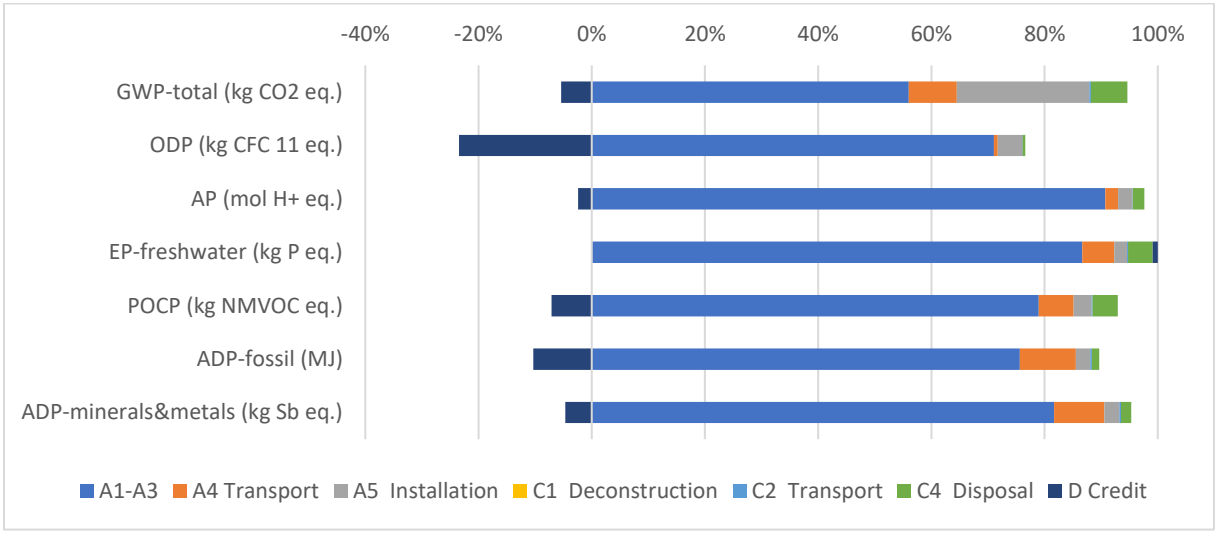
The Acidification Potential (AP) is also dominated by the manufacturing due to the emissions related to the processes and the energy consumption.

The Eutrophication Potential Fresh Water (all EP indicators in total) is significantly influenced by the manufacturing due to emissions from cupola furnace, curing oven and other unit processes.

The Formation Potential of Tropospheric Ozone (POCP) is particularly dominated by the manufacturing (emissions in the cupola furnace and other unit processes).

The Abiotic Depletion Potential for Non-Fossil Resources (ADP- minerals &metals) is mainly due to the raw material extraction.

The Abiotic Depletion Potential for Fossil Resources Potential (ADP-fossil) is dominated by the use of coke as energy carrier. Next to the coke, we have also the impact of natural gas and upstream the electricity energy mix.



RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the manufacturing of rock mineral wool products (especially due to the energy carrier, coke).

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the manufacturing, mostly due to electricity consumption and packaging.

References

International EPD® System
General Programme Instructions of the International EPD® System. Version 4.0.
Product category rules (PCR): PCR 2019:14 v1.3.2. Construction products (EN 15804:A2) Version 1.0
c-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804:2012+A2:2019/AC:2021
EN 15804:2012+A2:2019/AC:2021: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 16783:2017
Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

LCA for Experts 10.8
LCA for Experts 10.8: Software and database for life cycle engineering. LBP, University of Stuttgart and Sphera, 2023.

EN 1602
EN1602: 2013 Thermal insulation products for building applications – Determination of the apparent density

EN 12667
EN 12667: 2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

EN 13162
EN 13162:2012 Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification

EN 12086
EN 12086: 2013 Thermal insulating products for building applications –determination of water vapour transmission properties.

EN 15978: 2011
EN 15978: 2011 Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method.

ISO 8301:1991
Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus.

ISO 21930:2017
Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

DoP R4305JPCPR
Declaration of Performance
www.dopki.com

DIN 4102-17
Fire behaviour of building materials and building components – Part 17: Melting point of mineral wool insulating materials – Terms and definitions, requirements and test

***2024_05_14 Naturboard Partition* (I-report)**
I-report is an interactive report created with GaBi based on the scenario. More details about the product characteristics, plant allocation and scenario on i-report.

***BR_RMW_2022* (Background Report)**
Calculation rules for the Life Cycle Assessment and Requirements and more details about the production on the Background Report.

Contact information:

EPD owner:	Knauf Insulation Rue de Maestricht 95 4600 Visé Belgium www.knaufinsulation.com Contact : sustainability@knaufinsulation.com
LCA support:	CO_2 Logic Cantersteen 47 1000 Brussels Belgium Sphera Hauptstraße 111-113 70771 Leinfelden-Echterdingen Germany
Programme operator:	EPD International AB info@environdec.com
Certification body	Fabriksgatan 13 41250 Göteborg Sweden

KNAUF INSULATION

ENVIRONMENTAL PRODUCT DECLARATION

Naturboard Silence

In accordance with: ISO 14025, ISO 21930, EN15804+A2:2019/AC:2021

Program:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0014253
Publication date:	2024-06-18
Validity date:	2029-06-18

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

Knauf Insulation EPDs could cover one or several products (multi-products). In the case the EPD covers multiple products, the results are based on worst-case results.

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Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number:	EPD-IES-0014253
Published:	2024-06-18
Valid until:	2029-06-18
EPD owner	Knauf Insulation Sprl Rue de Maestricht 95 4600 Visé (Belgium)
Product Category Rules:	PCR 2019:14. Construction products (EN 15804+A2) Version 1.3.2 Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20
Product group classification:	UN CPC 37
Reference year for plant data:	2023
Geographical application scope:	Europe

CEN standard EN 15804+A2 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14. Construction products (EN 15804+A2) Version 1.3.2 Sub-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20
PCR review was conducted by: The Technical Committee of the International EPD@ System
Independent third-party verification of the declaration and data, according to ISO 14025:2006. ☒ EPD verification by EPD Process Certification* Third-party verification: *Viktor Hakkarainen, Bureau Veritas (Certificate number: SE008541-1)* an approved certification body accountable for third-party verification. Third-party verifier is accredited by: *SWEDAC - Sverige AB 1236* *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see the GPI.
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

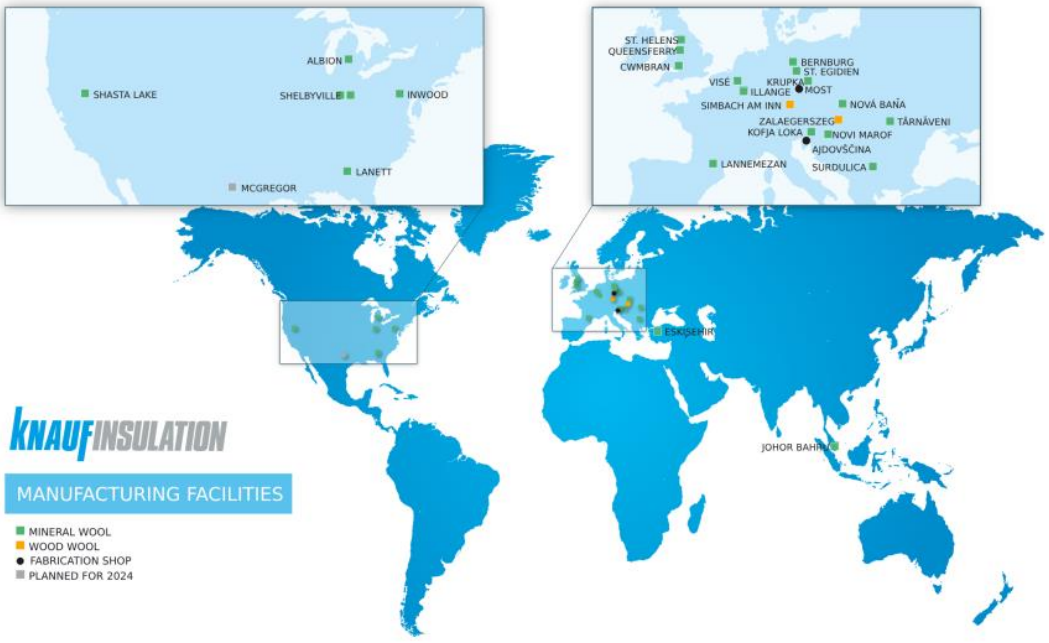
General information

Information about the company

Description of the organisation:
Knauf Insulation is a leading provider of glass and rock mineral wool, as well as wood wool insulation solutions. With more than 40 years of experience in the insulation industry, it is one of the most respected names in insulation worldwide.

As part of the Knauf Group, a €15.4bn turnover family-owned global manufacturer of building materials and construction systems, Knauf Insulation employs more than 6,000 employees and has 28 manufacturing sites in 15 countries, with a turnover of €2.5bn.

Knauf Insulation's mission is to challenge conventional thinking and create innovative insulation solutions that shape the way we live and build in the future, with care for the people who make them, the people who use them and the world we all depend on. Its vision is to lead the change in smarter insulation solutions for a better world.



The Headquarters are located in Visé, in Belgium.

Product-related or management system-related certifications:
All Knauf Insulation sites which are covered by EPD process certification system, including the sites considered for this EPD, are ISO 9001, ISO 14001, ISO 50001 and ISO 45001 certified under the scope "Design, Development and Production of Insulation Materials and Systems".

Knauf Insulation supports the Ten Principles of the United Nations Global Compact on human rights, labor, environment and anti-corruption.

Name and location of production site:
The intended application of this product in the construction industry is within Europe. The data used for the production stage life cycle assessment is related to production plants located in Novi Marof (Croatia).

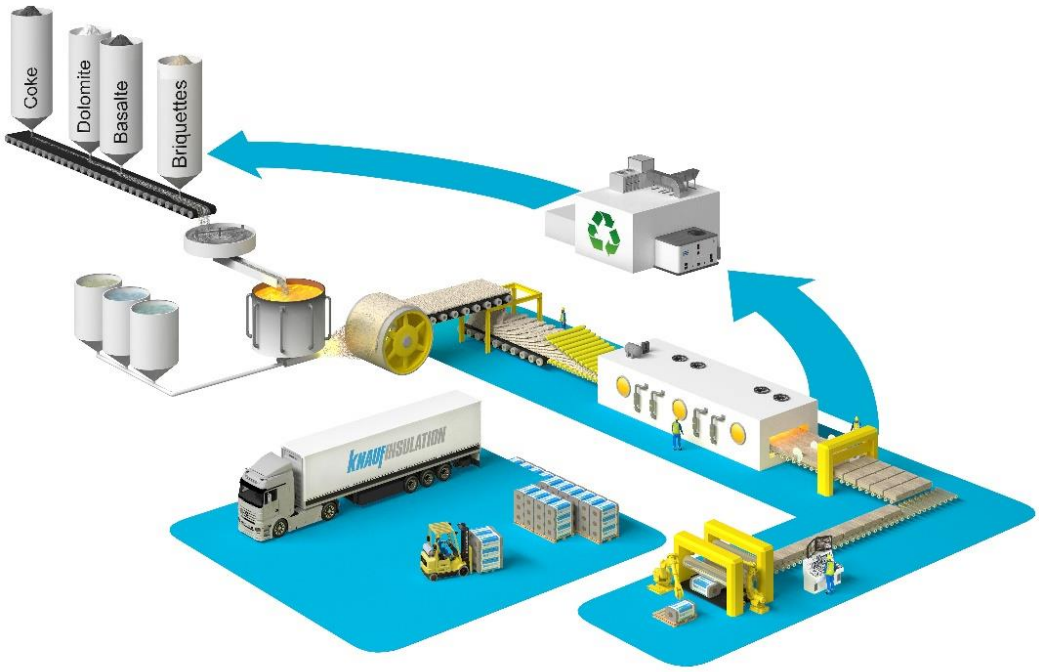
Address: Varaždinska ul. 140, 42220, Novi Marof, Croatia

Information about Rock Mineral Wool production

The rock mineral wool (RMW) products for building construction are available in the form of slabs, boards, lamellas and rolls. RMW slabs are used as a thermal, acoustical and fire insulation product.

In general, the density for rock mineral wool products ranges from 20 to 200 kg/m³. In terms of composition, the inorganic part (92-98%) is composed of volcanic rocks, typically basalt, and some dolomite and with an increasing proportion of recycled material like slags from steel industry or in the form of briquettes, a mix of stone wool scrap, other secondary materials and cement.

For the considered products, the remaining fraction is made of bio-based binder components through the ECOSE Technology® binder process.



Product information

Product name: Naturboard Silence

Product identification: The declared insulation Naturboard Silence is a rock mineral wool, uncoated, unfaced slab of 1m^2 (considered for this EPD).
For the placement of the products on the construction market in the European Union/ EFTA (with exception of Switzerland and UK), the Regulation/ (EU) No 305/2011/ applies. The products concerned need Declarations of Performance / DoP R4305MPCPR taking into consideration the harmonized product standard EN 13162 and the CE-mark.

Product description: The main application for Naturboard Silence is Partition walls.

UN CPC code:
37990: Non-metallic mineral products (including mineral wool, expanded mineral materials, worked mica, articles of mica, non-electrical articles of graphite or other carbon and articles of peat).

Geographical scope: The product is manufactured in Novi Marof (Croatia). Energy-related information is described in the next section. Regarding the market area, the product is mainly marketed in Europe.

Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN 12667	0.034 W/(mK) at 10°C
Water vapor diffusion resistance (EN 12086)	1
Thermal Resistance (ISO 8301)	2.90 m^{2}K/W
Declared density range/ EN 1602	70 kg/m^3 (+/-10%)
Melting point of fibers DIN 4102-17	≥ 1000°C

LCA information

Functional unit / declared unit
The declared unit is 1m^2 of unfaced, uncoated rock mineral wool Naturboard Silence with R-value of 2.90 m^{2}K/W (for a thickness of 100 mm and a declared lambda of 0.034 W/mK).

Reference service life: The RSL or durability of Naturboard Silence is as long as the lifetime of the building equipment in which it is used (at least 60 years).

Time representativeness & Information on Specific Data:
The complete reference year used for the plant production data is 2023. The product group/s considered in this EPD is produced in one single manufacturing plant; therefore, variations issue for sites is not relevant.
The data which is used to carry out the LCA calculations contains >90% specific data and less than 10% generic data. Data quality information used in this EPD is compliant with EN 15941.

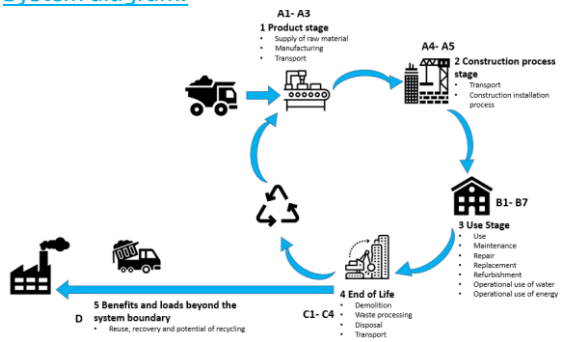
Database(s) and LCA software used:
The LCA model, the data aggregation and environmental impacts are calculated with the software LCA for Experts (GaBi) 10.8 and its content version 2024.1. The impact models used are those indicated in EN 15804:2012+A2:2019.

Gas information
Gas input (reference year: 2020) from Croatia is selected for Novi Marof, Croatia.

Electricity information

Plants (countries)	Electricity mixes	Locations (electricity)	Dataset Reference Year	Impact (kg CO_2/kwh)
Novi Marof (Croatia)	Renewable Energy Certificates	Croatia	2021	0.006

System diagram:



Description of system boundaries:

The system boundary of the EPD follows the modularity approach defined by the EN 15804:2012+A2:2019.

The type of EPD is cradle-to-grave.

For a comprehensive assessment, it is strongly recommended to consider the results from all the modules. Relying exclusively on Modules A1-A3 may lead to incomplete conclusions.

A comprehensive list and detailed explanations of each stage within the EPD are available as follows.

The product stage (A1-A3) includes:

- A1 – raw material extraction and processing, processing of secondary material input (e.g. recycling processes),
- A2 – transport to the manufacturer and
- A3 – manufacturing.

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage.

The LCA results are presented in an aggregated format for the product stage, where modules A1, A2, and A3 are consolidated into a single module, denoted as A1-A3.

Product Parameters	Value
Rock mineral wool weight	7 kg
Area	1m²
Thickness	100 mm
Volume	0.10 m^3
Packaging – PE film	0.09 kg
Packaging - Wooden pallet	0.70 kg

The construction process stage includes:

- A4 - transport to the construction site and
- A5 - installation into the building.

The transport to the building site (A4) and installation (A5) included in this LCA use the following parameters:

Parameter	Value
Average transport distance	600 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck Euro 6 (28 – 32 t / 22 t payload).
Truck capacity utilisation (including 30% of empty returns)	22.91 % of the weight capacity
Loss of materials on site	2%
Packaging – PE film	40% recycled, 60% incinerated
Packaging – Wooden pallet	40% recycled, 60% incinerated

The treatment and the transport of the packaging waste after the installation of the product (A5) has been considered.

The Use stage (B1-B7) includes:

- B1: Use
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational Energy Use
- B7: Operational Water Use

Once installation is complete, no actions or technical operations are required during the use stages until the end of life. Therefore, the mineral wool has no impact (excluding potential energy savings) on this stage.

The end-of-life stage includes:

- C1 – de-construction, demolition,
- C2 – transport to waste processing,
- C3 – waste processing for reuse, recovery and/or recycling and
- C4 – disposal.

This includes provision of all transport, materials, products and related energy and water use. The common manual dismantling impact of insulation is considered as very small and can be neglected in C1.

Although glass mineral wool products from Knauf Insulation are partly recycled at their end-of-life, an established collection system does not yet exist.

Therefore, the assumption chosen in this study, 100% landfill (C4) after the use phase, is the most conservative approach.

Parameter	Value
Disposal type (mineral wool)	100% landfill
Average transport distance waste (C2)	50 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck-trailer, Euro 6, 34 - 40t gross weight / 27t payload capacity/ 40 L for 100 km. (if 100 % utilization).
Truck capacity utilization	50 % of the weight capacity

Module D includes reuse, recovery and/or recycling potentials. According to EN 15804:2012+A2:2019 any declared benefits and loads from net flows leaving the product system not allocated as co-products and having passed the end-of waste state shall be included in module D. The benefits considered in module D originate from packaging recycling or incineration.

Recycled material

The mineral wool waste generated during the manufacturing process is recycled internally and fed back into the mineral wool production process at multiple stages.

Recycled content average for the considered plants for this product was calculated at 18% in 2023. The calculation is taking into account the % of secondary materials from external supply input into the batch against virgin raw materials supply. The external waste considerations and the calculation methodology applied are also in accordance with the ISO 14021standard.

Additional information:

All raw materials used in the manufacture of the declared product, the required energy, water consumption and the resulting emissions are considered in the LCA. As a result, recipe components with a share of less than 1% are included. All neglected processes contribute less than 5% to the total mass or less than 5% to the total energy consumption. For information, the impact of the glass mineral wool plant construction or manufacturing equipment is not taken into account in the life cycle assessment. Allocation criteria with by-products (mineral wool for ceiling tiles) are based on cost.

Materials required for fixing and installation are not included in the scope of this LCA. The impact of any additional construction products or materials not included in this EPD should be accounted for at building level. Regarding installation, this EPD only includes the environmental impacts relating to the product itself, such as material losses and packaging disposal.

Knauf Insulation adopts a conservative approach in its EPDs.

The conversion factor used in this EPD involves multiplying the results by 0.14 to obtain Environmental Impact Indicator results for 1 kg. An insulation product should always be characterized by its thickness and R-value. Solely considering the product's weight could potentially lead to misinterpretations.

More information:
www.knaufinsulation.com

Name and contact information of LCA practitioner:

Clara del Val
Knauf Insulation Sprl
Rue de Maestricht 95
4600 Visé (Belgium)
Contact : sustainability@knaufinsulation.com

Content Declaration

The product does not contain substances on the "Candidate List of Substances of Very High Concern for Authorisation" under the REACH regulation (if above 0.1% of the mass).

Product components	Weight %	Pre-consumer material, weight - % *(out of total)*	Post- costumer % *(out of total)*	Renewable material, weight- % *(out of total)*
Basalt	55 - 60	0	0	0
Dolomite - Limestone	15 - 20	0	0	0
Recovered metallurgical slags	5 - 20	100	0	0
Bio- based binder	2 – 5	0	0	80
Additives	< 1	0	0	0
Packaging Materials	Weight, kg/ DU or FU	Weight -% (versus the product)		
Packaging – PE film	0.085	1.21%		
Packaging - Wooden Pallet	0.67	9.57%		
TOTAL	0.76	10.79%		

Declared Modules, geography, share of specific data (in GWP-GHG indicator) & data variation

Life cycle stages as defined in the European standard EN 15978 :2011 and the description of the system boundaries for the reference product LCA (X = included in the LCA, MND = module is not declared)

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe	Europe
Share of specific data	> 90 %																
Variation* – products	0%																
Variation** – Sites	0%																

*Variation regarding the average EPD result in terms of GWP-GHG indicator

**Variation regarding the average EPD result in terms of GWP-GHG indicator amongst products covered with this EPD

According to PCR 2019:14 v1.3.2 infrastructure should be outside of the system boundary. However, infrastructure impacts could have been considered in some GaBi background datasets.

Environmental performance

Potential environmental impacts: 1m² of rock mineral wool Naturboard Silence with a thickness of 100 mm and the R-value of 2.90.

These results are representative of all the products mentioned in this EPD.

ENVIRONMENTAL IMPACTS										
Parameter	**Unit**	**A1-3*****	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D****
GWP-fossil	kg CO_2 eq.	7.88E+00	8.68E-01	3.34E-01	0.00E+00	0.00E+00	2.71E-02	0.00E+00	1.13E-01	-3.16E-01
GWP-biogenic	kg CO_2 eq.	-1.55E+00	0.00E+00	1.08E+00	0.00E+00	0.00E+00	3.37E-04	0.00E+00	4.88E-01	0.00E+00
GWP-luluc	kg CO_2 eq.	3.40E-03	7.81E-03	3.28E-04	0.00E+00	0.00E+00	2.44E-04	0.00E+00	4.91E-04	-2.90E-05
GWP-total	kg CO_2 eq.	6.34E+00	8.76E-01	1.42E+00	0.00E+00	0.00E+00	2.77E-02	0.00E+00	6.01E-01	-3.16E-01
ODP	kg CFC 11 eq.	8.15E-12	1.10E-13	4.10E-13	0.00E+00	0.00E+00	3.43E-15	0.00E+00	6.46E-14	-1.98E-12
AP	mol H^+ eq.	3.72E-02	9.49E-04	9.33E-04	0.00E+00	0.00E+00	2.81E-05	0.00E+00	8.37E-04	-5.66E-04
EP-freshwater	kg P eq.	4.20E-05	3.08E-06	1.05E-06	0.00E+00	0.00E+00	9.63E-08	0.00E+00	2.40E-06	2.57E-07
EP-marine	kg N eq.	4.13E-03	3.07E-04	1.36E-04	0.00E+00	0.00E+00	8.82E-06	0.00E+00	2.31E-04	-1.96E-04
EP-terrestrial	mol N eq.	3.98E-02	3.67E-03	1.52E-03	0.00E+00	0.00E+00	1.06E-04	0.00E+00	2.46E-03	-2.20E-03
POCP	kg NMVOC eq.	1.11E-02	9.42E-04	3.73E-04	0.00E+00	0.00E+00	2.73E-05	0.00E+00	6.73E-04	-6.11E-04
ADP-minerals&metals*	kg Sb eq.	4.25E-07	5.59E-08	1.26E-08	0.00E+00	0.00E+00	1.75E-09	0.00E+00	1.17E-08	-1.66E-08
ADP-fossil*	MJ	8.09E+01	1.15E+01	2.41E+00	0.00E+00	0.00E+00	3.59E-01	0.00E+00	1.51E+00	-6.92E+00
WDP*	m^3	4.04E-01	1.02E-02	9.40E-02	0.00E+00	0.00E+00	3.18E-04	0.00E+00	8.66E-03	-3.06E-02
Acronyms	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 = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; 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 = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

***: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*

**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Potential environmental impact – additional mandatory and voluntary indicators

Indicator	Unit	Tot.A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-GHG [2]	kg CO_2 eq.	7.94E+00	8.80E-01	3.36E-01	0.00E+00	0.00E+00	2.74E-02	0.00E+00	1.14E-01	-3.22E-01

[2] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of resources: 1m² of rock mineral wool Naturboard Silence with a thickness of 100 mm and the R-value of 2.90.

These results are representative of all the products mentioned in this EPD.

RESOURCES USE										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D*
PERE [MJ]	MJ	1.95E+01	8.36E-01	-6.74E+00	0.00E+00	0.00E+00	2.61E-02	0.00E+00	1.76E-01	0.00E+00
PERM [MJ]	MJ	1.39E+01	0.00E+00	2.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT [MJ]	MJ	3.33E+01	8.36E-01	-6.47E+00	0.00E+00	0.00E+00	2.61E-02	0.00E+00	1.76E-01	0.00E+00
PENRE [MJ]	MJ	7.74E+01	1.15E+01	8.34E+01	0.00E+00	0.00E+00	3.60E-01	0.00E+00	1.51E+00	0.00E+00
PENRM [MJ]	MJ.	3.67E+00	0.00E+00	7.34E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT [MJ]	MJ	8.11E+01	1.15E+01	8.35E+01	0.00E+00	0.00E+00	3.60E-01	0.00E+00	1.51E+00	0.00E+00
SM	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	0.00E+00
RSF	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	0.00E+00
NRSF	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	0.00E+00
FW	m^3	1.54E-02	9.16E-04	2.40E-03	0.00E+00	0.00E+00	2.86E-05	0.00E+00	2.88E-04	-1.23E-03
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*

**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Waste production and output flows: 1m² of rock mineral wool Naturboard Silence with a thickness of 100 mm and the R-value of 2.90.

These results are representative of all the products mentioned in this EPD.

OUTPUT FLOWS AND WASTE CATEGORIES										
Parameter	**Unit**	**A1-3*****	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
Hazardous waste disposed	kg	1.68E-09	3.57E-11	6.53E-10	0.00E+00	0.00E+00	1.12E-12	0.00E+00	2.39E-08	-3.65E-10
Non-hazardous waste disposed	kg	6.07E-01	1.76E-03	1.92E-01	0.00E+00	0.00E+00	5.49E-05	0.00E+00	7.01E+00	1.18E-03
Radioactive waste disposed	kg	5.24E-04	2.16E-05	5.05E-05	0.00E+00	0.00E+00	6.74E-07	0.00E+00	2.06E-05	-3.58E-04
Components for reuse	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	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	3.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	4.51E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	1.14E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	2.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*
**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

Additional impact categories and indicators: 1m² of rock mineral wool Naturboard Silence with a thickness of 100 mm and the R-value of 2.90.

These results are representative of all the products mentioned in this EPD.

ADDITIONAL IMPACT CATEGORIES AND INDICATORS										
Parameter	**Unit**	**A1-3*** **	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D***
PM	Disease Incidence	3.96E-07	6.81E-09	9.40E-09	0.00E+00	0.00E+00	2.07E-10	0.00E+00	1.02E-08	-1.09E-08
IRP	kBq U235 eq.	5.92E-02	3.22E-03	7.68E-03	0.00E+00	0.00E+00	1.01E-04	0.00E+00	2.00E-03	-5.96E-02
ETP- fw	CTUe	1.30E+01	8.23E+00	6.90E-01	0.00E+00	0.00E+00	2.57E-01	0.00E+00	9.14E-01	-1.84E+00
HTP-c	CTUh	1.44E-09	1.67E-10	4.79E-11	0.00E+00	0.00E+00	5.22E-12	0.00E+00	1.16E-10	-7.78E-11
HTP- nc	CTUh	1.01E-07	7.43E-09	3.10E-09	0.00E+00	0.00E+00	2.32E-10	0.00E+00	1.23E-08	-1.72E-09
SQP	dimensionless	1.85E+02	4.80E+00	4.01E+00	0.00E+00	0.00E+00	1.50E-01	0.00E+00	3.55E-01	-4.25E+00
Acronyms	PM = Particulate matter emissions; IRP= Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality									

Information on biogenic carbon content

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	**kg C**	**kg CO_2 eq.**
Biogenic carbon content in product	5.83E-02	2.14E-01
Biogenic carbon content in packaging	3.35E-01	1.23E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

**: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].*
**** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 100% for that plant.*

LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories, except the Abiotic Depletion Potential Element and the Ozone Depletion Potential, are dominated by the manufacturing processes. This can be explained by the huge impact of the energy use (electricity, natural gas and coke) for rock mineral wool production.

In almost all impact categories, the transport to installation (module A4) is quite visible because of the transport emissions. The end-of-life of the product has almost no influence as almost no emissions from inert waste occur (modules C2 & C4).

The Global Warming Potential (GWP-total) is dominated by the manufacturing in the cupola, mostly due to CO_2 emissions from raw materials and energy consumption.

The Depletion Potential of the Stratospheric Ozone layer (ODP) is mostly influenced by the manufacturing phase (module A1-A3) and significantly influenced using electricity.

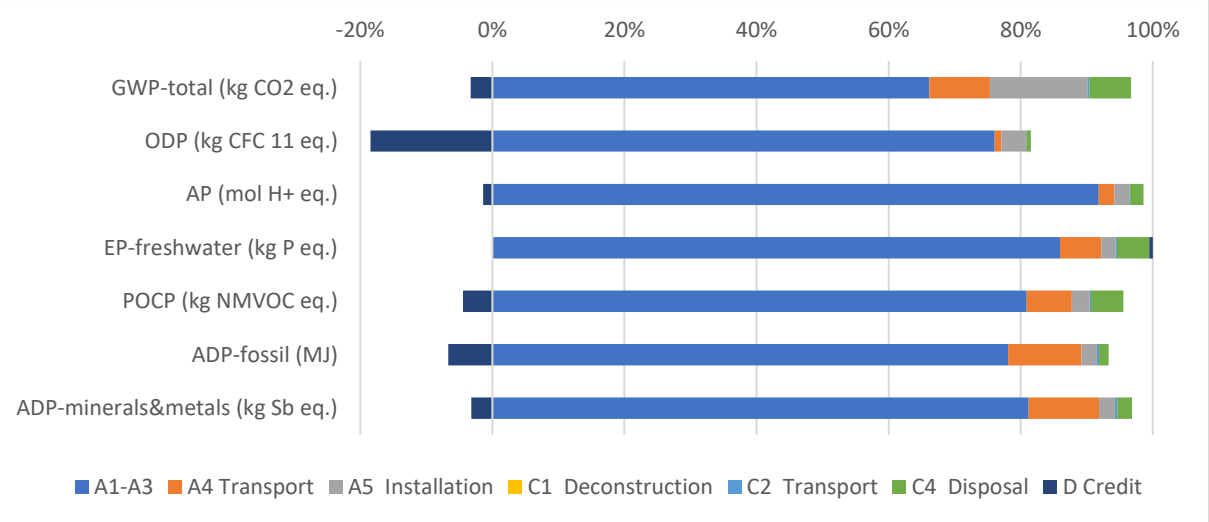
The Acidification Potential (AP) is also dominated by the manufacturing due to the emissions related to the processes and the energy consumption.

The Eutrophication Potential Fresh Water (all EP indicators in total) is significantly influenced by the manufacturing due to emissions from cupola furnace, curing oven and other unit processes.

The Formation Potential of Tropospheric Ozone (POCP) is particularly dominated by the manufacturing (emissions in the cupola furnace and other unit processes).

The Abiotic Depletion Potential for Non-Fossil Resources (ADP- minerals &metals) is mainly due to the raw material extraction.

The Abiotic Depletion Potential for Fossil Resources Potential (ADP-fossil) is dominated by the use of coke as energy carrier. Next to the coke, we have also the impact of natural gas and upstream the electricity energy mix.



RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the manufacturing of rock mineral wool products (especially due to the energy carrier, coke).

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the manufacturing, mostly due to electricity consumption and packaging.

References

International EPD® System
General Programme Instructions of the International EPD® System. Version 4.0.
Product category rules (PCR): PCR 2019:14 v1.3.2. Construction products (EN 15804:A2) Version 1.0
c-PCR-005 Thermal insulation products (EN 16783: 2017) Version: 2019-12-20

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804:2012+A2:2019/AC:2021
EN 15804:2012+A2:2019/AC:2021: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 16783:2017
Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

LCA for Experts 10.8
LCA for Experts 10.8: Software and database for life cycle engineering. LBP, University of Stuttgart and Sphera, 2023.

EN 1602
EN1602: 2013 Thermal insulation products for building applications – Determination of the apparent density

EN 12667
EN 12667: 2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

EN 13162
EN 13162:2012 Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification

EN 12086
EN 12086: 2013 Thermal insulating products for building applications –determination of water vapour transmission properties.

EN 15978: 2011
EN 15978: 2011 Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method.

ISO 8301:1991
Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus.

ISO 21930:2017
Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

DoP R4305MPCPR
Declaration of Performance
www.dopki.com

DIN 4102-17
Fire behaviour of building materials and building components – Part 17: Melting point of mineral wool insulating materials – Terms and definitions, requirements and test

***2024_05_15 Naturboard Silence - NM* (I-report)**
I-report is an interactive report created with GaBi based on the scenario. More details about the product characteristics, plant allocation and scenario on i-report.

***BR_RMW_2022* (Background Report)**
Calculation rules for the Life Cycle Assessment and Requirements and more details about the production on the Background Report.

Contact information:

EPD owner:	Knauf Insulation Rue de Maestricht 95 4600 Visé Belgium www.knaufinsulation.com Contact : sustainability@knaufinsulation.com
LCA support:	CO_2 Logic Cantersteen 47 1000 Brussels Belgium Sphera Hauptstraße 111-113 70771 Leinfelden-Echterdingen Germany
Programme operator:	EPD International AB info@environdec.com
Certification body	Fabriksgatan 13 41250 Göteborg Sweden

BCCA

BCCA

EUCEB CERTIFICATE

BCCA, independent Certification Body designated by the scheme owner EUCEB,
declares that all requirements have been met to attest that the products
to which the right to use the EUCEB Trademark is granted and that are manufactured by

Knauf Insulation sprl

Rue de Maestricht 95, BE - 4600 Visé

in the plant situated at

Visé

are made of fibres with a chemical composition that lies within the chemical range of the reference fibre

Mineral Wool 9909

that has successfully been tested

**in accordance with Note Q of the Regulation (EC) No 1272/2008
of the European Parliament and of the Council as currently in force**

as given in report No 02G00009 of 01-09-2000.

This certificate is granted on the basis of the Implementation Rules TRA-BEUC-511
for EUCEB Certification of mineral wool products.

N° certificate BEUC-511-7-289-20364 I Valid from 2023-06-01 until 2026-05-31
Furnace: VB 1 and VB 2

Issued in Brussels, on 1 June 2023.

ir. **Benny DE BLAERE**
President of the General management
Committee for Certification & Approval

The validity of this certificate can be checked on the website www.bcca.be.
Further clarification regarding the scope of this certificate and the applicability
of the requirements of the standard may be obtained from the certified organisation.

BELGIAN CONSTRUCTION CERTIFICATION ASSOCIATION NPO
HEADQUARTERS: CANTERSTEEN, 47 BE-1000 BRUSSELS
OPERATIONAL HEADQUARTERS: HERMESLAAN, 9 BE-1831 DIEGEM
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Certificate

Indoor Air Comfort Gold

Veil faced Rock Mineral Wool products with ECOSE® Technology

Certified Product

Knauf Insulation

Applicant

The above product complies with the Indoor Air Comfort Gold specifications, version 9.0 (2023). These include both inspection of factory production and VOC emissions testing according to EN 16516, at regular intervals. Indoor Air Comfort Gold combines all key European and selected global requirements on VOC product emissions. Additional requirements not related to VOC product emissions, for example content of certain substances or odour are not combined or evaluated. The following VOC emission requirements are combined and the certified product shows compliance with these VOC emission related limit values:

- France VOC class A+
- Germany (AgBB/ABG)
- Italian CAM Edilizia
- EU Taxonomy Regulation
- LEED (ACP)
- BREEAM New Construction
- WELL Building
- DGNB
- SKA Rating
- French HQE certification
- Blue Angel DE-UZ 132
- Austrian Baubook
- M1
- Danish Indoor Climate Label (Emission Class 1)
- BVB (Sweden)
- Miljöbyggnad (Sweden)
- Eco Product Norway
- SINTEF (Norway)
- Cradle to Cradle
- very low emitting products according to EN 16798-1
- Singapore Green Label
- Global GreenTag
- Declare 2.0

Issue date: 08 September 2023

Validity date: 08 September 2028

Product type: Thermal Insulation

Certificate number: IACG-323-02-02-2023

This certificate is valid as specified if regular surveillance and testing is done.

Thomas Neuhaus, Head of Certification Body

eurofins | Product Testing

Appendix to Certificate IACG-323-02-02-2023

Knauf Insulation

receives the Indoor Air Comfort Gold certificate with validity 08 September 2028

for below product group produced at sites as listed:

Product group:	Veil faced Rock Mineral Wool products with ECOSE® Technology
Product type:	Thermal Insulation

Production sites:

Novi Marof, Croatia
Surdulica, Serbia

The products in this group are based on identical or similar recipe and are produced under equivalent conditions. Grouping of the products and inspection of the production process is part of the Indoor Air Comfort Gold certification. A worst-case product, which is representative for the whole group, is being tested frequently.

eurofins | Product Testing

Certificate

Indoor Air Comfort Gold

Knauf Plasterboards

Certified Product

Knauf di Knauf S.r.l. s.a.s

Applicant

The product complies with Indoor Air Comfort Gold requirements for product type, version 7.0 (2020). These include both inspections of factory production according to DIN 18200 and VOC testing according to EN 16516 by an ISO 17025 accredited laboratory, at regular interval.

Indoor Air Comfort Gold certification ensures that low product emission requirements are fulfilled and is a sign of the applicant's focus on quality and contribution to a healthy indoor environment.

Product type:	Plasterboards
Certificate number:	IACG-458-01-01-2022
Issue date:	23 June 2022
Validity date:	23 June 2027

This certificate is valid as specified if regular surveillance and testing is done.

Compliance with Indoor Air Comfort Gold means compliance with VOC requirements on low emitting products of:

France VOC class A+, Germany (AgBB/ABG), BREEAM international, BREEAM NOR, BREEAM NL, LEED (ACP), WELL Building, SKA Rating, French HQE certification, Italian CAM Edilizia, BVB (Sweden), Eco Product Norway, M1, Danish Indoor Climate Label (Emission Class 1), very low emitting products according to EN 16798-1, Singapore Green Label, GreenTag Australia, Cradle to Cradle (Gold/Platinum), Miljöbyggnad (Sweden)

Thomas Neuhaus
Head of Certification Body

eurofins | Product Testing

Appendix to Certificate IACG-458-01-01-2022

Knauf di Knauf S.r.l. s.a.s

receives the Indoor Air Comfort Gold certificate with validity 23 June 2027

for below product group, including subgroups and individual products as listed:

Product group: Knauf Plasterboards

Product type: Plasterboards

Products included:

Diamant 12.5 mm
GKB 9.5 mm, 12.5 mm and 15.0 mm
GKB + BV 12.5 mm
GKB Advanced 12.5 mm
GKB Advanced + BV 12.5 mm
GKF 12.5 mm and 15.0 mm
GKI 12.5 mm
Kasa 12.5 mm
Lastra A-Zero 12.5 mm
Lastra F-Zero 12.5 mm and 15.0 mm

The products in this group are based on identical or similar recipe and are produced under equivalent conditions. Grouping of the products and inspection of the production process is part of the Indoor Air Comfort Gold certification. A worst-case product, which is representative for the whole group, is being tested frequently.

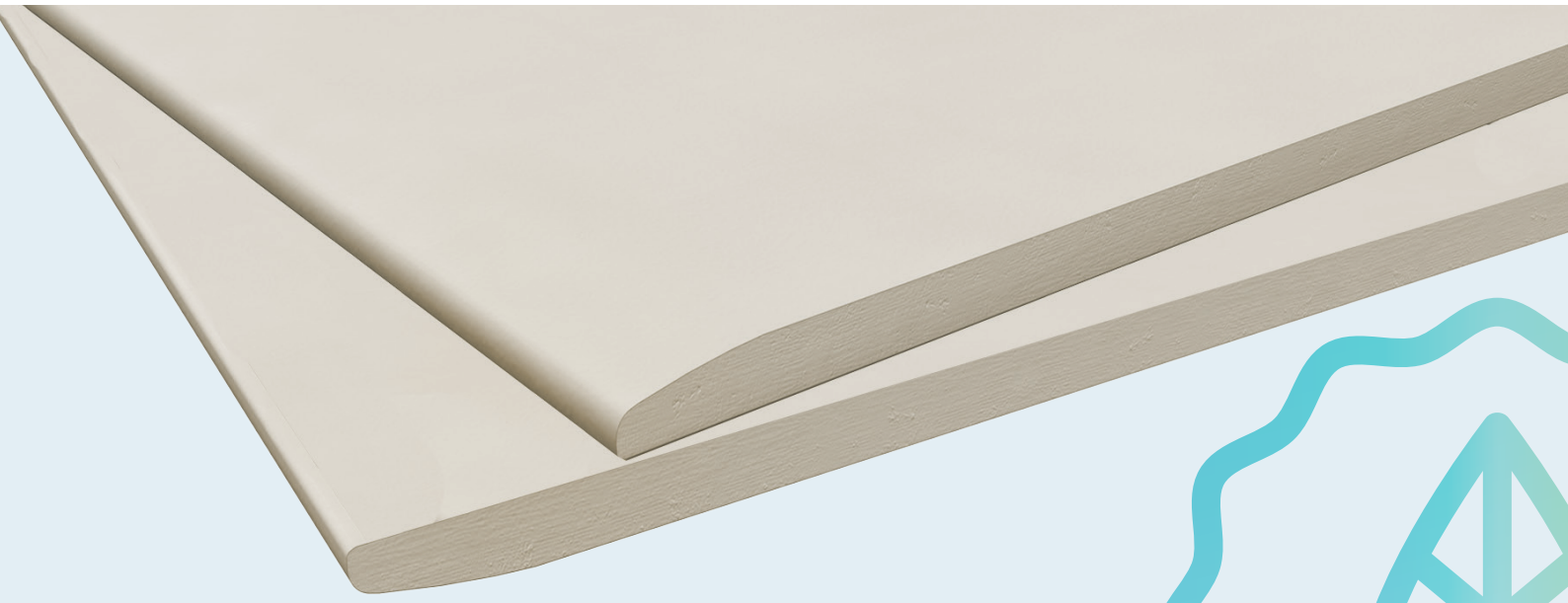
eurofins | Product Testing

ECO EPD 00001146

N° VERIFICATION : S-P-01936

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804 for:
12.5 mm, 15 mm Plasterboard Knauf F-ZERO



> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-01936

> **Publication date:**
2020/05/06

> **Valid until:**
2025/04/22

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s. - Via Livornese, 20
56040 Castellina Marittima (PI), Italy

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com
EPD registration number/declaration number: S-P-01936
Product / product family name and manufacturer represented: F-ZERO plasterboard, manufactured by Knauf di Knauf S.r.l. S.a.s
Product description and use: : F-ZERO plasterboard is made up of a gypsum core (calcium sulphate dihydrate) with additive and a paper liner. F-ZERO plasterboard is designed for use in the residential sector.
Declaration issued: 2020/04/22
Valid until: 2025/04/22
Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Via Livornese 20, 56040 Castellina Marittima (PI), Italy. Tel. 050 69211 - Fax 050 692301, knauf@knauf.it.
EPD prepared by: Ergo s.r.l, www.ergosrl.net
Scope: The LCA is based on 2018 production data for Castellina Marittima manufacturing site in Italy for 12.5 mm and 15 mm F-ZERO. This EPD covers information modules A1 to C4 (cradle to gate with option) as defined in EN 15804:2014 for F-ZERO sold and used in Europe. The use stage (B1-B7) was not considered in this study.
Functional unit/declared unit: The declared unit (DU) is 1 m^2 of gypsum-based plasterboard.

CEN standard EN 15804 served as the core PCR[a]	
PCR:	PCR 2012:01 Construction products and construction services, Version 2.3.
Product group classification:	The UN CPC code of the product is 314 Boards and panels.
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A.Via Corsica 12, Genova -Italy, Tel +39 010-5385306, www.rina.org ACCREDIA Registration number:001H REV. 17
Accredited or approved by:	The International EPD System

[a]*Product Category Rules*

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 150 production facilities and sales organizations in over 86 countries, 27,500 employees worldwide, and sales of 6.5 billion Euro (in 2016), the Knauf Group is without doubt one of the big players on the market – in Europe, the USA, South America, Russia, Asia, Africa, and Australia.
The company's headquarter in Italy is in Castellina Marittima (Pisa). Currently, the Castellina Marittima plant has a global area of 90,000 square meters, covers an area of 30,000 square meters and owns more than 100 hectares of quarries. The products manufactured in Knauf plant in Castellina Marittima are plasterboard, steel profiles required for the implementation of the plasterboards, ceilings, stucco and impregnators.

3. PRODUCT INFORMATION

3.1 Product description

Knauf F-ZERO are plasterboard reinforced with mineral fibers and additives for better cohesion of the plaster core under the action of fire. Knauf F-ZERO plasterboards are used in all areas of interior construction especially for partition walls, counterwalls on metal or direct-tackle structure, countertops where fire protection is required. Knauf F-ZERO are also suitable for the fire protection of structural elements (class A1 of reaction to fire). F-ZERO plasterboard is available in sizes 12.5 mm and 15 mm.

3.2 Technical data

Technical data referred to Knauf F-ZERO plasterboard are given in Table 1.

Table 1 - Technical information.

Product identification	DIN 18180 F-ZERO UNI EN 520 DF
Nominal density	The assumed density is 820 kg/m^3
Thermal conductivity	0.20 W/mk
Class of reaction to fire performance (accordingto en 13501:1)	Building material class: A1 Burning droplets: s1 Smoke gas development: d0

3.3 Delivery Status

The EPD refers to 12.5 mm and 15 mm thick Knauf F-ZERO plasterboard.

3.4 Base materials / Ancillary materials

Plasterboards covered by this EPD are made from:

- gypsum: up to 96%
- cardboard: up to 2%
- additives (including starch, glass fibers and foaming agent, additive for core cohesion): less than 2%

Knauf F-ZERO plasterboards do not contain SVHC (Substances of Very High Concern). No additives used are classed as substances of concern; substances are not listed specifically to protect proprietary information.

3.5 Packaging

Plasterboards Knauf F-ZERO are piled up on bearers and pallets, and are protected against damage by strapping tape (polyethylene). Packing materials are externally recovered/disposed of.

3.6 Recycled material

Board liner for the covering of gypsum core is produced from 100% recycled waste paper and is supplied by truck from the German and Spanish manufacturing sites. The F-ZERO manufacturing process uses a part of recovered gypsum derived from production wastes and dust from the filtration plants.

3.7 Re-use phase

Once plasterboards Knauf F-ZERO are installed, they are not suited for re-use in an unchanged way. Prior to collection, plasterboards Knauf F-ZERO should be separated from other used building materials.

3.8 Disposal

Knauf F-ZERO plasterboards have to be disposed of in compliance with the following waste codes of the European Waste Catalogue /EWC/:17 08 02 gypsum-based construction materials.

3.9 Further information

Further information can be found through the enquiry desk:
+39 050 69211
E- mail: knauf@knauf.it | www.knauf.it

3.10 Manufacture

Knauf F-ZERO plasterboard is manufactured using a continuous production process, showed in the Figure 1 below:

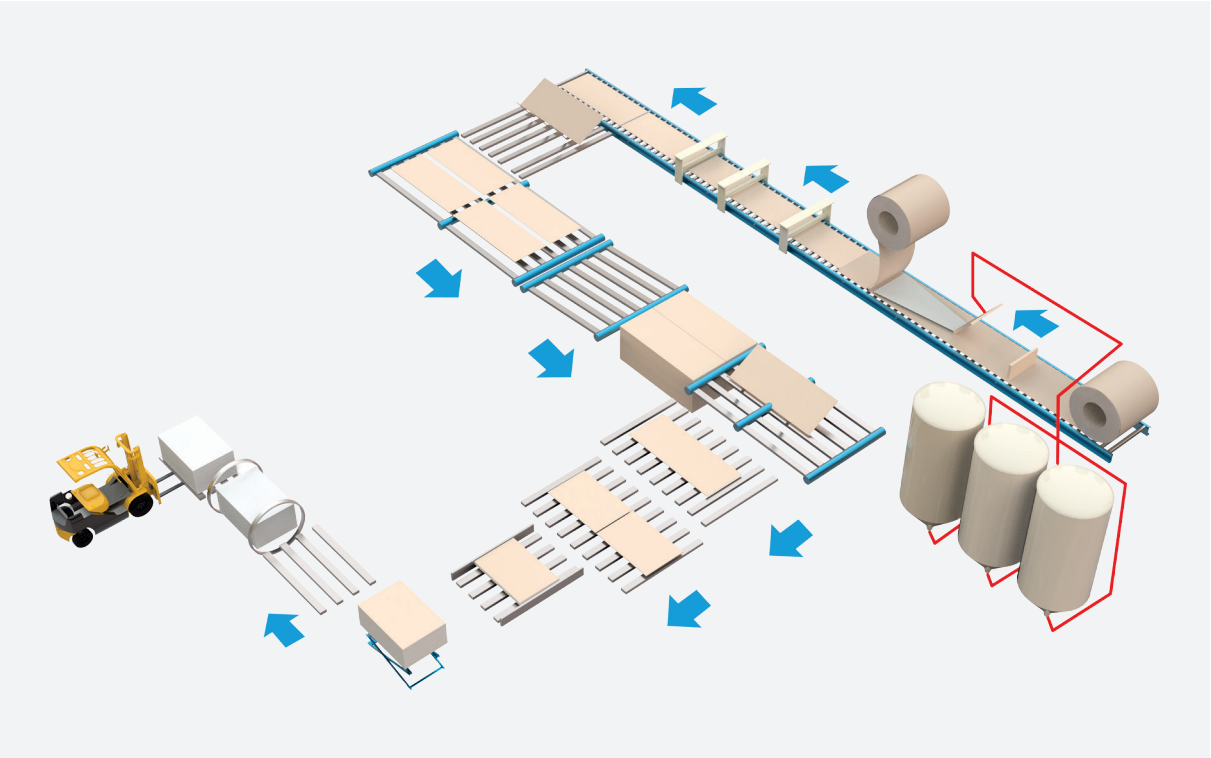


Figure 1 - Gypsum board manufacturing process.

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

3.11 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free. A target of zero accidents at work for employees, visitors and contractors is set by the business.
In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured. To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 18001 certified systems.

4. LCA INFORMATION

Figure 2 shows a flow diagram of the system under study. The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'. In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4). Accordingly, the EPD is a cradle-to-gate declaration with options.

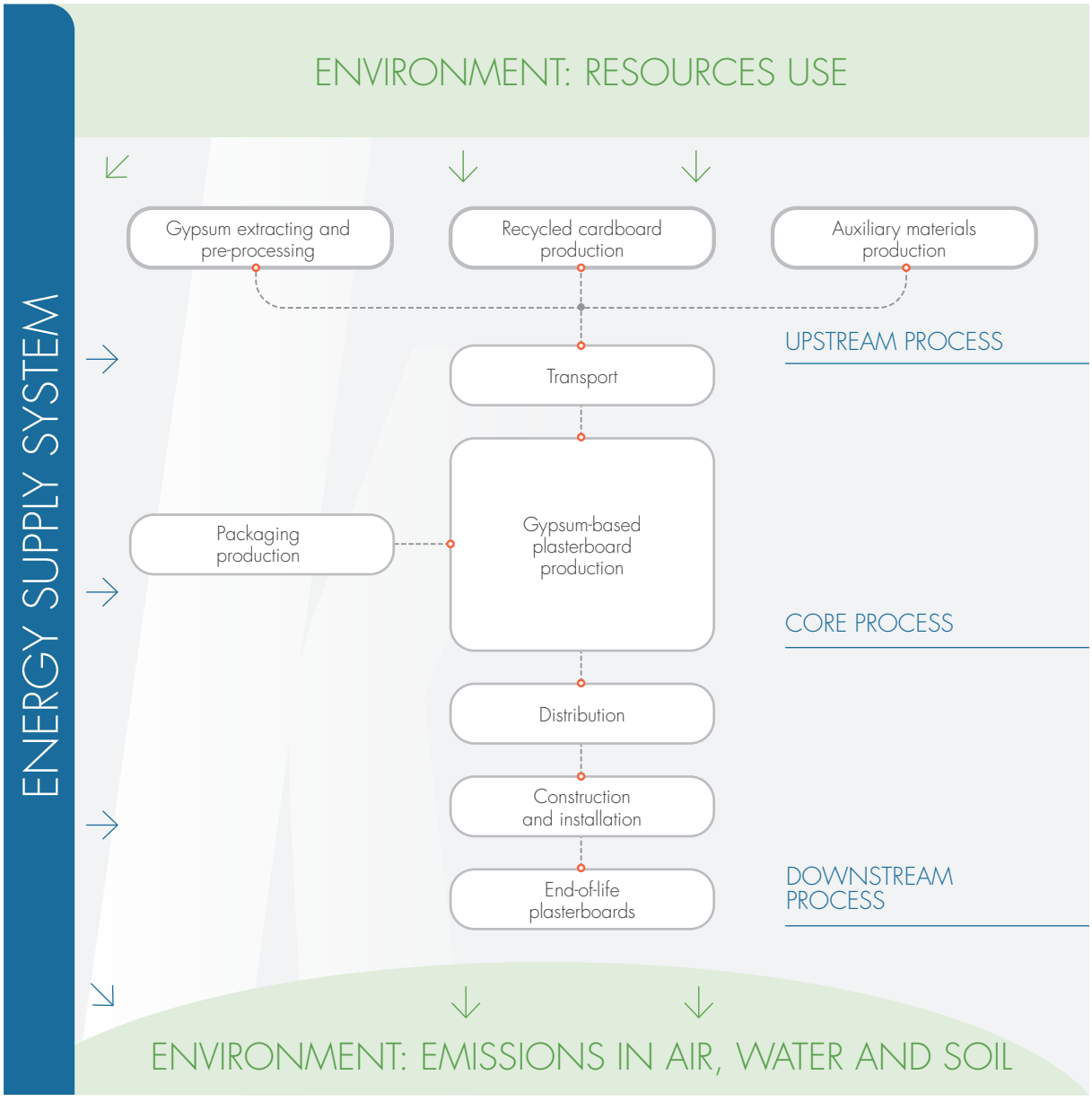


Figure 2 - Flow diagram of system boundary under assessment

The system boundaries in tabular form for all modules are shown in the Table 2 below.

Table 2 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 3.

Table 3 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 m^2 of gypsum-based plasterboard. Weights of finished gypsum-based boards: F-ZERO 12.5 mm: approx. 10.7 kg/m^2 F-ZERO 15 mm: approx. 13.6 kg/m^2
5.2	**System boundaries**	Cradle to gate with option: A1-A3,A4,A5,C1-C4.
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts. The F-ZERO product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. For the production of additives and packaging materials (and their disposal), generic data have been used, since their mass flow in relation to the declared unit is limited. Furthermore, these materials are common to the different plasterboard systems (and gypsum sources) under assessment. Since there is no waste processing at the end of life, modules C3 and D are not applicable. The declared plasterboards are typically disposed of as construction waste which is declared in module C4.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2014 Clause 6.3.5. In compliance with these criteria, the infrastructure of the manufacturing site, small parts of the packaging and personnel related activities (travel, office operations and supplies) are excluded from the study.

5.5	**Background data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Castellina Marittima plant. All secondary data was retrieved using SIMAPRO 9 software, with Ecoinvent 3.5 database.
5.6	**Data quality**	Primary data refer to 2018 and have been collected at Knauf S.r.l. S.a.s. plant located in Castellina Marittima (IT), whereas selected generic data have been retrieved from Ecoinvent 3.5 database and using the most updated datasets and – as far as possible- those representative for at least 5 years into the future. Moreover, as required by the General Programme Instructions, the environmental impacts associated to proxy data do not exceed 10% of the overall environmental impact from the product system. The energy mix of Knauf di Knauf S.r.l. S.a.s. Castellina Marittima plant is characterized by 61% of electricity self-produced by cogeneration and 39% by electricity purchased from an external energy company. The energy-related data from the energy supplier refer to the supplier energy mix, whereas for the production of raw materials a European energy mix has been accounted for.
5.7	**Period under review**	The data is representative of the manufacturing processes of 2018.
5.8	**Allocations**	Allocations were avoided in the calculation model.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries

This EPD evaluates the environmental impacts of 1 m^2 of gypsum based plasterboard from cradle to gate with options. Within the Life Cycle Assessment of the declared boards, the following processes are considered:

Product stage, A1-A3

Description of the stage

The product stage of the plasterboard products is subdivided into three modules; A1, A2 and A3 respectively "raw material supply", "transport" and "manufacturing".

A1, raw material supply

This includes raw material extraction and processing and energy production. The declared Knauf gypsum boards consist of a gypsum core, which also contains additives for easier processing and/or a fine adjustment of the respective properties of the individual boards. The natural gypsum is mainly extracted from open-cast mining in close vicinity to the manufacturing site. Natural gypsum is calcinated to stucco prior to the mixing with other components. Board liner for the covering of gypsum core is produced from recycled waste paper.

A2, transport to the manufacturer

Natural gypsum is extracted from mines close to the manufacturing sites. Accordingly, transport distances are short and trucks can be used. Further raw materials are supplied by truck from manufacturers within Italy or from neighbouring countries. Only some exceptional additives are delivered from overseas via container ship and truck to the manufacturing plant.

A3, manufacturing

The module includes the manufacture of product. Stucco and additives are suspended in water and spread on a continuous sheet of board liner (visible face, lower layer). Beforehand, the board liner is cut at the sides for edge shaping. The slurry is covered with a second sheet of board liner (back surface) in the forming station and the edges of the visible face board liner are flipped upwards. On the subsequent board line the gypsum sets continuously and the boards are dried in a multi-level drier to the permitted residual moisture level. Drying is followed by the cutting of the boards to the desired lengths. Finally, gypsum boards are piled up on bearers or reusable pallets. Apart from the reusable pallets, all other packaging materials are externally recycled/disposed of (external recycling is beyond the applied system boundaries). When recycled materials are being used, such as post-consumer recycled cardboard, burdens associated with the collection, processing and transport of these materials were included in the assessment.

Construction process stage, A4-A5

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

A4, transport to the building site
The Table 4 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO4, EURO 5 and EURO 6 articulated trucks has been accounted for, based on the sale figures in Italy and Europe in the reference year. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed.

Table 4 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck 16-32 tons. EURO 4, EURO 5, EURO 6. Boat, freight ship
Distanceto central warehouse	363 km weighted average by truck to all markets 21 km weighted average by boat to all markets
Distance to construction site	30 km
Fuel/energy consumption	0.04L diesel fuel per tkm (truck) 0.0002L diesel fuel per tkm (boat)
Capacity utilization	70%
Bulk density of transported products	820 kg/m^3

A5, installation into the building
The plasterboard is considered installed when it is attached in its designated place in the building. The accompanying Table 5 quantifies the parameters for installing the product at the building site. All installation materials and their waste processing and packaging waste of plasterboards are included.

Table 5 - Parameters for installing the product at the building site.

Parameter	Value (expressed per functional/declared unit)
Ancillary materials for installation(specified by materials)	Jointing compound: 0.350 kg Jointing tape: 0.00065 kg (1.5 m) Screw: 0.013 kg
Water use	0.00165 m^3
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Knauf F-ZERO 12.5 mm (0.535 kg) Knauf F-ZERO 15 mm (0.068 kg) Jointing compound: 0.0175 kg Polyethylene film: Knauf F-ZERO 12.5 mm (1.20 g) Knauf F-ZERO 15 mm (1.39 g) (waste from packaging)
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Knauf F-ZERO 12.5 mm (0.535 kg) Knauf F-ZERO 15 mm (0.068 kg) Jointing compound: 0.0175 kg to landfill Polyethylene film: Knauf F-ZERO 12.5 mm (1.20 g) Knauf F-ZERO 15 mm (1.39 g) to landfill and to energy recovery

Use stage (excluding potential savings), B1-B7

Description of the stage

The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information

The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf F-ZERO plasterboard is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
Deconstruction includes dismantling or demolition of the product from the construction.
No on-site sorting of the materials occurs.
C2, transport to waste processing
Once the product is uninstalled, the construction mixed waste is transported for 40 km to the landfill disposal.
C3, waste processing for reuse, recovery and/or recycling
Since there is no waste processing at the end of life, modules C3 and D (expressed as net impacts and benefits) are not applicable.
C4, disposal
Product residues (e.g. plasterboard scraps, jointing tapes, jointing compound) are considered to be deposited in a landfill.

Table 6 - End-of-life stage.

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	10.7 kg (F-ZERO 12.5 mm), 13.6 kg (F-ZERO 15 mm) collected and transported by truck for landfill
C2) Assumption for scenario development (e.g. transportation)	Diesel consumption 0.04L per tkm; 40 km from demolition site to waste handle
C3) Recovery system specified by type	None
C4) Disposal specified by type	100% of waste is landfilled

6. LCA RESULTS

In following tables the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 2.5 May 2015) and those indicated in PCR 2012:01 version 2.3 for Construction Products and construction services. For clarity, the results are reported subdivided by panel's thickness. The LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. CML 2001 has been used as the impact model.

7. LCA RESULTS INTERPRETATION

The following interpretation of results is given for the Knauf F-ZERO 12.5 mm plasterboard. Nevertheless, the statements in general are also valid for Knauf F-ZERO 15 mm plasterboard declared in this EPD.
Product stage (modules A1-A3) is responsible for the biggest share of the environmental impact for most indicators (from 65% to 96%) except abiotic depletion potential for non-fossil resources 58%, radioactive waste disposed 34% and non-hazardous waste disposed 1%.
The distribution of finished product (transport in module A4) influence the LCA results with a medium percentage of 18%, except for global warming potential -biogenic 7%, global warming potential- land use 3%, non-hazardous waste disposed 4% and hazardous waste disposed 5%, abiotic depletion potential for non-fossil resources 34% and radioactive waste disposed 51%. By contrast, transports in modules A2 and C2 contribute only 7% at maximum.
The installation phase (module A5) has a negligible contribution to the impact categories, less than 5%. With regard to total energy consumption, the product stage (modules A1 – A3) has the highest contribution to this indicator, with a maximum percentage of 89%. Energy consumption for drying phase of the plasterboards is the main contributor to this indicator.
The same trend of results is related to the use of fresh water, where A1 – A3 modules are the main responsible of impacts, with a contribution of 76%.
The effect of disposal life cycle stage has little effect (less than 7%) on life cycle impacts, except for non-hazardous waste where the contribution of plasterboard disposal (module C4) to the overall results is 92%.

ADDITIONAL INFORMATION

Greenhouse gas emission from the use of electricity in the manufacturing phase

Electricity used in the manufacturing processes has been accounted for using the electricity mix (22.96% Renewables, 16.04% coal, 51.62% natural gas, 0.68% oil, 4.76% nuclear, 3.93% other sources) from energy supplier (for the year 2018):

Greenhouse gas emissions: 0.141 kg CO_2 eq/MJ

Table 7 - LCA results of potential environmental impact referred to the declared unit.

F-ZERO 12.5 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**	**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**		
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	2.55E+00	7.14E-01	6.41E-02	-	-	-	-	-	-	-	3.55E-02	3.71E-02	0	5.72E-02	-	3.45E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.54E+00	7.14E-01	6.40E-02	-	-	-	-	-	-	-	3.55E-02	3.71E-02	0	5.71E-02	-	3.44E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.03E-03	1.59E-04	4.75E-05	-	-	-	-	-	-	-	3.59E-06	9.52E-06	0	2.78E-05	-	2.28E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	7.45E-03	2.06E-04	3.30E-05	-	-	-	-	-	-	-	3.17E-06	7.98E-06	0	2.55E-05	-	7.73E-03
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	4.23E-07	1.33E-07	5.60E-09	-	-	-	-	-	-	-	6.39E-09	7.36E-09	0	1.89E-08	-	5.93E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	7.37E-03	2.33E-03	3.38E-04	-	-	-	-	-	-	-	3.42E-04	2.07E-04	0	4.88E-04	-	1.11E-02
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	1.15E-03	3.33E-04	5.11E-05	-	-	-	-	-	-	-	5.77E-05	3.33E-05	0	7.26E-05	-	1.70E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	3.22E-04	1.14E-04	2.20E-05	-	-	-	-	-	-	-	7.09E-06	6.33E-06	0	2.08E-05	-	4.91E-04
Photochemical ozone creation = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	3.72E-06	2.19E-06	3.29E-07	-	-	-	-	-	-	-	1.19E-08	7.23E-08	0	6.53E-08	-	6.38E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	3.81E+01	1.08E+01	7.77E-01	-	-	-	-	-	-	-	5.11E-01	5.87E-01	0	1.61E+00	-	5.24E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

Table 8 - LCA results of potential environmental impact referred to the declared unit.

F-ZERO 15 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**	**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**		
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	3.45E+00	9.77E-01	6.04E-02	-	-	-	-	-	-	-	4.51E-02	4.72E-02	0	7.27E-02	-	4.65E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	3.44E+00	9.76E-01	6.04E-02	-	-	-	-	-	-	-	4.51E-02	4.72E-02	0	7.26E-02	-	4.64E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.47E-03	2.18E-04	3.97E-05	-	-	-	-	-	-	-	4.56E-06	1.21E-05	0	3.54E-05	-	2.78E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	5.48E-03	2.83E-04	3.13E-05	-	-	-	-	-	-	-	4.02E-06	1.01E-05	0	3.25E-05	-	5.84E-03
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	5.77E-07	1.81E-07	4.81E-09	-	-	-	-	-	-	-	8.12E-09	9.36E-09	0	2.40E-08	-	8.05E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	9.49E-03	3.21E-03	3.14E-04	-	-	-	-	-	-	-	4.35E-04	2.63E-04	0	6.20E-04	-	1.43E-02
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	1.44E-03	4.57E-04	4.74E-05	-	-	-	-	-	-	-	7.34E-05	4.23E-05	0	9.22E-05	-	2.15E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	4.18E-04	1.56E-04	2.11E-05	-	-	-	-	-	-	-	9.01E-06	8.05E-06	0	2.64E-05	-	6.39E-04
Photochemical ozone creation = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	4.68E-06	2.99E-06	3.23E-07	-	-	-	-	-	-	-	1.51E-08	9.19E-08	0	8.30E-08	-	8.18E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	5.18E+01	1.47E+01	7.05E-01	-	-	-	-	-	-	-	6.50E-01	7.46E-01	0	2.04E+00	-	7.07E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

Table 9 - LCA results of use of resources referred to the declared unit.

F-ZERO 12.5 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.16E+00	1.62E-01	4.60E-02	-	-	-	-	-	-	-	2.98E-03	1.05E-02	0	4.18E-02	-	2.42E+00
Use of renewable primary energy used as raw materials MJ/DU	2.63E-04	4.24E-05	1.33E-05	-	-	-	-	-	-	-	6.19E-07	2.50E-06	0	2.01E-05	-	3.42E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.16E+00	1.62E-01	4.60E-02	-	-	-	-	-	-	-	2.98E-03	1.05E-02	0	4.18E-02	-	2.42E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	3.98E+01	1.10E+01	8.18E-01	-	-	-	-	-	-	-	5.16E-01	6.05E-01	0	1.63E+00	-	5.44E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	3.98E+01	1.10E+01	8.18E-01	-	-	-	-	-	-	-	5.16E-01	6.05E-01	0	1.63E+00	-	5.44E+01
Use of secondary material kg/DU	2.63E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	2.63E-01
Use of renewable secondary fuels- MJ/FU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m^3/DU	1.53E-02	2.27E-03	4.98E-04	-	-	-	-	-	-	-	7.87E-05	1.38E-04	0	1.83E-03	-	2.01E-02

Table 10 - LCA results of use of resources referred to the declared unit.

F-ZERO 15 mm - RESOURCES USE																
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.99E+00	2.22E-01	4.38E-02	-	-	-	-	-	-	-	3.79E-03	1.34E-02	0	5.31E-02	-	3.33E+00
Use of renewable primary energy used as raw materials MJ/DU	3.83E-04	5.81E-05	1.26E-05	-	-	-	-	-	-	-	7.87E-07	3.17E-06	0	2.56E-05	-	4.83E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.99E+00	2.22E-01	4.38E-02	-	-	-	-	-	-	-	3.79E-03	1.34E-02	0	5.32E-02	-	3.33E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	5.41E+01	1.51E+01	7.44E-01	-	-	-	-	-	-	-	6.55E-01	7.68E-01	0	2.07E+00	-	7.34E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	5.41E+01	1.51E+01	7.44E-01	-	-	-	-	-	-	-	6.55E-01	7.68E-01	0	2.07E+00	-	7.34E+01
Use of secondary material kg/DU	3.04E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	3.04E-01
Use of renewable secondary fuels- MJ/FU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m^3/DU	1.91E-02	3.10E-03	4.35E-04	-	-	-	-	-	-	-	1.00E-04	1.75E-04	0	2.33E-03	-	2.53E-02

Table 11 - LCA results of waste categories referred to the declared unit.

F-ZERO 12.5 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.20E-04	6.46E-06	2.37E-06	-	-	-	-	-	-	-	2.30E-07	3.06E-07	0	1.15E-06	-	1.30E-04
Non-hazardous (excluding inert) waste disposed kg/DU	1.53E-01	5.26E-01	2.57E-01	-	-	-	-	-	-	-	5.59E-04	5.21E-02	0	1.07E+01	-	1.17E+01
Radioactive waste disposed kg/DU	5.07E-05	7.56E-05	2.49E-06	-	-	-	-	-	-	-	3.57E-06	4.25E-06	0	1.07E-05	-	1.47E-04

Table 12 - LCA results of waste categories referred to the declared unit.

F-ZERO 15 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.51E-04	8.84E-06	2.31E-06	-	-	-	-	-	-	-	2.92E-07	3.89E-07	0	1.46E-06	-	1.64E-04
Non-hazardous (excluding inert) waste disposed kg/DU	2.01E-01	7.18E-01	5.20E-02	-	-	-	-	-	-	-	7.10E-04	6.62E-02	0	1.36E+01	-	1.46E+01
Radioactive waste disposed kg/DU	6.48E-05	1.03E-04	2.03E-06	-	-	-	-	-	-	-	4.54E-06	5.40E-06	0	1.35E-05	-	1.94E-04

The images below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of Knauf F-ZERO 12.5 mm and 15 mm plasterboards.

F-ZERO 12.5 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)	Total environmental impact
GLOBAL WARMING	2.55	0.71	0.06	0.00	0.13	3.45 kg CO_2 equiv/DU
NON RENEWABLE RESOURCES CONSUMPTION[1]	38.13	10.79	0.78	0.00	2.70	52.36 MJ/DU
ENERGY CONSUMPTION[2]	42.00	11.18	0.86	0.00	2.81	56.85 MJ/DU
WATER CONSUMPTION [3]	0.0153	0.0023	0.0005	0.00	0.0020	0.020 m^3/DU
WASTE PRODUCTION[4]	0.15	0.53	0.26	0.00	10.75	11.69 kg/DU

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.

[2] This indicator corresponds to the total use of primary energy.

[3] This indicator corresponds to the net use of fresh water.

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.

F-ZERO 15 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)	Total environmental impact
GLOBAL WARMING	3.45	0.98	0.06	0.00	0.16	4.65 kg CO_2 equiv/DU
NON RENEWABLE RESOURCES CONSUMPTION[1]	51.80	14.72	0.71	0.00	3.44	70.66 MJ/DU
ENERGY CONSUMPTION[2]	57.05	15.29	0.79	0.00	3.57	76.69 MJ/DU
WATER CONSUMPTION [3]	0.0191	0.0031	0.0004	0.0000	0.0026	0.025 m^3/DU
WASTE PRODUCTION[4]	0.20	0.72	0.05	0.00	13.66	14.63 kg/DU

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.

[2] This indicator corresponds to the total use of primary energy.

[3] This indicator corresponds to the net use of fresh water.

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.

8. REFERENCES

CML2001
Life cycle assessment - an operational guideline to the ISO standards, Hrsg. Guinée, J. B., Ministry of Housing, Spatial Planning and the Environment and Centre of Environmental Science - Leiden University, Leiden (NL), 2001

General principles
EPD International (2015) General Programme Instructions for the International EPD® System. Version 2.5

LCA study
Life Cycle Assessment delle lastre in cartongesso GKB®, GKI, GKF, A-ZERO, F-ZERO, DIAMANT, KASA, FLEXILASTRA®, prodotti da Knauf di Knauf S.r.l. S.a.s. Castellina Marittima (PI), Italia (18/03/2020, Rev. 02)

PCR
PCR 2012:01 version 2.3 for Construction Products and construction services.
IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä. Swedish Wood Preservation Institute, Swedisol, SCDA. Svenskt Limträ AB. SSAB (2018)

Standards:

EN 15804:2014. Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

ISO 14025:2011-10. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

BS:OHSAS 18001:2007- ISO 45001:2018. Occupational Health and Safety Management

ISO 14001:2015. Environmental management systems - Requirements with guidance for use

ISO 9001:2015. Quality management systems - Requirements

ISO 14040:2006. Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2018. Environmental management - Life cycle assessment - Requirements and guidelines

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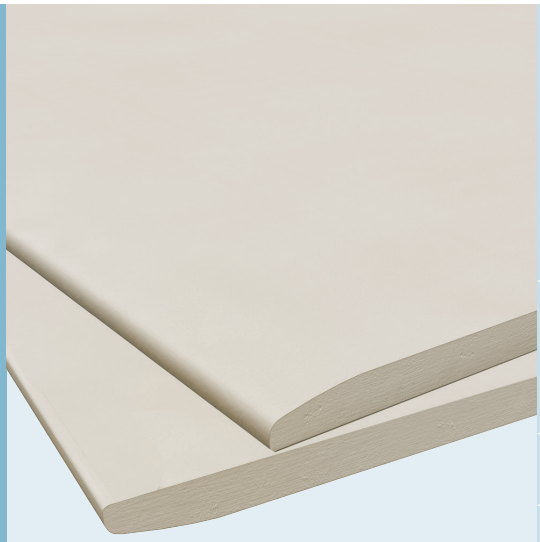
For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Castellina Marittima manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo s.r.l., spin off company of the Scuola Superiore Sant'Anna, coordinated by Prof. Francesco Testa.



Le nostre certificazioni

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05/2020

RINA
HEAD OFFICE
Via Corsica, 12
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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

VALIDATION IN COMPLIANCE

WITH THE REQUIREMENTS GENERAL PROGRAMME INSTRUCTIONS FOR EPD V. 3.0

63

Laura Severino
Sustainability & Food Certification Compliance, Head

RINA Services S.p.A.

Genoa, 22/4/2020

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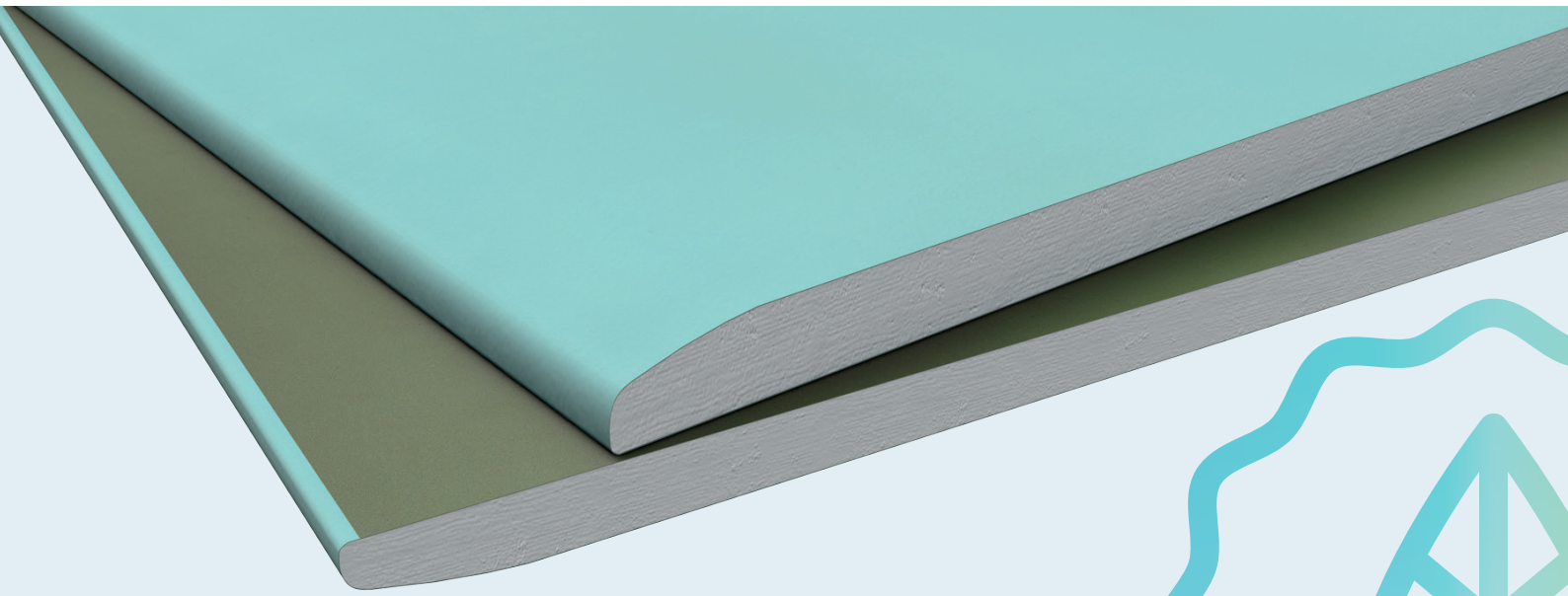
ECO EPD 00001144

N° VERIFICATION : S-P-01934

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804 for:

12.5 mm Plasterboard Knauf GKI



> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-01934

> **Publication date:**
2020/05/06

> **Valid until:**
2025/04/22

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s. - Via Livornese, 20
56040 Castellina Marittima (PI), Italy

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com
EPD registration number/declaration number: S-P-01934
Product / product family name and manufacturer represented: GKI plasterboard, manufactured by Knauf di Knauf S.r.l. S.a.s.
Product description and use: GKI plasterboard is made up of a gypsum core (calcium sulphate dihydrate) with additive and a paper liner. GKI plasterboard is designed for use in the residential sector.
Declaration issued: 2020/04/22
Valid until: 2025/04/22
Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Via Livornese 20, 56040 Castellina Marittima (PI), Italy. Tel. 050 69211 - Fax 050 692301, knauf@knauf.it.
EPD prepared by: Ergo s.r.l, www.ergosrl.net
Scope: The LCA is based on 2018 production data for Castellina Marittima manufacturing site in Italy for 12.5 mm GKI. This EPD covers information modules A1 to C4 (cradle to gate with option) as defined in EN 15804:2014 for GKI sold and used in Europe. The use stage (B1-B7) was not considered in this study.
Functional unit/declared unit: The declared unit (DU) is 1 m^2 of gypsum-based plasterboard.

CEN standard EN 15804 served as the core PCR[a]	
PCR:	PCR 2012:01 Construction products and construction services, Version 2.3.
Product group classification:	The UN CPC code of the product is 314 Boards and panels.
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A.Via Corsica 12, Genova -Italy, Tel +39 010-5385306, www.rina.org ACCREDIA Registration number:001H REV. 17
Accredited or approved by:	The International EPD® System

[a]*Product Category Rules*

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 150 production facilities and sales organizations in over 86 countries, 27,500 employees worldwide, and sales of 6.5 billion Euro (in 2016), the Knauf Group is without doubt one of the big players on the market – in Europe, the USA, South America, Russia, Asia, Africa, and Australia.
The company's headquarter in Italy is in Castellina Marittima (Pisa). Currently, the Castellina Marittima plant has a global area of 90,000 square meters, covers an area of 30,000 square meters and owns more than 100 hectares of quarries. The products manufactured in Knauf plant in Castellina Marittima are plasterboard, steel profiles required for the implementation of the plasterboards, ceilings, stucco and impregnators.

3. PRODUCT INFORMATION

3.1 Product description

Knauf GKI plasterboard is a standard gypsum board consisting of an aerated gypsum core encased in and firmly bonded to strong paper liners. Knauf GKI plasterboards are used in all areas of interior construction especially for partition walls, counterwalls on metal or direct-tackle structure, countertops and velettes. Knauf GKI plasterboard undergoes a special process to limit the absorption of moisture and can be used in damp interiors, such as bathrooms or kitchens. GKI plasterboard is available in size 12.5 mm.

3.2 Technical data

Technical data referred to Knauf GKI plasterboard are given in Table 1.

Table 1 - Technical information.

Product identification	DIN 18180 GKI UNI EN 520 H
Nominal density	The assumed density is 700 kg/m^3
Thermal conductivity	0.20 W/mk
Class of reaction to fire performance (accordingto EN 13501:1)	Building material class: A2 Burning droplets: s1 Smoke gas development: d0

3.3 Delivery Status

The EPD refers to 12.5 mm thick Knauf GKI plasterboard.

3.4 Base materials / Ancillary materials

Plasterboards covered by this EPD are made from:
- gypsum: up to 96%
- cardboard: up to 3%
- additives (including starch, glass fibers and foaming agent, additive for core cohesion): less than 1%

Knauf GKI plasterboards do not contain SVHC (Substances of Very High Concern). No additives used are classed as substances of concern; substances are not listed specifically to protect proprietary information.

3.5 Packaging

Plasterboards Knauf GKI are piled up on bearers, and are protected against damage by strapping tape (polyethylene). Packing materials are externally recovered/disposed of.

3.6 Recycled material

Board liner for the covering of gypsum core is produced from 100% recycled waste paper and is supplied by truck from the German and Spanish manufacturing sites. The GKI manufacturing process uses a part of recovered gypsum derived from production wastes and dust from the filtration plants.

3.7 Re-use phase

Once plasterboards Knauf GKI are installed, they are not suited for re-use in an unchanged way. Prior to collection, plasterboards Knauf GKI should be separated from other used building materials.

3.8 Disposal

Knauf GKI plasterboards have to be disposed of in compliance with the following waste codes of the European Waste Catalogue /EWC/:17 08 02 gypsum-based construction materials.

3.9 Further information

Further information can be found through the enquiry desk:
+39 050 69211
E- mail: knauf@knauf.it | www.knauf.it

3.10 Manufacture

Knauf GKI plasterboard is manufactured using a continuous production process, showed in the Figure 1 below:

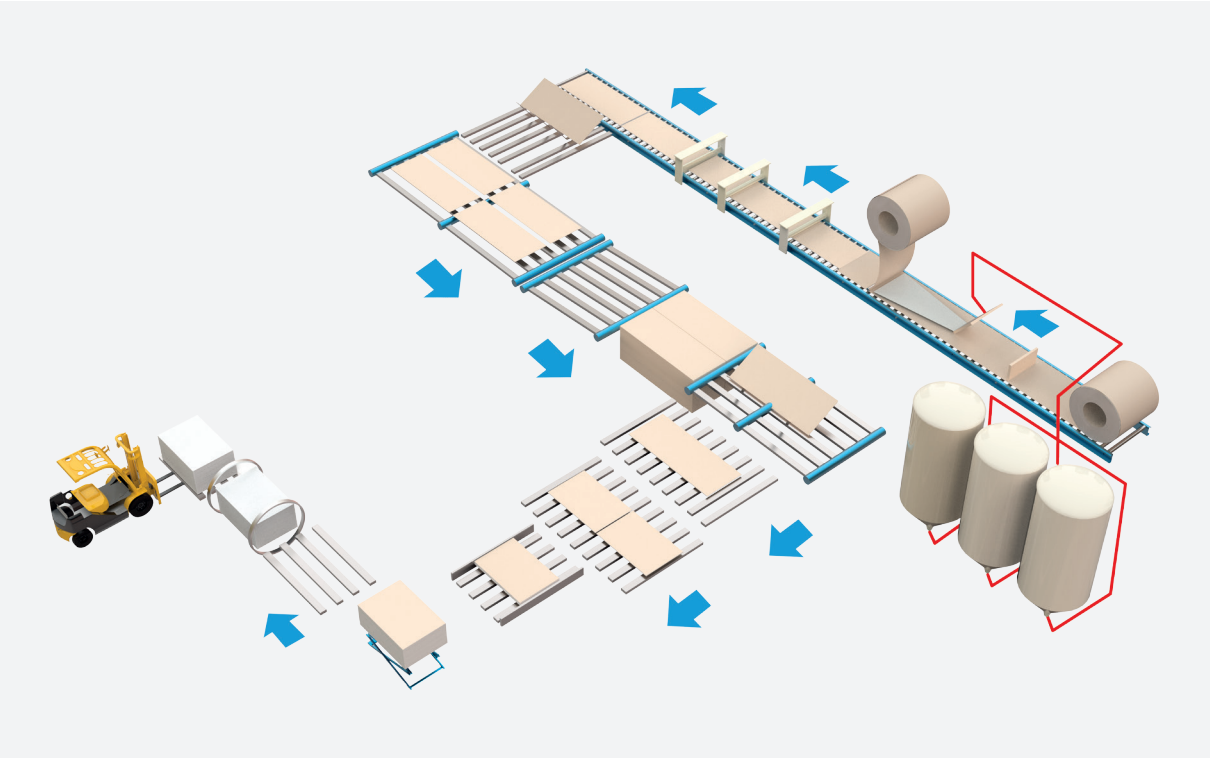


Figure 1 - Gypsum board manufacturing process.

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

3.11 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free. A target of zero accidents at work for employees, visitors and contractors is set by the business.
In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured. To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 18001 certified systems.

4. LCA INFORMATION

Figure 2 shows a flow diagram of the system under study. The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'. In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4). Accordingly, the EPD is a cradle-to-gate declaration with options.

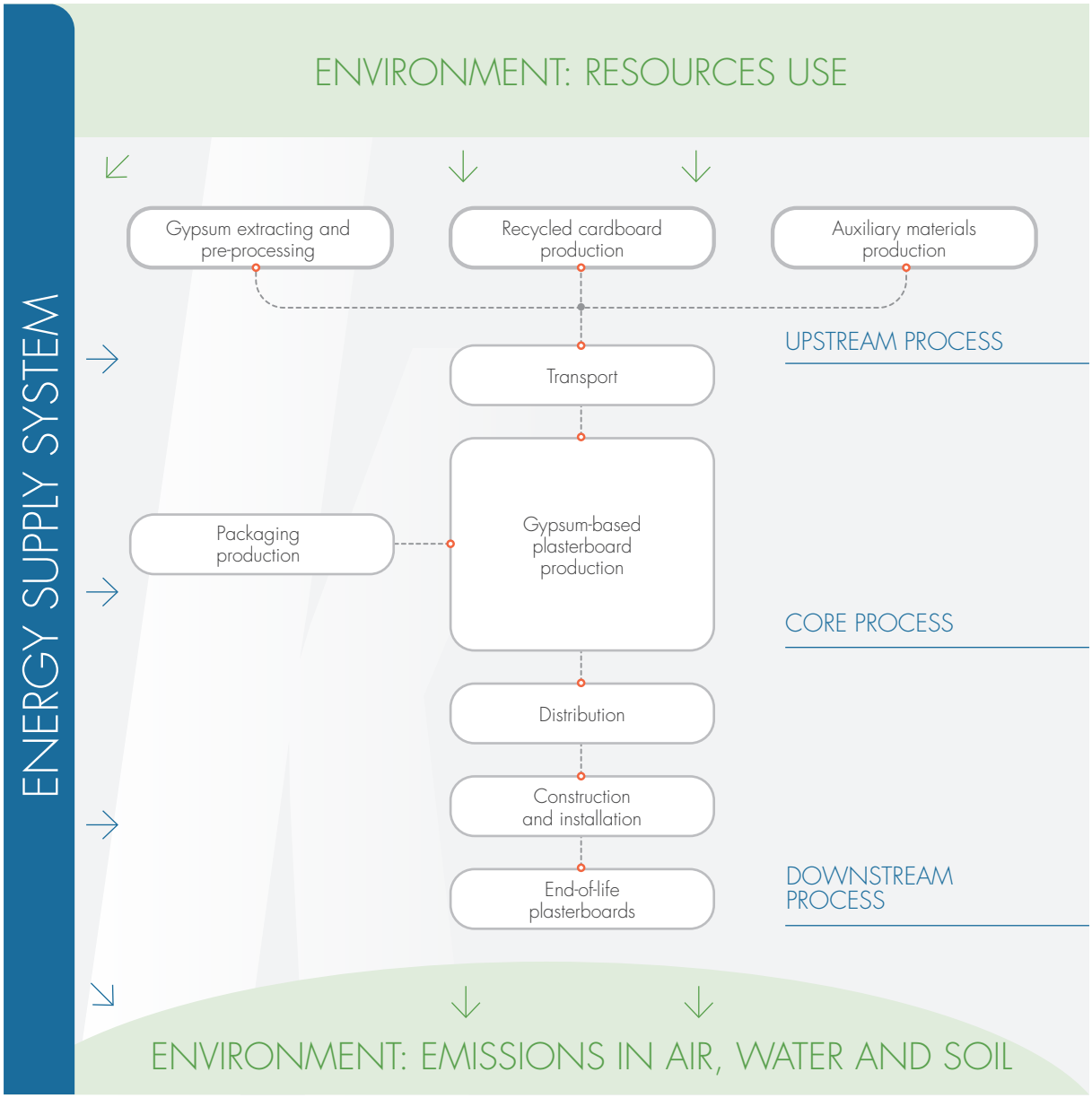


Figure 2 - Flow diagram of system boundary under assessment

The system boundaries in tabular form for all modules are shown in the Table 2 below.

Table 2 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 3.

Table 3 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 m^2 of gypsum-based plasterboard. Weights of finished gypsum-based boards: GKI 12.5 mm: approx. 8.5 kg/m^2
5.2	**System boundaries**	Cradle to gate with option: A1-A3,A4,A5,C1-C4.
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts. The GKI product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. For the production of additives and packaging materials (and their disposal), generic data have been used, since their mass flow in relation to the declared unit is limited. Furthermore, these materials are common to the different plasterboard systems (and gypsum sources) under assessment. Since there is no waste processing at the end of life, modules C3 and D are not applicable. The declared plasterboards are typically disposed of as construction waste which is declared in module C4.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2014 Clause 6.3.5. In compliance with these criteria, the infrastructure of the manufacturing site, small parts of the packaging and personnel related activities (travel, office operations and supplies) are excluded from the study.

5.5	**Background data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Castellina Marittima plant. All secondary data was retrieved using SIMAPRO 9 software, with Ecoinvent 3.5 database.
5.6	**Data quality**	Primary data refer to 2018 and have been collected at Knauf S.r.l. S.a.s. plant located in Castellina Marittima (IT), whereas selected generic data have been retrieved from Ecoinvent 3.5 database and using the most updated datasets and – as far as possible- those representative for at least 5 years into the future. Moreover, as required by the General Programme Instructions, the environmental impacts associated to proxy data do not exceed 10% of the overall environmental impact from the product system. The energy mix of Knauf di Knauf S.r.l. S.a.s. Castellina Marittima plant is characterized by 61% of electricity self-produced by cogeneration and 39% by electricity purchased from an external energy company. The energy-related data from the energy supplier refer to the supplier energy mix, whereas for the production of raw materials a European energy mix has been accounted for.
5.7	**Period under review**	The data is representative of the manufacturing processes of 2018.
5.8	**Allocations**	Allocations were avoided in the calculation model.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries

This EPD evaluates the environmental impacts of 1 m^2 of gypsum based plasterboard from cradle to gate with options. Within the Life Cycle Assessment of the declared boards, the following processes are considered:

Product stage, A1-A3

Description of the stage

The product stage of the plasterboard products is subdivided into three modules; A1, A2 and A3 respectively "raw material supply", "transport" and "manufacturing".

A1, raw material supply

This includes raw material extraction and processing and energy production. The declared Knauf gypsum boards consist of a gypsum core, which also contains additives for easier processing and/or a fine adjustment of the respective properties of the individual boards. The natural gypsum is mainly extracted from open-cast mining in close vicinity to the manufacturing site. Natural gypsum is calcinated to stucco prior to the mixing with other components. Board liner for the covering of gypsum core is produced from recycled waste paper.

A2, transport to the manufacturer

Natural gypsum is extracted from mines close to the manufacturing sites. Accordingly, transport distances are short and trucks can be used. Further raw materials are supplied by truck from manufacturers within Italy or from neighbouring countries. Only some exceptional additives are delivered from overseas via container ship and truck to the manufacturing plant.

A3, manufacturing

The module includes the manufacture of product. Stucco and additives are suspended in water and spread on a continuous sheet of board liner (visible face, lower layer). Beforehand, the board liner is cut at the sides for edge shaping. The slurry is covered with a second sheet of board liner (back surface) in the forming station and the edges of the visible face board liner are flipped upwards. On the subsequent board line the gypsum sets continuously and the boards are dried in a multi-level drier to the permitted residual moisture level. Drying is followed by the cutting of the boards to the desired lengths. Finally, gypsum boards are piled up on bearers or reusable pallets. Apart from the reusable pallets, all other packaging materials are externally recycled/disposed of (external recycling is beyond the applied system boundaries). When recycled materials are being used, such as post-consumer recycled cardboard, burdens associated with the collection, processing and transport of these materials were included in the assessment.

Construction process stage, A4-A5

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

A4, transport to the building site
The Table 4 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO 4, EURO 5 and EURO 6 articulated trucks has been accounted for, based on the sale figures in Italy and Europe in the reference year. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed.

Table 4 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck 16-32 tons. EURO4, EURO5, EURO 6. Boat, freight ship
Distanceto central warehouse	356 km weighted average by truck to all markets 46 km weighted average by boat to all markets
Distance to construction site	16 km
Fuel/energy consumption	0.04L diesel fuel per tkm (truck) 0.0002L diesel fuel per tkm (boat)
Capacity utilization	70%
Bulk density of transported products	700 kg/m^3

A5, installation into the building
The plasterboard is considered installed when it is attached in its designated place in the building. The accompanying Table 5 quantifies the parameters for installing the product at the building site. All installation materials and their waste processing and packaging waste of plasterboards are included.

Table 5 - Parameters for installing the product at the building site.

Parameter	Value (expressed per functional/declared unit)
Ancillary materials for installation(specified by materials)	Jointing compound: 0.350 kg Jointing tape: 0.00065 kg (1.5 m) Screw: 0.013 kg
Water use	0.00165 m^3
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Knauf GKI 12.5 mm (0.525 kg) Jointing compound: 0.0175 kg Bearers: 34.40 g (waste from packaging) Polyethylene film: 1.24 g (waste from packaging)
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Knauf GKI 12.5 mm (0.425 kg) Jointing compound: 0.0175 kg to landfill Bearers: 34.40 g to landfill and to energy recovery Polyethylene film: 1.24 g to landfill and to energy recovery

Use stage (excluding potential savings), B1-B7

Description of the stage
The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information
The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf GKI plasterboard is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
Deconstruction includes dismantling or demolition of the product from the construction.
No on-site sorting of the materials occurs.
C2, transport to waste processing
Once the product is uninstalled, the construction mixed waste is transported for 40 km to the landfill disposal.
C3, waste processing for reuse, recovery and/or recycling
Since there is no waste processing at the end of life, modules C3 and D (expressed as net impacts and benefits) are not applicable.
C4, disposal
Product residues (e.g. plasterboard scraps, jointing tapes, jointing compound) are considered to be deposited in a landfill.

Table 6 - End-of-life stage.

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	8.5 kg collected and transported by truck for landfill
C2) Assumption for scenario development (e.g. transportation)	Diesel consumption 0.04L per tkm; 40 km from demolition site to waste handle
C3) Recovery system specified by type	None
C4) Disposal specified by type	100% of waste is landfilled

6. LCA RESULTS

In following tables the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 2.5 May 2015) and those indicated in PCR 2012:01 version 2.3 for Construction Products and construction services. For clarity, the results are reported subdivided by panel's thickness. The LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. CML 2001 has been used as the impact model.

7. LCA RESULTS INTERPRETATION

The following interpretation of results is given for the Knauf GKI 12.5mm plasterboard. Product stage (modules A1-A3) is responsible for the biggest share of the environmental impact for most indicators (from 63% to 98%) except abiotic depletion potential for non-fossil resources 57%, radioactive waste disposed 38% and non-hazardous waste disposed 2%.
The distribution of finished product (transport in module A4) influence the LCA results with a medium percentage of 15%, except for global warming potential -biogenic 3%, global warming potential- land use 2%, non-hazardous waste disposed 4% and hazardous waste disposed 3%, abiotic depletion potential for non-fossil resources 33% and radioactive waste disposed 47%. By contrast, transports in modules A2 and C2 contribute only 8% at maximum.
The installation phase (module A5) has a negligible contribution to the impact categories, less than 6% (except for the global warming potential-biogenic origin where it contributes up to a maximum of 33%). With regard to total energy consumption, the product stage (modules A1 – A3) has the highest contribution to this indicator, with a maximum percentage of 93%. Energy consumption for drying phase of the plasterboards is the main contributor to this indicator.
The same trend of results is related to the use of fresh water, where A1 – A3 modules are the main responsible of impacts, with a contribution of 81%.
The effect of disposal life cycle stage has little effect (less than 7%) on life cycle impacts, except for non-hazardous waste where the contribution of plasterboard disposal (module C4) to the overall results is 91%.

ADDITIONAL INFORMATION

Greenhouse gas emission from the use of electricity in the manufacturing phase

Electricity used in the manufacturing processes has been accounted for using the electricity mix (22.96% Renewables, 16.04% coal, 51.62% natural gas, 0.68% oil, 4.76% nuclear, 3.93% other sources) from energy supplier (for the year 2018):

Greenhouse gas emissions: 0.141 kg CO_2 eq/MJ

Table 7 - LCA results of potential environmental impact referred to the declared unit.

GKI 12.5 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**					**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	**D Reuse, recovery, recycling**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	2.27E+00	5.39E-01	6.67E-02	-	-	-	-	-	-	-	2.82E-02	2.95E-02	0	4.54E-02	-	2.98E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.26E+00	5.38E-01	6.53E-02	-	-	-	-	-	-	-	2.82E-02	2.95E-02	0	4.54E-02	-	2.96E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.48E-03	1.20E-04	1.31E-03	-	-	-	-	-	-	-	2.85E-06	7.56E-06	0	2.21E-05	-	3.94E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	1.01E-02	1.56E-04	3.29E-05	-	-	-	-	-	-	-	2.52E-06	6.34E-06	0	2.03E-05	-	1.03E-02
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	3.96E-07	9.99E-08	5.55E-09	-	-	-	-	-	-	-	5.07E-09	5.85E-09	0	1.50E-08	-	5.27E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	6.40E-03	1.80E-03	3.39E-04	-	-	-	-	-	-	-	2.72E-04	1.64E-04	0	3.87E-04	-	9.36E-03
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	1.08E-03	2.54E-04	5.20E-05	-	-	-	-	-	-	-	4.59E-05	2.64E-05	0	5.76E-05	-	1.52E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	2.85E-04	8.67E-05	2.28E-05	-	-	-	-	-	-	-	5.63E-06	5.03E-06	0	1.65E-05	-	4.22E-04
Photochemical ozone creation = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	2.80E-06	1.64E-06	3.29E-07	-	-	-	-	-	-	-	9.44E-09	5.74E-08	0	5.19E-08	-	4.89E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	3.36E+01	8.11E+00	7.72E-01	-	-	-	-	-	-	-	4.06E-01	4.66E-01	0	1.28E+00	-	4.46E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

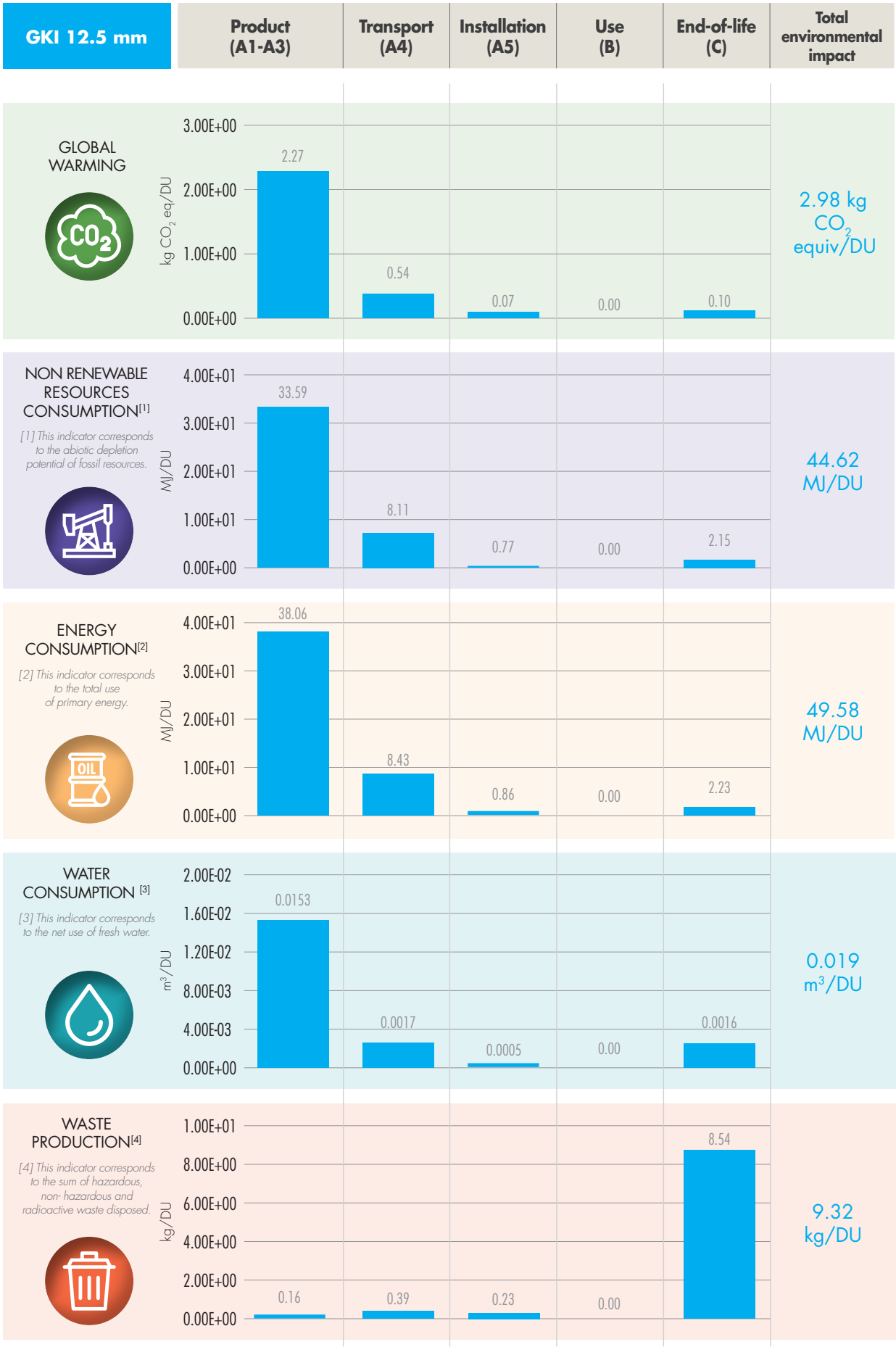
Table 8 - LCA results of use of resources referred to the declared unit.

GKI 12.5 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.97E+00	1.22E-01	4.57E-02	-	-	-	-	-	-	-	2.37E-03	8.37E-03	0	3.32E-02	-	3.18E+00
Use of renewable primary energy used as raw materials MJ/DU	5.21E-04	3.20E-05	1.32E-05	-	-	-	-	-	-	-	4.92E-07	1.98E-06	0	1.60E-05	-	5.85E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.97E+00	1.22E-01	4.58E-02	-	-	-	-	-	-	-	2.37E-03	8.38E-03	0	3.32E-02	-	3.18E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	3.51E+01	8.31E+00	8.13E-01	-	-	-	-	-	-	-	4.10E-01	4.80E-01	0	1.30E+00	-	4.64E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	3.51E+01	8.31E+00	8.13E01	-	-	-	-	-	-	-	4.10E-01	4.80E-01	0	1.30E+00	-	4.64E+01
Use of secondary material kg/DU	3.14E01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	3.14E01
Use of renewable secondary fuels- MJ/FU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m3/DU	1.53E-02	1.71E-03	4.88E04	-	-	-	-	-	-	-	6.25E-05	1.10E-04	0	1.45E-03	-	1.92E-02

Table 9 - LCA results of use of resources referred to the declared unit.

GKI 12.5 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.25E-04	4.87E-06	2.37E-06	-	-	-	-	-	-	-	1.83E-07	2.43E-07	0	9.14E-07	-	1.33E-04
Non-hazardous (excluding inert) waste disposed kg/DU	1.60E-01	3.95E-01	2.29E-01	-	-	-	-	-	-	-	4.44E-04	4.14E-02	0	8.50E+00	-	9.32E+00
Radioactive waste disposed kg/DU	4.54E-05	5.70E-05	2.45E-06	-	-	-	-	-	-	-	2.84E-06	3.38E-06	0	8.46E-06	-	1.20E-04

The image below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of Knauf GKI 12.5 mm plasterboard.



8. REFERENCES

CML2001
Life cycle assessment – an operational guideline to the ISO standards, Hrsg. Guinée, J. B., Ministry of Housing, Spatial Planning and the Environment and Centre of Environmental Science – Leiden University, Leiden (NL), 2001

General principles
EPD International (2015) General Programme Instructions for the International EPD® System. Version 2.5.

LCA study
Life Cycle Assessment delle lastre in cartongesso GKB®, GKI, GKF, A-ZERO, F-ZERO, DIAMANT, KASA, FLEXILASTRA®, prodotti da Knauf di Knauf S.r.l. S.a.s. Castellina Marittima (PI), Italia (18/03/2020, Rev. 02)

PCR
PCR 2012:01 version 2.3 for Construction Products and construction services.
IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä. Swedish Wood Preservation Institute, Swedisol, SCDA. Svenskt Limträ AB. SSAB (2018).

Standards:

EN 15804:2014. Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

ISO 14025:2011-10. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

BS:OHSAS 18001:2007- ISO 45001:2018. Occupational Health and Safety Management

ISO 14001:2015. Environmental management systems - Requirements with guidance for use

ISO 9001:2015. Quality management systems - Requirements

ISO 14040:2006. Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2018. Environmental management - Life cycle assessment - Requirements and guidelines

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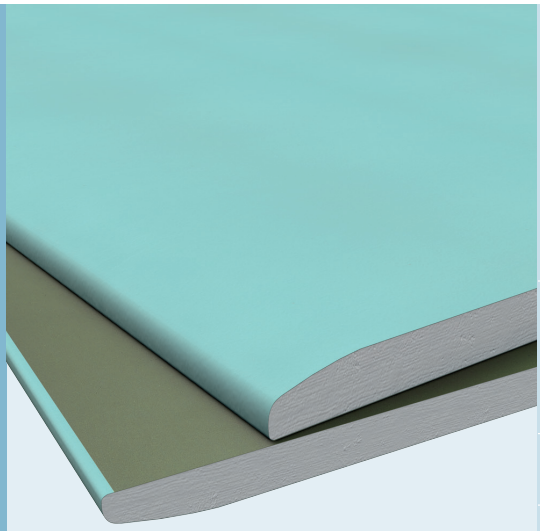
For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Castellina Marittima manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo s.r.l., spin off company of the Scuola Superiore Sant'Anna, coordinated by Prof. Francesco Testa.



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05/2020

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

VALIDATION IN COMPLIANCE

WITH THE REQUIREMENTS GENERAL PROGRAMME INSTRUCTIONS FOR EPD V. 3.0

63

Laura Severino
Sustainability & Food Certification Compliance, Head

RINA Services S.p.A.

Genoa, 22/4/2020

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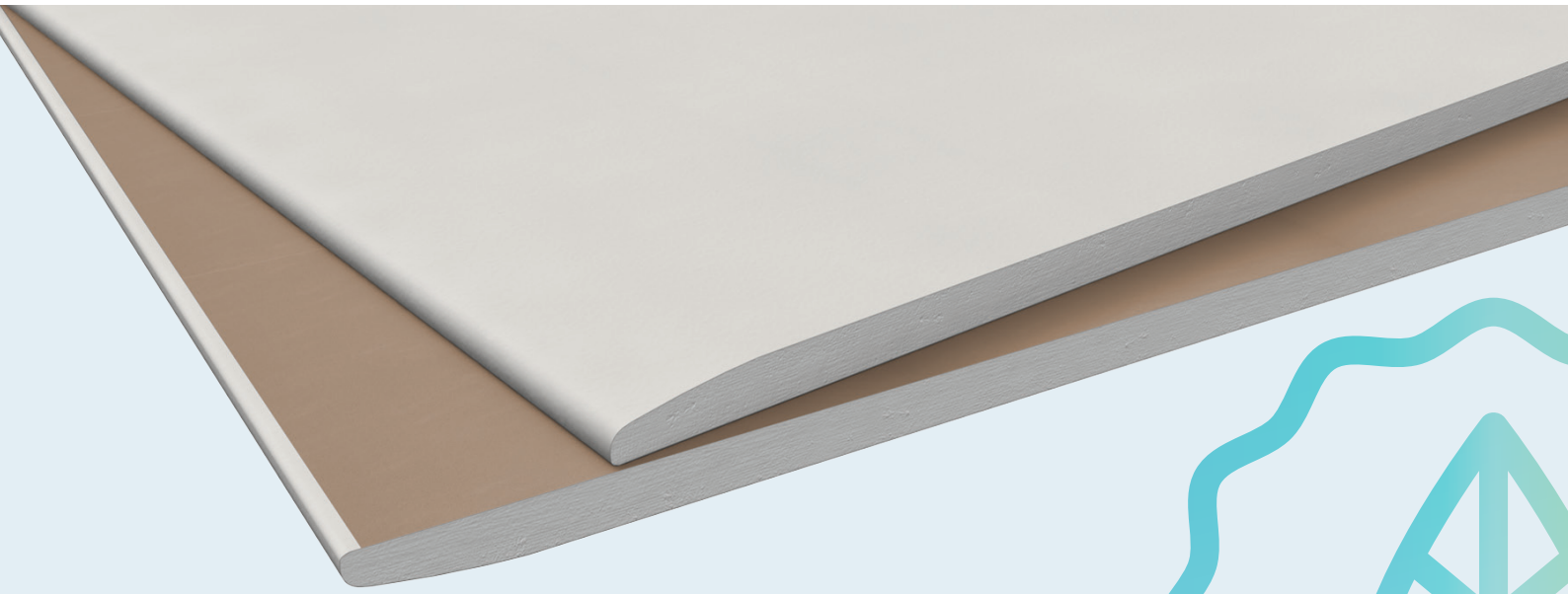
ECO EPD 00001143

N° VERIFICATION : S-P-01933

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804 for:
9.5 mm, 12.5 mm, 15 mm Plasterboard Knauf GKB®



> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-01933

> **Publication date:**
2020/05/06

> **Valid until:**
2025/04/22

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s. - Via Livornese, 20
56040 Castellina Marittima (PI), Italy

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com
EPD registration number/declaration number: S-P-01933
Product / product family name and manufacturer represented: GKB® plasterboard, manufactured by Knauf di Knauf S.r.l. S.a.s.
Product description and use: GKB® plasterboard is made up of a gypsum core (calcium sulphate dihydrate) with additive and a paper liner. GKB® plasterboard is designed for use in the residential sector.
Declaration issued: 2020/04/22
Valid until: 2025/04/22
Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Via Livornese 20, 56040 Castellina Marittima (PI), Italy. Tel. 050 69211 - Fax 050 692301, knauf@knauf.it.
EPD prepared by: Ergo s.r.l, www.ergosrl.net
Scope: The LCA is based on 2018 production data for Castellina Marittima manufacturing site in Italy for 9.5 mm, 12.5 mm, 15 mm GKB®. This EPD covers information modules A1 to C4 (cradle to gate with option) as defined in EN 15804:2014 for GKB® sold and used in Europe. The use stage (B1-B7) was not considered in this study.
Functional unit/declared unit: The declared unit (DU) is 1 m^2 of gypsum-based plasterboard.

CEN standard EN 15804 served as the core PCR[a]	
PCR:	PCR 2012:01 Construction products and construction services, Version 2.3.
Product group classification:	The UN CPC code of the product is 314 Boards and panels.
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A.Via Corsica 12, Genova -Italy, Tel +39 010-5385306, www.rina.org ACCREDIA Registration number:001H REV. 17
Accredited or approved by:	The International EPD® System

[a]*Product Category Rules*

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 150 production facilities and sales organizations in over 86 countries, 27,500 employees worldwide, and sales of 6.5 billion Euro (in 2016), the Knauf Group is without doubt one of the big players on the market – in Europe, the USA, South America, Russia, Asia, Africa, and Australia.
The company's headquarter in Italy is in Castellina Marittima (Pisa). Currently, the Castellina Marittima plant has a global area of 90,000 square meters, covers an area of 30,000 square meters and owns more than 100 hectares of quarries. The products manufactured in Knauf plant in Castellina Marittima are plasterboard, steel profiles required for the implementation of the plasterboards, ceilings, stucco and impregnators.

3. PRODUCT INFORMATION

3.1 Product description

Knauf GKB® plasterboard is a standard gypsum board consisting of an aerated gypsum core encased in and firmly bonded to strong paper liners. GKB® plasterboards are used in all areas of interior construction especially for partition walls, counterwalls on metal or direct-tackle structure, countertops and velettes. GKB® plasterboard is available in sizes 9.5 mm, 12.5 mm, 15 mm and 18 mm; this EPD applies only to 9.5 mm, 12.5 mm and 15 mm sizes.

3.2 Technical data

Technical data referred to Knauf GKB® plasterboard are given in Table 1.

Table 1 - Technical information.

Product identification	DIN 18180 GKB UNI EN 520 A
Nominal density	The assumed density is 680 kg/m³ of GKB® 9.5 mm, 667 kg/m³ of GKB® 12.5 mm and 885 kg/m³ of GKB® 15 mm.
Thermal conductivity	0.20 W/mk
Class of reaction to fire performance (accordingto EN 13501:1)	Building material class: A2 Burning droplets: s1 Smoke gas development: d0

3.3 Delivery Status

The EPD refers to 9.5 mm, 12.5 mm and 15 mm thick Knauf GKB® plasterboard.

3.4 Base materials / Ancillary materials

Plasterboards covered by this EPD are made from:
- gypsum: up to 96%
- cardboard: up to 3%
- additives (including starch, glass fibers and foaming agent, additive for core cohesion): less than 1%

Knauf GKB® plasterboards do not contain SVHC (Substances of Very High Concern).
No additives used are classed as substances of concern; substances are not listed specifically to protect proprietary information.

3.5 Packaging

Plasterboards Knauf GKB® are piled up on bearers and are protected against damage by strapping tape (polyethylene). Packing materials are externally recovered/disposed of.

3.6 Recycled material

Board liner for the covering of gypsum core is produced from 100% recycled waste paper and is supplied by truck from the German and Spanish manufacturing sites. The GKB® manufacturing process uses a part of recovered gypsum derived from production wastes and dust from the filtration plants.

3.7 Re-use phase

Once plasterboards Knauf GKB® are installed, they are not suited for re-use in an unchanged way. Prior to collection, plasterboards Knauf GKB® should be separated from other used building materials.

3.8 Disposal

Knauf GKB® plasterboards have to be disposed of in compliance with the following waste codes of the European Waste Catalogue /EWC/:17 08 02 gypsum-based construction materials.

3.9 Further information

Further information can be found through the enquiry desk:
+39 050 69211
E- mail: knauf@knauf.it | www.knauf.it

3.10 Manufacture

Knauf GKB® plasterboard is manufactured using a continuous production process, showed in the Figure 1 below:

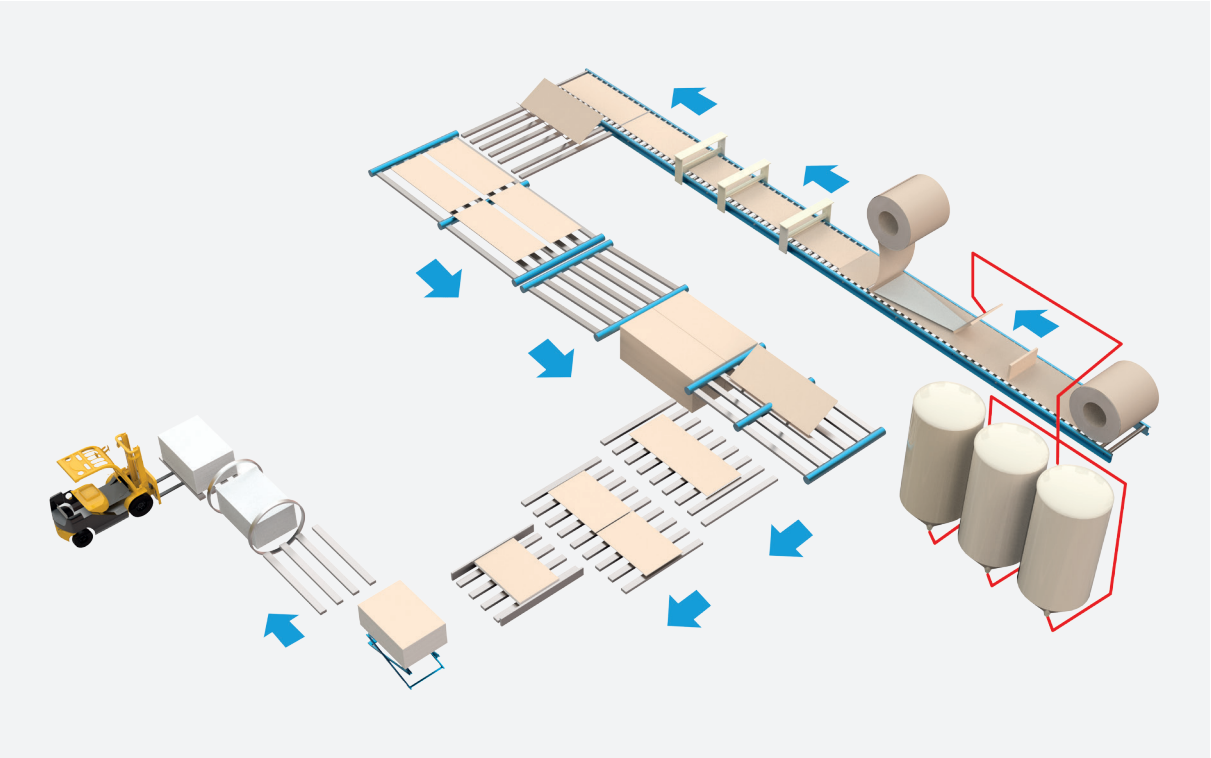


Figure 1 - Gypsum board manufacturing process.

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

3.11 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free. A target of zero accidents at work for employees, visitors and contractors is set by the business.
In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured. To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 18001 certified systems.

4. LCA INFORMATION

Figure 2 shows a flow diagram of the system under study. The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'. In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4). Accordingly, the EPD is a cradle-to-gate declaration with options.

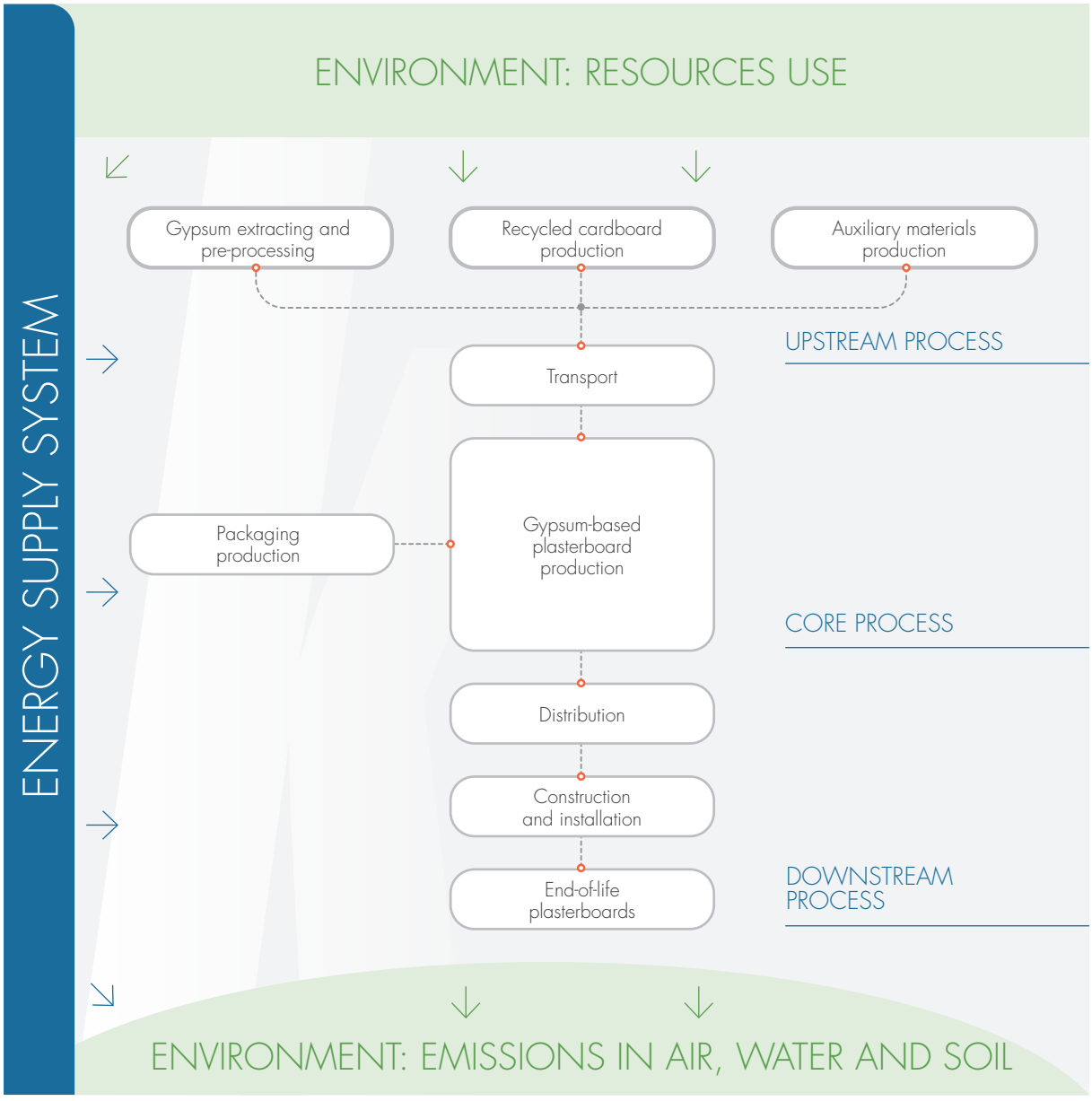


Figure 2 - Flow diagram of system boundary under assessment

The system boundaries in tabular form for all modules are shown in the Table 2 below.

Table 2 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 3.

Table 3 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 m^2 of gypsum-based plasterboard. Weights of finished gypsum-based boards: GKB® 9.5 mm: approx. 6.5 kg/m^2 GKB® 12.5 mm: approx. 8.5 kg/m^2 GKB® 15 mm: approx. 13.3 kg/m^2
5.2	**System boundaries**	Cradle to gate with option: A1-A3,A4,A5,C1-C4.
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts.The GKB® product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance,repair,replacement or refurbishment throughout this period. For the production of additives and packaging materials (and their disposal), generic data have been used, since their mass flow in relation to the declared unit is limited. Furthermore, these materials are common to the different plasterboard systems (and gypsum sources) under assessment. Since there is no waste processing at the end of life, modules C3 and D are not applicable. The declared plasterboards are typically disposed of as construction waste which is declared in module C4.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2014 Clause 6.3.5. In compliance with these criteria, the infrastructure of the manufacturing site, small parts of the packaging and personnel related activities (travel, office operations and supplies) are excluded from the study.

5.5	**Background data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Castellina Marittima plant. All secondary data was retrieved using SIMAPRO 9 software, with Ecoinvent 3.5 Database.
5.6	**Data quality**	Primary data refer to 2018 and have been collected at Knauf S.r.l. S.a.s. plant located in Castellina Marittima (IT), whereas selected generic data have been retrieved from Ecoinvent 3.5 database and using the most updated datasets and – as far as possible- those representative for at least 5 years into the future. Moreover, as required by the General Programme Instructions, the environmental impacts associated to proxy data do not exceed 10% of the overall environmental impact from the product system. The energy mix of Knauf di Knauf S.r.l. S.a.s. Castellina Marittima plant is characterized by 61% of electricity self-produced by cogeneration and 39% by electricity purchased from an external energy company. The energy-related data from the energy supplier refer to the supplier energy mix, whereas for the production of raw materials a European energy mix has been accounted for.
5.7	**Period under review**	The data is representative of the manufacturing processes of 2018.
5.8	**Allocations**	Allocations were avoided in the calculation model.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries

This EPD evaluates the environmental impacts of 1 m^2 of gypsum based plasterboard from cradle to gate with options. Within the Life Cycle Assessment of the declared boards, the following processes are considered:

Product stage, A1-A3

Description of the stage

The product stage of the plasterboard products is subdivided into three modules; A1, A2 and A3 respectively "raw material supply", "transport" and "manufacturing".

A1, raw material supply

This includes raw material extraction and processing and energy production. The declared Knauf gypsum boards consist of a gypsum core, which also contains additives for easier processing and/or a fine adjustment of the respective properties of the individual boards. The natural gypsum is mainly extracted from open-cast mining in close vicinity to the manufacturing site. Natural gypsum is calcinated to stucco prior to the mixing with other components. Board liner for the covering of gypsum core is produced from recycled waste paper.

A2, transport to the manufacturer

Natural gypsum is extracted from mines close to the manufacturing sites. Accordingly, transport distances are short and trucks can be used. Further raw materials are supplied by truck from manufacturers within Italy or from neighbouring countries. Only some exceptional additives are delivered from overseas via container ship and truck to the manufacturing plant.

A3, manufacturing

The module includes the manufacture of product. Stucco and additives are suspended in water and spread on a continuous sheet of board liner (visible face, lower layer). Beforehand, the board liner is cut at the sides for edge shaping. The slurry is covered with a second sheet of board liner (back surface) in the forming station and the edges of the visible face board liner are flipped upwards. On the subsequent board line the gypsum sets continuously and the boards are dried in a multi-level drier to the permitted residual moisture level. Drying is followed by the cutting of the boards to the desired lengths. Finally, gypsum boards are piled up on bearers or reusable pallets. Apart from the reusable pallets, all other packaging materials are externally recycled/disposed of (external recycling is beyond the applied system boundaries). When recycled materials are being used, such as post-consumer recycled cardboard, burdens associated with the collection, processing and transport of these materials were included in the assessment.

Construction process stage, A4-A5

Description of the stage

The construction process is divided into 2 modules: A4, transport to the building site and A5, installation into the building.

A4, transport to the building site

The Table 4 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO 4, EURO 5 and EURO 6 articulated trucks has been accounted for, based on the sale figures in Italy and Europe in the reference year. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed.

Table 4 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck 16-32 tons. EURO 4, EURO 5, EURO 6. Boat, freight ship
Distanceto central warehouse	356 km weighted average by truck to all markets 67 km weighted average by boat to all markets
Distance to construction site	15-34 km
Fuel/energy consumption	0.04L diesel fuel per tkm (truck) 0.0002L diesel fuel per tkm (boat)
Capacity utilization	70%
Bulk density of transported products	667-885 kg/m^3

A5, installation into the building

The plasterboard is considered installed when it is attached in its designated place in the building. The accompanying Table 5 quantifies the parameters for installing the product at the building site. All installation materials and their waste processing and packaging waste of plasterboards are included.

Table 5 - Parameters for installing the product at the building site.

Parameter	Value (expressed per functional/declared unit)
Ancillary materials for installation(specified by materials)	Jointing compound: 0.350 kg Jointing tape: 0.00065 kg (1.5 m) Screw: 0.013 kg
Water use	0.00165 m^3
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Knauf GKB® 9.5 mm (0.325 kg), Knauf GKB® 12.5 mm (0.325 kg), Knauf GKB® 15 mm (0.665 kg) Jointing compound: 0.0175 kg Bearers: 34.40 g (waste from packaging) Polyethylenefilm: 1.24 g (waste from packaging)
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Knauf GKB® 9.5 mm (0.325 kg), Knauf GKB® 12.5 mm (0.325 kg), Knauf GKB® 15 mm (0.665 kg) Jointing compound: 0.0175 kg to landfill Bearers: 34.40 g to landfill and to energy recovery Polyethylene film: 1.24 g to landfill and to energy recovery

Use stage (excluding potential savings), B1-B7

Description of the stage

The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information

The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf GKB® plasterboard is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
Deconstruction includes dismantling or demolition of the product from the construction.
No on-site sorting of the materials occurs.
C2, transport to waste processing
Once the product is uninstalled, the construction mixed waste is transported for 40 km to the landfill disposal.
C3, waste processing for reuse, recovery and/or recycling
Since there is no waste processing at the end of life, modules C3 and D (expressed as net impacts and benefits) are not applicable.
C4, disposal
Product residues (e.g. plasterboard scraps, jointing tapes, jointing compound) are considered to be deposited in a landfill.

Table 6 - End-of-life stage.

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	6.5 kg (GKB® 9.5 mm), 8.5 kg (GKB® 12.5 mm) and 13.3 kg (GKB® 15 mm) collected and transported by truck for landfill
C2) Assumption for scenario development (e.g. transportation)	Diesel consumption 0.04L per tkm; 40 km from demolition site to waste handle
C3) Recovery system specified by type	None
C4) Disposal specified by type	100% of waste is landfilled

6. LCA RESULTS

In following tables the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 2.5 May 2015) and those indicated in PCR 2012:01 version 2.3 for Construction Products and construction services. For clarity, the results are reported subdivided by panel's thickness. The LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. CML 2001 has been used as the impact model.

7. LCA RESULTS INTERPRETATION

The following interpretation of results is given in detail exemplarily for the Knauf GKB® 9,5mm plasterboard. Nevertheless, the statements in general are also valid for the other two board types with different thickness, declared in this EPD.
Product stage (modules A1-A3) is responsible for the biggest share of the environmental impact for most indicators (from 57% to 97%) except abiotic depletion potential for non-fossil resources 54%, radioactive waste disposed 39% and non-hazardous waste disposed 2%.
The distribution of finished product (transport in module A4) influence the LCA results with a medium percentage of 16%, except for global warming potential-biogenic 3%, global warming potential-land use 3%, non-hazardous waste disposed 4% and hazardous waste disposed 3%, abiotic depletion potential for non-fossil resources 35% and radioactive waste disposed 46%. By contrast, transports in modules A2 and C2 contribute only 7% at maximum.
The installation phase (module A5) has a negligible contribution to the impact categories, less than 5% (except for the global warming potential-biogenic origin where it contributes up to a maximum of 39%). With regard to total energy consumption, the product stage (modules A1 – A3) has the highest contribution to this indicator, with a maximum percentage of 94%. Energy consumption for drying phase of the plasterboards is the main contributor to this indicator.
The same trend of results is related to the use of fresh water, where A1 – A3 modules are the main responsible of impacts, with a contribution of 78%.
The effect of disposal life cycle stage has little effect (less than 8%) on life cycle impacts, except for non-hazardous waste where the contribution of plasterboard disposal (module C4) to the overall results is 91%.

ADDITIONAL INFORMATION

Greenhouse gas emission from the use of electricity in the manufacturing phase

Electricity used in the manufacturing processes has been accounted for using the electricity mix (22.96% renewables, 16.04% coal, 51.62% natural gas, 0.68% oil, 4.76% nuclear, 3.93% other sources) from energy supplier (for the year 2018):

Greenhouse gas emissions: 0.141 kg CO_2 eq/MJ

Table 7 - LCA results of potential environmental impact referred to the declared unit.

GKB® 9.5 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**	**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**		
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	1.73E+00	4.18E-01	6.59E-02	-	-	-	-	-	-	-	2.15E-02	2.26E-02	0	3.47E-02	-	2.29E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	1.72E+00	4.18E-01	6.45E-02	-	-	-	-	-	-	-	2.15E-02	2.25E-02	0	3.47E-02	-	2.29E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	1.92E-03	9.41E-05	1.31E-03	-	-	-	-	-	-	-	2.18E-06	5.78E-06	0	1.69E-05	-	3.35E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	5.20E-03	1.22E-04	3.25E-05	-	-	-	-	-	-	-	1.92E-06	4.85E-06	0	1.55E-05	-	5.38E-03
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	2.76E-07	7.74E-08	5.38E-09	-	-	-	-	-	-	-	3.88E-09	4.47E-09	0	1.15E-08	-	3.79E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	5.05E-03	1.48E-03	3.34E-04	-	-	-	-	-	-	-	2.08E-04	1.26E-04	0	2.96E-04	-	7.50E-03
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	8.95E-04	2.04E-04	5.12E-05	-	-	-	-	-	-	-	3.51E-05	2.02E-05	0	4.41E-05	-	1.25E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	2.18E-04	6.98E-05	2.26E-05	-	-	-	-	-	-	-	4.31E-06	3.85E-06	0	1.26E-05	-	3.32E-04
Photochemical ozone creation potential= Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	1.96E-06	1.26E-06	3.28E-07	-	-	-	-	-	-	-	7.22E-09	4.39E-08	0	3.97E-08	-	3.64E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	2.56E+01	6.29E+00	7.57E-01	-	-	-	-	-	-	-	3.11E-01	3.56E-01	0	9.76E-01	-	3.42E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

Table 8 - LCA results of potential environmental impact referred to the declared unit.

GKB® 12.5 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**					**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	**D Reuse, recovery, recycling**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	2.01E+00	5.56E-01	6.59E-02	-	-	-	-	-	-	-	2.82E-02	2.95E-02	0	4.54E-02	-	2.74E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	2.00E+00	5.55E-01	6.45E-02	-	-	-	-	-	-	-	2.82E-02	2.95E-02	0	4.54E-02	-	2.73E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.01E-03	1.25E-04	1.31E-03	-	-	-	-	-	-	-	2.85E-06	7.56E-06	0	2.21E-05	-	3.48E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	9.16E-03	1.62E-04	3.25E-05	-	-	-	-	-	-	-	2.52E-06	6.34E-06	0	2.03E-05	-	9.38E-03
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	3.25E-07	1.03E-07	5.38E-09	-	-	-	-	-	-	-	5.07E-09	5.85E-09	0	1.50E-08	-	4.60E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	5.71E-03	1.90E-03	3.34E-04	-	-	-	-	-	-	-	2.72E-04	1.64E-04	0	3.87E-04	-	8.77E-03
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	9.85E-04	2.65E-04	5.12E-05	-	-	-	-	-	-	-	4.59E-05	2.64E-05	0	5.76E-05	-	1.43E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	2.45E-04	9.07E-05	2.26E-05	-	-	-	-	-	-	-	5.63E-06	5.03E-06	0	1.65E-05	-	3.85E-04
Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	2.31E-06	1.69E-06	3.28E-07	-	-	-	-	-	-	-	9.44E-09	5.74E-08	0	5.19E-08	-	4.44E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	2.97E+01	8.37E+00	7.57E-01	-	-	-	-	-	-	-	4.06E-01	4.66E-01	0	1.28E+00	-	4.09E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

Table 9 - LCA results of potential environmental impact referred to the declared unit.

GKB® 15 mm - ENVIRONMENTAL IMPACTS																
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**					**TOTAL**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	**D Reuse, recovery, recycling**	
Global Warming Potential (GWP) TOT - kg CO_2 eq./DU	3.16E+00	8.93E-01	6.85E-02	-	-	-	-	-	-	-	4.41E-02	4.62E-02	0	7.11E-02	-	4.28E+00
Global Warming Potential= Potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Global Warming' covers three sub-categories: fossil, biogenic, land use and land use change.																
Global Warming Potential (GWP) Fossil - kg CO_2 eq./DU	3.15E+00	8.92E-01	6.72E-02	-	-	-	-	-	-	-	4.41E-02	4.61E-02	0	7.10E-02	-	4.27E+00
GWP-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).																
Global Warming Potential (GWP) biogenic - kg CO_2 eq./DU	2.16E-03	1.98E-04	1.32E-03	-	-	-	-	-	-	-	4.46E-06	1.18E-05	0	3.46E-05	-	3.72E-03
GWP-biogenic covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth - i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.																
Global Warming Potential (GWP) Land use - kg CO_2 eq./DU	5.31E-03	2.57E-04	3.38E-05	-	-	-	-	-	-	-	3.94E-06	9.92E-06	0	3.17E-05	-	5.64E-03
GWP-land use and land use change accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).																
Ozone Depletion Potential (ODP) - kg CFC11 eq./DU	5.43E-07	1.66E-07	5.95E-09	-	-	-	-	-	-	-	7.94E-09	9.15E-09	0	2.35E-08	-	7.55E-07
Ozone Depletion Potential= Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.																
Acidification Potential (AP) - kg SO_2 eq./DU	7.44E-03	2.86E-03	3.51E-04	-	-	-	-	-	-	-	4.25E-04	2.57E-04	0	6.06E-04	-	1.19E-02
Acidification Potential = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.																
Eutrophication Potential (EP) - kg PO_4^{3-} eq./DU	1.18E-03	4.12E-04	5.39E-05	-	-	-	-	-	-	-	7.18E-05	4.13E-05	0	9.02E-05	-	1.85E-03
Eutrophication potential = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.																
Photochemical Ozone Creation (POCP)- kg C_2H_4 eq./DU	3.43E-04	1.40E-04	2.33E-05	-	-	-	-	-	-	-	8.82E-06	7.87E-06	0	2.58E-05	-	5.49E-04
Photochemical ozone creation potential = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.																
Abiotic depletion potential for non-fossil resources (elements) kg Sb eq./DU	2.71E-06	2.74E-06	3.33E-07	-	-	-	-	-	-	-	1.48E-08	8.99E-08	0	8.12E-08	-	5.97E-06
Abiotic depletion potential for non-fossil resources (ADP-elements)/ = Consumption of non-renewable resources, thereby lowering their availability for future generations.																
Abiotic depletion potential for fossil resources (ADP-fossil fuels) MJ, net calorific value/DU	4.78E+01	1.35E+01	8.09E-01	-	-	-	-	-	-	-	6.36E-01	7.29E-01	0	2.00E+00	-	6.55E+01
Abiotic depletion potential for fossil resources (ADP-fossil fuels) =Consumption of non-renewable resources, thereby lowering their availability for future generations.																

Table 10 - LCA results of use of resources referred to the declared unit.

GKB® 9.5 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.63E+00	9.54E-02	4.53E-02	-	-	-	-	-	-	-	1.81E-03	6.40E-03	0	2.54E-02	-	2.81E+00
Use of renewable primary energy used as raw materials MJ/DU	4.56E-04	2.48E-05	1.31E-05	-	-	-	-	-	-	-	3.76E-07	1.52E-06	0	1.22E-05	-	5.08E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.63E+00	9.55E-02	4.53E-02	-	-	-	-	-	-	-	1.81E-03	6.41E-03	0	2.54E-02	-	2.81E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	2.67E+01	6.44E+00	7.97E-01	-	-	-	-	-	-	-	3.13E-01	3.67E-01	0	9.91E-01	-	3.56E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	2.67E+01	6.44E+00	7.97E01	-	-	-	-	-	-	-	3.13E-01	3.67E-01	0	9.91E-01	-	3.56E+01
Use of secondary material kg/DU	3.04E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	3.04E-01
Use of renewable secondary fuels- MJ/FU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m^3/DU	1.08E-02	1.33E-03	4.75E04	-	-	-	-	-	-	-	4.78E-05	8.39E-05	0	1.11E-03	-	1.39E-02

Table 11 - LCA results of use of resources referred to the declared unit.

GKB® 12.5 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.73E+00	1.26E-01	4.53E-02	-	-	-	-	-	-	-	2.37E-03	8.37E-03	0	3.32E-02	-	2.94E+00
Use of renewable primary energy used as raw materials MJ/DU	4.69E-04	3.30E-05	1.31E-05	-	-	-	-	-	-	-	4.92E-07	1.98E-06	0	1.60E-05	-	5.33E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.73E+00	1.26E-01	4.53E-02	-	-	-	-	-	-	-	2.37E-03	8.38E-03	0	3.32E-02	-	2.95E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	3.10E+01	8.57E+00	7.97E-01	-	-	-	-	-	-	-	4.10E-01	4.80E-01	0	1.30E+00	-	4.25E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	3.10E+01	8.57E+00	7.97E01	-	-	-	-	-	-	-	4.10E-01	4.80E-01	0	1.30E+00	-	4.25E+01
Use of secondary material kg/DU	3.04E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	3.04E-01
Use of renewable secondary fuels- MJ/FU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels - MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m^3/DU	1.20E-02	1.76E-03	4.75E04	-	-	-	-	-	-	-	6.25E-05	1.10E-04	0	1.45E-03	-	1.59E-02

Table 12 - LCA results of use of resources referred to the declared unit.

GKB® 15 mm - RESOURCES USE															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	2.88E+00	2.02E-01	4.69E-02	-	-	-	-	-	-	-	3.70E-03	1.31E-02	0	5.20E-02	-	3.19E+00
Use of renewable primary energy used as raw materials MJ/DU	4.81E-04	5.31E-05	1.36E-05	-	-	-	-	-	-	-	7.69E-07	3.10E-06	0	2.50E-05	-	5.77E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	2.88E+00	2.02E-01	4.69E-02	-	-	-	-	-	-	-	3.71E-03	1.31E-02	0	5.20E-02	-	3.19E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	4.93E+01	1.38E+01	8.52E-01	-	-	-	-	-	-	-	6.41E-01	7.51E-01	0	2.03E+00	-	6.73E+01
Use of non-renewable primary energy used as raw materials MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	4.93E+01	1.38E+01	8.52E-01	-	-	-	-	-	-	-	6.41E-01	7.51E-01	0	2.03E+00	-	6.73E+01
Use of secondary material kg/DU	3.04E-01	0	0	-	-	-	-	-	-	-	0	0	0	0	-	3.04E-01
Use of renewable secondary fuels- MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of non-renewable secondary fuels – MJ/DU	0	0	0	-	-	-	-	-	-	-	0	0	0	0	-	0
Use of net fresh water m^3/DU	1.57E-02	2.83E-03	5.21E-04	-	-	-	-	-	-	-	9.78E-05	1.72E-04	0	2.28E-03	-	2.16E-02

Table 13 - LCA results of waste categories referred to the declared unit.

GKB® 9.5 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.10E-04	3.78E-06	2.36E-06	-	-	-	-	-	-	-	1.40E-07	1.86E-07	0	6.99E-07	-	1.17E-04
Non-hazardous (excluding inert) waste disposed kg/DU	1.26E-01	3.03E-01	1.85E-01	-	-	-	-	-	-	-	3.39E-04	3.17E-02	0	6.50E+00	-	7.14E+00
Radioactive waste disposed kg/DU	3.70E-05	4.42E-05	2.36E-06	-	-	-	-	-	-	-	2.17E-06	2.58E-06	0	6.47E-06	-	9.48E-05

Table 14 - LCA results of waste categories referred to the declared unit.

GKB® 12.5 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.17E-04	5.03E-06	2.36E-06	-	-	-	-	-	-	-	1.83E-07	2.43E-07	0	9.14E-07	-	1.26E-04
Non-hazardous (excluding inert) waste disposed kg/DU	1.43E-01	4.06E-01	1.85E-01	-	-	-	-	-	-	-	4.44E-04	4.14E-02	0	8.50E+00	-	9.27E+00
Radioactive waste disposed kg/DU	4.12E-05	5.88E-05	2.36E-06	-	-	-	-	-	-	-	2.84E-06	3.38E-06	0	8.46E-06	-	1.17E-04

Table 15 - LCA results of waste categories referred to the declared unit.

GKB® 15 mm - WASTE CATEGORIES															
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling	TOTAL
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposed kg/DU	1.46E-04	8.08E-06	2.40E-06	-	-	-	-	-	-	-	2.86E-07	3.80E-07	0	1.43E-06	-	1.58E-04
Non-hazardous (excluding inert) waste disposed kg/DU	1.51E-01	6.59E-01	3.34E-01	-	-	-	-	-	-	-	6.95E-04	6.48E-02	0	1.33E+01	-	1.45E+01
Radioactive waste disposed kg/DU	4.75E-05	9.46E-05	2.69E-06	-	-	-	-	-	-	-	4.44E-06	5.28E-06	0	1.32E-05	-	1.68E-04

The images below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of 9.5 mm, 12.5 mm, 15 mm Knauf GKB® plasterboards.

GKB® 9.5 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)	Total environmental impact
GLOBAL WARMING	1.73	0.42	0.07	0.00	0.08	2.29 kg CO_2 equiv/DU
NON RENEWABLE RESOURCES CONSUMPTION[1]	25.55	6.29	0.76	0.00	1.64	34.24 MJ/DU
ENERGY CONSUMPTION[2]	29.34	6.53	0.84	0.00	1.70	38.42 MJ/DU
WATER CONSUMPTION [3]	0.0108	0.0013	0.0005	0.0000	0.0012	0.014 m^3/DU
WASTE PRODUCTION[4]	0.13	0.30	0.18		6.53	7.14 kg/DU

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.

[2] This indicator corresponds to the total use of primary energy.

[3] This indicator corresponds to the net use of fresh water.

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.

GKB® 12.5 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)	Total environmental impact
GLOBAL WARMING	2.01	0.56	0.07	0.00	0.10	2.74 kg CO_2 equiv/DU
NON RENEWABLE RESOURCES CONSUMPTION[1]	29.66	8.37	0.76	0.00	2.15	40.93 MJ/DU
ENERGY CONSUMPTION[2]	33.71	8.69	0.84	0.00	2.23	45.47 MJ/DU
WATER CONSUMPTION [3]	0.0120	0.0018	0.0005	0.0000	0.0016	0.016 m^3/DU
WASTE PRODUCTION[4]	0.14	0.41	0.18	0.00	8.54	9.27 kg/DU

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.

[2] This indicator corresponds to the total use of primary energy.

[3] This indicator corresponds to the net use of fresh water.

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.

GKB® 15 mm	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)	Total environmental impact
GLOBAL WARMING	3.16	0.89	0.07	0.00	0.16	4.28 kg CO_2 equiv/DU
NON RENEWABLE RESOURCES CONSUMPTION[1]	47.84	13.46	0.81	0.00	3.36	65.47 MJ/DU
ENERGY CONSUMPTION[2]	52.18	13.98	0.90	0.00	3.49	70.54 MJ/DU
WATER CONSUMPTION [3]	0.0157	0.0028	0.0005	0.0000	0.0025	0.022 m^3/DU
WASTE PRODUCTION[4]	0.15	0.66	0.33	0.00	13.36	14.50 kg/DU

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.

[2] This indicator corresponds to the total use of primary energy.

[3] This indicator corresponds to the net use of fresh water.

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.

8. REFERENCES

CML2001
Life cycle assessment – an operational guideline to the ISO standards, Hrsg. Guinée, J. B., Ministry of Housing, Spatial Planning and the Environment and Centre of Environmental Science – Leiden University, Leiden (NL), 2001

General principles
EPD International (2015) General Programme Instructions for the International EPD® System. Version 2.5.

LCA study
Life Cycle Assessment delle lastre in cartongesso GKB®, GKI, GKF, A-ZERO, F-ZERO, DIAMANT, KASA, FLEXILASTRA®, prodotti da Knauf di Knauf S.r.l. S.a.s. Castellina Marittima (PI), Italia (18/03/2020, Rev. 02)

PCR
PCR 2012:01 version 2.3 for Construction Products and construction services.
IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä. Swedish Wood Preservation Institute, Swedisol, SCDA. Svenskt Limträ AB. SSAB (2018).

Standards:

EN 15804:2014. Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

ISO 14025:2011-10. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

BS:OHSAS 18001:2007- ISO 45001:2018. Occupational Health and Safety Management

ISO 14001:2015. Environmental management systems - Requirements with guidance for use

ISO 9001:2015. Quality management systems - Requirements

ISO 14040:2006. Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2018. Environmental management - Life cycle assessment - Requirements and guidelines

Contacts for environmental product declaration:
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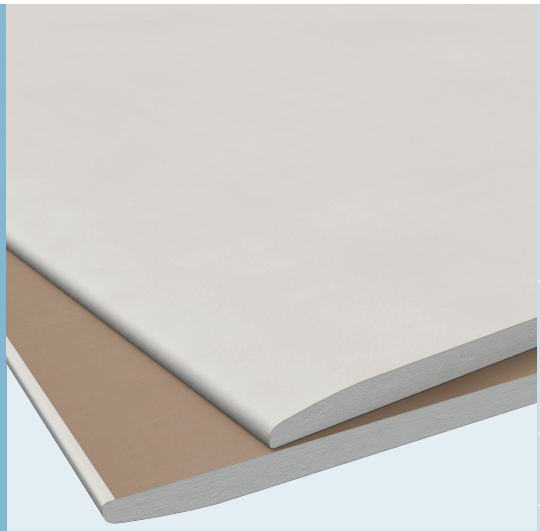
For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Castellina Marittima manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo s.r.l., spin off company of the Scuola Superiore Sant'Anna, coordinated by Prof. Francesco Testa.



Le nostre certificazioni

www.knauf.it

knauf@knauf.it

05/2020

RINA
HEAD OFFICE
Via Corsica, 12
16128 GENOVA

ENVIRONMENTAL PRODUCT DECLARATION (EPD)

VALIDATION IN COMPLIANCE

WITH THE REQUIREMENTS GENERAL PROGRAMME INSTRUCTIONS FOR EPD V. 3.0

63

Laura Severino
Sustainability & Food Certification Compliance, Head

RINA Services S.p.A.

Genoa, 22/4/2020

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ICMQ
Certificazione
di prodotto

CERTIFICAZIONE DI PRODOTTO
PRODUCT CERTIFICATION

CERTIFICATO N° **CERTIFICATE N°**

P235

AZIENDA ***COMPANY***

KNAUF di Knauf S.r.l. s.a.s.

Via Livornese, 20 – 56040 Castellina Marittima (PI)

UNITA' PRODUTTIVA ***PRODUCTION UNIT***

Via Livornese, 20 – 56040 Castellina Marittima (PI)

OGGETTO DEL CERTIFICATO ***SCOPE OF THE CERTIFICATE***

CONTENUTO DI MATERIALE RICICLATO/RECUPERATO/SOTTOPRODOTTO
Content of recycled/recovered/by-product materials

NORME DI RIFERIMENTO ***REFERENCE STANDARDS***

Regolamento Particolare ICMQ per la certificazione di prodotto relativa a prodotti per le costruzioni con percentuale dichiarata di materiale riciclato/recuperato/sottoprodotto - CP DOC 262 rev. 2

Particular rules for recycled/recovered/by-product content of building products certification – CP DOC 262 rev. 2

SISTEMA DI CERTIFICAZIONE ***CERTIFICATION SYSTEM***

Sistema di Certificazione 3 - ISO/IEC 17067
Certification System 3 – ISO/IEC 17067

PRODOTTI ***PRODUCTS***

L'elenco dei prodotti oggetto della certificazione è allegato al presente certificato
The list of the certified products is annexed to this certificate

PRIMA EMISSIONE	EMISSIONE CORRENTE	SCADENZA
First issue	*Current issue*	*Expiry*
31/05/2018	*28/11/2023*	*28/11/2026*

IL PRESIDENTE E DIRETTORE GENERALE
LORENZO ORSENIGO

Allegato al Certificato di Prodotto P235 del 28/11/2023

Annex to the certificate P235 of 28/11/2023

CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO

Minimum content of recycled, recovered, by-product materials

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO *Product name*		MATERIALE RICICLATO *Recycled material* Totale [%]	Pre-consumer [%]	Post-consumer [%]	MATERIALE RECUPERATO *Recovered material* [%]	SOTTO PRODOTTO *By-product material* [%]	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2)] *Total content of Recycled, Recovered, By-product material* [%]
LASTRE IN CARTONGESSO Knauf - Plasterboards	LASTRA KNAUF GKB - 9,5 mm	≥	4,9	0	4,9	n.p.d.	0,2	5,1
	LASTRA KNAUF GKB - 12,5 mm		3,7	0	3,7	n.p.d.	1,4	5,1
	LASTRA KNAUF GKB - 15 mm		2,9	0	2,9	n.p.d.	2,2	5,1
	LASTRA KNAUF GKB Advanced		4,1	0	4,1	n.p.d.	1,0	5,1
	IDROLASTRA KNAUF GKI		3,9	0	3,9	n.p.d.	1,2	5,1
	LASTRA KNAUF DIAMANT		3,5	0	3,5	n.p.d.	1,6	5,1
	IGNILASTRA KNAUF GKF - 12,5 mm		3,1	0	3,1	n.p.d.	2,0	5,1
	IGNILASTRA KNAUF GKF - 15 mm		2,4	0	2,4	n.p.d.	2,7	5,1
	LASTRA KNAUF A-ZERO		2,9	0	2,9	n.p.d.	2,2	5,1
	LASTRA KNAUF F-ZERO - 12,5 mm		2,7	0	2,7	n.p.d.	2,4	5,1
	LASTRA KNAUF F-ZERO - 15 mm		2,0	0	2,0	n.p.d.	3,1	5,1
	LASTRA KNAUF KASA		3,8	0	3,8	n.p.d.	1,3	5,1
ISOLASTRE ADVANCED KNAUF LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	ISOLASTRA ADVANCED PSE-B (LASTRA KNAUF GKB Advanced - 12,5 + polistirene espanso bianco)	≥	6,4	0	6,4	n.p.d.	1,0	7,4
	ISOLASTRA ADVANCED PSE-G (LASTRA KNAUF GKB Advanced - 12,5 + polistirene espanso grafitato)		6,4	0	6,4	n.p.d.	1,0	7,4
	ISOLASTRA ADVANCED PU (LASTRA KNAUF GKB Advanced - 12,5 + poliuretano)		4,8	0	4,8	n.p.d.	1,0	5,8
	ISOLASTRA ADVANCED LM 85 (LASTRA KNAUF GKB Advanced - 12,5 + lana minerale)		27,8	0	27,8	n.p.d.	1,0	28,8
	ISOLASTRA ADVANCED XPS (LASTRA KNAUF GKB Advanced - 12,5 + polistirene estruso)		6,9	0	6,9	n.p.d.	1,0	7,9

Allegato al Certificato di Prodotto P235 del 28/11/2023

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CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO

Minimum content of recycled, recovered, by-product materials

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO *Product name*		MATERIALE RICICLATO *Recycled material*			MATERIALE RECUPERATO *Recovered material*	SOTTO PRODOTTO *By-product material*	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2)] *Total content of Recycled, Recovered, By-product material*
			Totale [%]	Pre-consumer [%]	Post-consumer [%]	[%]	[%]	[%]
ISOLASTRE KNAUF LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	ISOLASTRA PSE-B (LASTRA KNAUF GKB - 9,5 + polistirene espanso bianco)	≥	6,5	0	6,5	n.p.d.	0,2	6,7
	ISOLASTRA PSE-B (LASTRA KNAUF GKB - 12,5 + polistirene espanso bianco)		6,0	0	6,0	n.p.d.	1,4	7,4
	ISOLASTRA PSE-B (IDROLASTRA KNAUF GKI + polistirene espanso bianco)		6,2	0	6,2	n.p.d.	1,2	7,4
	ISOLASTRA PSE-G (LASTRA KNAUF GKB - 9,5 + polistirene espanso grafitato)		6,5	0	6,5	n.p.d.	0,2	6,7
	ISOLASTRA PSE-G (LASTRA KNAUF GKB - 12,5 + polistirene espanso grafitato)		6,0	0	6,0	n.p.d.	1,4	7,4
	ISOLASTRA PSE-G (IDROLASTRA KNAUF GKI + polistirene espanso grafitato)		6,2	0	6,2	n.p.d.	1,2	7,4
	ISOLASTRA PU (LASTRA KNAUF GKB - 9,5 + poliuretano)		5,3	0	5,3	n.p.d.	0,2	5,5
	ISOLASTRA PU (LASTRA KNAUF GKB - 12,5 + poliuretano)		4,4	0	4,4	n.p.d.	1,4	5,8
	ISOLASTRA PU (IDROLASTRA KNAUF GKI + poliuretano)		4,6	0	4,6	n.p.d.	1,2	5,8
	ISOLASTRA LM 85 (LASTRA KNAUF GKB – 9,5 + lana minerale)		33,1	0	33,1	n.p.d.	0,2	33,3
	ISOLASTRA LM 85 (LASTRA KNAUF GKB - 12,5 + lana minerale)		27,4	0	27,4	n.p.d.	1,4	28,8

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CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO

Minimum content of recycled, recovered, by-product materials

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO *Product name*		MATERIALE RICICLATO *Recycled material*			MATERIALE RECUPERATO *Recovered material*	SOTTO PRODOTTO *By-product material*	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2)] *Total content of Recycled, Recovered, By-product material*
			Totale [%]	Pre-consumer [%]	Post-consumer [%]	[%]	[%]	[%]
ISOLASTRE KNAUF LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	ISOLASTRA LM 85 (LASTRA KNAUF GKI + lana minerale)	IV	27,6	0	27,6	n.p.d.	1,2	28,8
	ISOLASTRA XPS (LASTRA KNAUF GKB – 9,5 + polistirene estruso)		6,6	0	6,6	n.p.d.	0,2	6,8
	ISOLASTRA XPS (LASTRA KNAUF GKB – 12,5 + polistirene estruso)		6,5	0	6,5	n.p.d.	1,4	7,9
	LASTRA DIAMANT PHONO - 10 mm (LASTRA DIAMANT + fibra di poliestere)		3,4	0	3,4	n.p.d.	1,7	5,1
	LATRA DIAMANT PHONO - 20 e 40 mm (LASTRA DIAMANT + fibra di poliestere)		3,0	0	3,0	n.p.d.	2,1	5,1
	LASTRA KNAUF CON BARRIERA AL VAPORE (LASTRA KNAUF GKB - 9,5 + lamina in alluminio)		4,9	0	4,9	n.p.d.	0,2	5,1
	LASTRA KNAUF CON BARRIERA AL VAPORE (LASTRA KNAUF GKB - 12,5 + lamina in alluminio)		3,7	0	3,7	n.p.d.	1,4	5,1
	LASTRA KNAUF CON BARRIERA AL VAPORE (LASTRA KNAUF GKB Advanced + lamina in alluminio)		4,1	0	4,1	n.p.d.	1,0	5,1
	LASTRA KNAUF CON BARRIERA AL VAPORE (IDROLASTRA KNAUF GKI + lamina in alluminio)		3,9	0	3,9	n.p.d.	1,2	5,1

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Annex to the certificate P235 of 28/11/2023

INFORMAZIONI SUL CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO DEI COMPONENTI DEL PRODOTTO

Information about minimum content of recycled, recovered, by-product materials of the product components

TIPOLOGIA DI PRODOTTO *Product type*	**NOME PRODOTTO**[1] *Product name*[1]	**NOME COMPONENTE DEL PRODOTTO** *Product components*		**Materiale riciclato** *Ricycled material*			**Materiale recuperato** *Recovered material*	**Sottoprodotto** *By-product material*	**CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO**[2] *Total content of Recycled, Recovered, By-product material*
				Totale [%]	**Pre-consumer [%]**	**Post-consumer [%]**	**[%]**	**[%]**	**[%]**
Isolastre Advanced Knauf Lastre in cartongesso accoppiate con isolante – Composite boards	**ISOLASTRA ADVANCED PSE-B (LASTRA KNAUF GKB Advanced - 12,5 + polistirene espanso bianco)**	**LASTRA KNAUF GKB Advanced - 12,5 mm**	≥	4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene Espanso bianco		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA ADVANCED PSE-G (LASTRA KNAUF GKB Advanced - 12,5 + polistirene espanso grafitato)	**LASTRA KNAUF GKB Advanced - 12,5 mm**		4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene Espanso grafitato		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA ADVANCED PU (LASTRA KNAUF GKB Advanced - 12,5 + Poliuretano)	**LASTRA KNAUF GKB Advanced - 12,5 mm**		4,9	0	4,9	n.p.d.	0,2	5,1
		Poliuretano		2,0	0	2,0	n.p.d.	0	2,0
	ISOLASTRA ADVANCED LM85 (LASTRA KNAUF GKB Advanced - 12,5 + lana minerale)	**LASTRA KNAUF GKB Advanced - 12,5 mm**		4,9	0	4,9	n.p.d.	0,2	5,1
		Lana Minerale		70,0	0	70,0	n.p.d.	0	70,0

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Information about minimum content of recycled, recovered, by-product materials of the product components

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO[1] *Product name[1]*	NOME COMPONENTE DEL PRODOTTO *Product components*		Materiale riciclato *Recycled material*			Materiale recuperato *Recovered material* [%]	Sottoprodotto *By-product material* [%]	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2] *Total content of Recycled, Recovered, By-product material* [%]
				Totale [%]	Pre-consumer [%]	Post-consumer [%]			
Isolastre Advanced Knauf Lastre in cartongesso accoppiate con isolante – Composite boards	ISOLASTRA ADVANCED XPS (LASTRA KNAUF GKB Advanced - 12,5 + polistirene estruso)	LASTRA KNAUF GKB Advanced - 12,5 mm		4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene Estruso		15,0	0	15,0	n.p.d.	n.p.d.	15,0
Isolastre Lastre in cartongesso accoppiate con isolante – Composite boards	ISOLASTRA PSE-B (LASTRA KNAUF GKB - 9,5 + polistirene espanso bianco)	LASTRA KNAUF GKB - 9,5 mm		4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene Espanso bianco		10,0	0	10,0	n.p.d.	0	10,0
	ISOLASTRA PSE-B (LASTRA KNAUF GKB - 12,5 + polistirene espanso bianco)	LASTRA KNAUF GKB - 12,5 mm		3,7	0	3,7	n.p.d.	1,4	5,1
		Polistirene Espanso bianco		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA PSE-B (IDROLASTRA KNAUF GKI + polistirene espanso bianco	IDROLASTRA KNAUF GKI		3,9	0	3,9	n.p.d.	1,2	5,1
		Polistirene Espanso bianco		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA PSE-G (LASTRA KNAUF GKB - 9,5 + polistirene espanso grafitato)	LASTRA KNAUF GKB - 9,5 mm		4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene Espanso grafitato		15,0	0	15,0	n.p.d.	0	15,0

Allegato al Certificato di Prodotto P235 del 28/11/2023

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Information about minimum content of recycled, recovered, by-product materials of the product components

TIPOLOGIA DI PRODOTTO *Product type*	**NOME PRODOTTO[1)]** *Product name[1)]*	**NOME COMPONENTE DEL PRODOTTO** *Product components*		**Materiale riciclato** *Ricycled material*			**Materiale recuperato** *Recovered material* **[%]**	**Sottoprodotto** *By-product material* **[%]**	**CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2)]** *Total content of Recycled, Recovered, By-product material* **[%]**
				Totale [%]	**Pre-consumer [%]**	**Post-consumer [%]**			
ISOLASTRE LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	**ISOLASTRA PSE-G (LASTRA KNAUF GKB - 12,5 + polistirene espanso grafitato)**	**LASTRA KNAUF GKB - 12,5 mm**	≥ IV	3,7	0	3,7	n.p.d.	1,4	5,1
		Polistirene Espanso grafitato		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA PSE-G (IDROLASTRA KNAUF GKI + polistirene espanso grafitato)	**IDROLASTRA KNAUF GKI**		3,9	0	3,9	n.p.d.	1,2	5,1
		Polistirene Espanso grafitato		15,0	0	15,0	n.p.d.	0	15,0
	ISOLASTRA PU (LASTRA KNAUF GKB - 9,5 + poliuretano)	**LASTRA KNAUF GKB - 9,5 mm**		4,9	0	4,9	n.p.d.	0,2	5,1
		Poliuretano		2,0	0	2,0	n.p.d.	0	2,0
	ISOLASTRA PU (LASTRA KNAUF GKB - 12,5 poliuretano)	**LASTRA KNAUF GKB - 12,5 mm**		3,7	0	3,7	n.p.d.	1,4	5,1
		Poliuretano		2,0	0	2,0	n.p.d.	0	2,0

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Information about minimum content of recycled, recovered, by-product materials of the product components

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO[1] *Product name[1]*	NOME COMPONENTE DEL PRODOTTO *Product components*		Materiale riciclato *Ricycled material*			Materiale recuperato *Recovered material* [%]	Sottoprodotto *By-product material* [%]	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2] *Total content of Recycled, Recovered, By-product material* [%]
				Totale [%]	Pre-consumer [%]	Post-consumer [%]			
ISOLASTRE LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	ISOLASTRA PU (IDROLASTRA KNAUF GKI + poliuretano)	IDROLASTRA KNAUF GKI	≥	3,9	0	3,9	n.p.d.	1,2	5,1
		Poliuretano		2,0	0	2,0	n.p.d.	0	2,0
	ISOLASTRA LM 85 (LASTRA KNAUF GKB - 9,5 + lana minerale)	LASTRA KNAUF GKB - 9,5 mm		4,9	0	4,9	n.p.d.	0,2	5,1
		Lana Minerale		70,0	0	70,0	n.p.d.	0	70,0
	ISOLASTRA LM85 (LASTRA KNAUF GKB - 12,5 + lana minerale)	LASTRA KNAUF GKB - 12,5 mm		3,7	0	3,7	n.p.d.	1,4	5,1
		Lana Minerale		70,0	0	70,0	n.p.d.	0	70,0

Allegato al Certificato di Prodotto P235 del 28/11/2023

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INFORMAZIONI SUL CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO DEI COMPONENTI DEL PRODOTTO

Information about minimum content of recycled, recovered, by-product materials of the product components

TIPOLOGIA DI PRODOTTO *Product type*	NOME PRODOTTO[1] *Product name[1]*	NOME COMPONENTE DEL PRODOTTO *Product components*		Materiale riciclato *Ricycled material*			Materiale recuperato *Recovered material* [%]	Sottoprodotto *By-product material* [%]	CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO[2] *Total content of Recycled, Recovered, By-product material* [%]
				Totale [%]	Pre-consumer [%]	Post-consumer [%]			
ISOLASTRE LASTRE IN CARTONGESSO ACCOPPIATE CON ISOLANTE – Composite boards	ISOLASTRA LM85 (IDROLASTRA KNAUF GKI + lana minerale)	IDROLASTRA KNAUF GKI	≥	3,9	0	3,9	n.p.d.	1,2	5,1
		Lana Minerale		70,0	0	70,0	n.p.d.	0	70,0
	ISOLASTRA XPS (LASTRA KNAUF GKB - 9,5 + polistirene estruso)	LASTRA KNAUF GKB - 9,5 mm		4,9	0	4,9	n.p.d.	0,2	5,1
		Polistirene estruso		10,0	0	10,0	n.p.d.	0	10,0
	ISOLASTRA XPS (LASTRA KNAUF GKB - 12,5 + polistirene estruso)	LASTRA KNAUF GKB - 12,5 mm		3,7	0	3,7	n.p.d.	1,4	5,1
		Polistirene estruso		10,0	0	10,0	n.p.d.	0	10,0

Legenda: n.p.d. prestazione non dichiarata

RAPPORTO DI VALUTAZIONE N. 425231

ASSESSMENT REPORT No. 425231

il presente documento si basa sul rapporto di prova n. 425228
emesso da Istituto Giordano in data 29 gennaio 2025

this document is based on test report No. 425228 dated 29 January 2025 issued by Istituto Giordano

Cliente */ Customer*

KNAUF di Knauf s.r.l. S.a.s.

Via Livornese, 20 - 56040 CASTELLINA MARITTIMA (PI) - Italia

Oggetto */ Item#*

adesivo in polvere a base di gesso con aggiunta di additivi denominato "Perlfix"

powder adhesive based on gypsum with additives named "Perlfix"

Attività / Activity

valutazione delle emissioni VOC

assessment of the VOC emission

Risultati */ Results*

Regolamento o protocollo *Regulation or protocol*	**Conclusioni** *Findings*
Legislazione VOC Francia *French VOC regulation*	A+
Componenti CMR Francia *French CMR components*	**conforme** *complies*
CAM Edilizia Italiana *Italian CAM Edilizia*	**conforme** *complies*
ABG/AgBB	**conforme** *complies*
Legislazione Belga *Belgian Regulation*	**conforme** *complies*
LEED v4.1 BETA	**conforme** *complies*
BREEAM® NOR	**livello esemplare** *exemplary level*
BREEAM® International	**livello esemplare** *exemplary level*
EMICODE®	**EC1 Plus**

(##) La sola conformità non dà diritto all'utilizzo delle etichette BREEAM® NOR, BREEAM® International, EMICODE®.
Compliance with the limits alone does not entitle to use of BREEAM® NOR, BREEAM® International, EMICODE® label..

(#) secondo le dichiarazioni del cliente.
according to that stated by the customer.

Bellaria-Igea Marina - Italia, 29 gennaio 2025
Bellaria-Igea Marina - Italy, 29 January 2025

L'Amministratore Delegato
(Dott. Nazario Giordano)

Firmato digitalmente da NAZARIO GIORDANO

Commessa:
Order:
103014

Data dell'attività:
Activity date:
27 gennaio 2025
27 January 2025

Luogo dell'attività:
Activity site:
Istituto Giordano S.p.A. - Blocco 4 - Via San Mauro, 8 - 47814 Bellaria-Igea Marina (RN) - Italia

Indice **Pagina**

Responsabile Tecnico: */ Chief Technician:*
Dott. Alessandro Lorenzi
Responsabile del Laboratorio di Chimica: */ Head of Chemical Laboratory:*
Dott. Alessandro Lorenzi

Compilatore: */ Compiler:* Francesca Manduchi

ISTITUTO GIORDANO S.p.A. Via Gioacchino Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italia - Tel. +39 0541 343030 - istitutogiordano@giordano.it - www.giordano.it
Cap. Soc. € 1.500.000 i.v. - R.E.A. c/o C.C.I.A.A. (RN): 156766 - Registro Imprese Romagna (Forlì-Cesena e Rimini) e CF/P. IVA: n. 00 549 540 409

Scheda di dati di sicurezza
ai sensi del regolamento 1907/2006/CE, Articolo 31

Stampato il: 28.04.2016 *Versione: 4 (CHI)* *Revisione: 28.04.2016*

*
SEZIONE 1: Identificazione della sostanza o della miscela e della società/ impresa

1.1 Identificatore del prodotto

Denominazione commerciale: Perlfix

1.2 Usi identificati pertinenti della sostanza o della miscela e usi sconsigliati
Non sono disponibili altre informazioni.

Utilizzazione della Sostanza / del Preparato: Gesso a presa rapida

1.3 Informazioni sul fornitore della scheda di dati di sicurezza

Produttore/fornitore:
Knauf Bauprodukte GmbH & Co. KG
Postfach 10
97343 Iphofen
Germany
Tel +49 (0)9323/31-0
Fax +49 (0)9323/31-323

Distributore per il mercato svizzero:
Knauf AG
Kägenstrasse 17
4153 Reinach BL
Schweiz
Tel +41 (58) 775 88 00
Fax +41 (58) 775 88 01
E-mail Info@knauf.ch

1.4 Numero telefonico di emergenza:
Numero d'urgenza 145 Tox Info Suisse, Freiestrasse 16, 8032 Zürich

SEZIONE 2: Identificazione dei pericoli

2.1 Classificazione della sostanza o della miscela

Classificazione secondo il regolamento (CE) n. 1272/2008
Il prodotto non è classificato conformemente al regolamento CLP.

2.2 Elementi dell'etichetta

Etichettatura secondo il regolamento (CE) n. 1272/2008 non applicabile
Pittogrammi di pericolo non applicabile
Avvertenza non applicabile
Indicazioni di pericolo non applicabile
Indicazioni di pericolosità specifiche per l'uomo e l'ambiente:
Nessun pericolo particolare da dichiarare.

2.3 Altri pericoli

Risultati della valutazione PBT e vPvB
PBT: Non applicabile.
vPvB: Non applicabile.

SEZIONE 3: Composizione/informazioni sugli ingredienti

Caratteristiche chimiche: Miscele
Descrizione: Gesso a presa rapida di solfato di calcio semiidrato e additivi.

Sostanze pericolose: non applicabile

Scheda di dati di sicurezza

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Altri componenti:
CAS: 7778-18-9 Solfato di calcio
EINECS: 231-900-3
Reg.nr.: 01-2119444918-26-XXXX
Osservazione: Sostanze con un valore limite di esposizione sul posto di lavoro, vedere punto 8.

SEZIONE 4: Misure di primo soccorso

4.1 Descrizione delle misure di primo soccorso
Indicazioni generali: Non sono necessari provvedimenti specifici.
Inalazione: Portare in zona ben areata, in caso di disturbi consultare il medico.
Contatto con la pelle: Lavare con sapone e acqua.
Contatto con gli occhi:
Lavare con acqua corrente per diversi minuti tenendo le palpebre ben aperte Se persiste il dolore consultare il medico.
Ingestione:
Risciacquare la bocca e bere molta acqua.
Sottoporre a cure mediche.

4.2 Principali sintomi ed effetti, sia acuti che ritardati Non sono disponibili altre informazioni.

4.3 Indicazione dell'eventuale necessità di consultare immediatamente un medico e di trattamenti speciali
Non sono disponibili altre informazioni.

SEZIONE 5: Misure antincendio

Indicazioni generali:
Il prodotto non brucia.
In caso di incendio in un'area adiacente si devono tenere presenti i seguenti aspetti.
5.1 Mezzi di estinzione
Mezzi di estinzione idonei: Tutti i mezzi di estinzione sono idonei.
Mezzi di estinzione inadatti per motivi di sicurezza: Nessuno.

5.2 Pericoli speciali derivanti dalla sostanza o dalla miscela Nessuno.

5.3 Raccomandazioni per gli addetti all'estinzione degli incendi
Mezzi protettivi specifici: Non sono richiesti provvedimenti particolari.
Altre indicazioni Il prodotto non è infiammabile.

SEZIONE 6: Misure in caso di rilascio accidentale

6.1 Precauzioni personali, dispositivi di protezione e procedure in caso di emergenza
Non necessario.

6.2 Precauzioni ambientali:
Impedire infiltrazioni nella fognatura/nelle acque superficiali/nelle acque freatiche.

6.3 Metodi e materiali per il contenimento e per la bonifica:
Raccogliere con mezzi meccanici (secco).

6.4 Riferimento ad altre sezioni
Per informazioni relative ad un manipolazione sicura, vedere capitolo 7.
Per informazioni relative all'equipaggiamento protettivo ad uso personale vedere Capitolo 8.
Per informazioni relative allo smaltimento vedere Capitolo 13.

Scheda di dati di sicurezza

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Il prodotto indurisce al contatto con l'acqua.

SEZIONE 7: Manipolazione e immagazzinamento

7.1 Precauzioni per la manipolazione sicura Non sono richiesti provvedimenti particolari.
Indicazioni in caso di incendio ed esplosione: Non sono richiesti provvedimenti particolari.

7.2 Condizioni per lo stoccaggio sicuro, comprese eventuali incompatibilità
Requisiti dei magazzini e dei recipienti: Non sono richiesti requisiti particolari.
Indicazioni sullo stoccaggio misto: Non necessario.
Ulteriori indicazioni relative alle condizioni di immagazzinamento:
Conservare in luogo asciutto.
Mantenere i recipienti ermeticamente chiusi.

7.3 Usi finali particolari Non sono disponibili altre informazioni.

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SEZIONE 8: Controllo dell'esposizione/protezione individuale

Ulteriori indicazioni sulla struttura di impianti tecnici: Nessun dato ulteriore, vedere punto 7.

8.1 Parametri di controllo

Componenti i cui valori limite devono essere tenuti sotto controllo negli ambienti di lavoro:

CAS: 7778-18-9 solfato di calcio, naturale

MAK (Svizzeria) Valore a lungo termine: 3 a mg/m³
SSc;

MAK (Svizzeria) Valore a lungo termine: 3 a mg/m³
SSc;

Limite gen. polveri
Svizzera: 3 mg/m³ a, 10 mg/m³ e
Germania: 1,25 mg/m³ a, 10 mg/m³ e

Annotazione A = frazione respirabile, E = frazione inalabile
Ulteriori indicazioni:
Le liste valide alla data di compilazione sono state usate come base.
SUVA Protezione della salute: valori limite d'esposizione sui posti di lavoro

8.2 Controlli dell'esposizione
Norme generali protettive e di igiene del lavoro:
Osservare le misure di sicurezza usuali nella manipolazione di sostanze chimiche.
Maschera protettiva:
In caso di sviluppo di polveri, indossare la maschera respiratoria con filtro FFP2.

Guanti protettivi:
In caso di contatto prolungato o ripetuto indossare guanti protettivi.
Il materiale dei guanti deve essere impermeabile e stabile contro il prodotto/ la sostanza/ la formulazione.
Scelta del materiale dei guanti in considerazione dei tempi di passaggio, dei tassi di permeazione e della degradazione.
Materiale dei guanti Guanti di cotone imbevuti di nitrile.
Tempo di permeazione del materiale dei guanti
Richiedere dal fornitore dei guanti il tempo di passaggio preciso il quale deve essere rispettato.

Occhiali protettivi:
In caso di sviluppo di poveri, utilizzare occhiali protettivi con protezione laterale.
In caso di pericolo di spruzzi, indossare occhiali protettivi con protezioni laterali.

Scheda di dati di sicurezza

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Denominazione commerciale: Perlfix

Tuta protettiva: Tuta protettiva

SEZIONE 9: Proprietà fisiche e chimiche

9.1 Informazioni sulle proprietà fisiche e chimiche fondamentali
Indicazioni generali
Aspetto:

Forma:	Polvere
Colore:	bianco, bianco-beige, bianco-grigio
Odore:	Inodore
Soglia olfattiva:	Non definito.
valori di pH:	Non pertinente nello stato alla fornitura.
Cambiamento di stato	
Temperatura di fusione/ambito di fusione:	Non applicabile.
Temperatura di ebollizione/ambito di ebollizione:	Non applicabile.
Punto di infiammabilità:	Non applicabile.
Infiammabilità (solido, gassoso):	Non applicabile.
Temperatura di accensione:	Non applicabile.
Temperatura di decomposizione:	Non definito.
Autoaccensione:	Prodotto non autoinfiammabile.
Pericolo di esplosione:	Prodotto non esplosivo.
Tensione di vapore:	Non applicabile.
Densità:	circa 2,7 g/cm³
Densità relativa	Non definito.
Densità del vapore	Non applicabile.
Velocità di evaporazione	Non applicabile.
Solubilità in/Miscibilità con acqua:	circa 3 g/l (20 °C)
Coefficiente di distribuzione (n-Octanol/ acqua):	Non applicabile.
Viscosità:	
Dinamica:	Non applicabile.
Cinematica:	Non applicabile.
9.2 Altre informazioni	Decomposizione termica del gesso: in $CaSO_4$ e H_2O ca. 140 °C in CaO e SO_3 ca. 1000 °C

SEZIONE 10: Stabilità e reattività

10.1 Reattività Non sono disponibili altre informazioni.
Reattività Non sono disponibili altre informazioni.

10.2 Stabilità chimica
Decomposizione termica/ condizioni da evitare:
Il prodotto non si decompone se manipolato e immagazzinato secondo le norme.

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Evitare l'azione dell'umidità.

10.3 Possibilità di reazioni pericolose Non sono note reazioni pericolose.

10.4 Condizioni da evitare Non sono disponibili altre informazioni.

10.5 Materiali incompatibili: Nessuna nota.

10.6 Prodotti di decomposizione pericolosi: Non sono noti prodotti di decomposizione pericolosi.

SEZIONE 11: Informazioni tossicologiche

11.1 Informazioni sugli effetti tossicologici
Tossicità acuta Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Irritabilità primaria:
Corrosione/irritazione cutanea
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Lesioni oculari gravi/irritazioni oculari gravi
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Sensibilizzazione respiratoria o cutanea
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.

Ulteriori dati tossicologici: Non tossico.
Effetti CMR (cancerogenicità, mutagenicità e tossicità per la riproduzione)
Mutagenicità delle cellule germinali
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Cancerogenicità Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Tossicità per la riproduzione
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Tossicità specifica per organi bersaglio (STOT) - esposizione singola
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Tossicità specifica per organi bersaglio (STOT) - esposizione ripetuta
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.
Pericolo in caso di aspirazione
Basandosi sui dati disponibili i criteri di classificazione non sono soddisfatti.

SEZIONE 12: Informazioni ecologiche

12.1 Tossicità
Tossicità acquatica: Non sono disponibili altre informazioni.

12.2 Persistenza e degradabilità Non sono disponibili altre informazioni.

12.3 Potenziale di bioaccumulo Non sono disponibili altre informazioni.

12.4 Mobilità nel suolo Non sono disponibili altre informazioni.

Ulteriori indicazioni in materia ambientale:
Ulteriori indicazioni:
Non immettere nelle acque freatiche, nei corsi d'acqua o nelle fognature non diluito o in grandi quantità.

12.5 Risultati della valutazione PBT e vPvB
PBT: Non applicabile.
vPvB: Non applicabile.

12.6 Altri effetti avversi Non sono disponibili altre informazioni.

Scheda di dati di sicurezza

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SEZIONE 13: Considerazioni sullo smaltimento

13 Metodi di trattamento dei rifiuti
Consigli: Smaltimento in conformità con le disposizioni amministrative.
Catalogo europeo dei rifiuti

17 08 02 materiali da costruzione a base di gesso diversi da quelli di cui alla voce 17 08 01

17 09 04 rifiuti misti dell'attività di costruzione e demolizione, diversi da quelli di cui alle voci 17 09 01, 17 09 02 e 17 09 03

Elenco dei rifiuti CH (OTRif)
17 09 04: Rifiuti edili non selezionati nonché altri rifiuti edili inquinati
17 08 02: Rifiuti edili a base di gesso diversi da quelli di cui al codice 17 08 01

Imballaggi non puliti:
Consigli:
Gli imballaggi contaminati devono essere ben svuotati, possono essere poi riutilizzati dopo aver subito appropriato trattamento di pulitura.

SEZIONE 14: Informazioni sul trasporto

14.1 Numero ONU	
ADR, IMDG, IATA	non applicabile
14.2 Nome di spedizione dell'ONU	
ADR, IMDG, IATA	non applicabile
14.3 Classi di pericolo connesso al trasporto	
ADR, IMDG, IATA	
Classe	non applicabile
14.4 Gruppo di imballaggio	
ADR, IMDG, IATA	non applicabile
14.5 Pericoli per l'ambiente:	Non applicabile.
14.6 Precauzioni speciali per gli utilizzatori	Non applicabile.
14.7 Trasporto di rinfuse secondo l'allegato II di MARPOL ed il codice IBC	Non applicabile.
UN "Model Regulation":	non applicabile

*
SEZIONE 15: Informazioni sulla regolamentazione

15.1 Disposizioni legislative e regolamentari su salute, sicurezza e ambiente specifiche per la sostanza o la miscela
Direttiva 2012/18/UE
Sostanze pericolose specificate - ALLEGATO I Nessuno dei componenti è contenuto.

Disposizioni nazionali:

Classe di pericolosità per le acque:
Pericolosità per le acque classe 1 (VwVwS Germania 27.07.2005, Anhang 4): poco pericoloso.

15.2 Valutazione della sicurezza chimica:
Una valutazione della sicurezza chimica non è stata effettuata.

SEZIONE 16: Altre informazioni

I dati sono riportati sulla base delle nostre conoscenze attuali, non rappresentano tuttavia alcuna garanzia delle caratteristiche del prodotto e non motivano alcun rapporto giuridico contrattuale.

Scheda di dati di sicurezza

ai sensi del regolamento 1907/2006/CE, Articolo 31

Denominazione commerciale: Perlfix

Scheda rilasciata da: Knauf Gips KG, Abteilung Nachhaltigkeit und REACH, 97343 Iphofen

Abbreviazioni e acronimi:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative

*** Dati modificati rispetto alla versione precedente**

ECO PLATFORM EPD VERIFIED

EPD®

N° VERIFICATION : S-P-08349

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804:2012+A2:2019/AC:2021 for:
Knauf Fugenfuller Advanced Joint Filler - Gypsum based

> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-08349

> **Publication date:**
2023/02/14

> **Valid until:**
2028/02/14

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s.
Loc. Treschi - 50050 Gambassi Terme (FI), Italy

KNAUF

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com
EPD registration number/declaration number: S-P-08349
Product / product family name and manufacturer represented: gypsum-based joint filler, namely Fugenfüller Advanced manufactured by Knauf di Knauf S.r.l. S.a.s.
Product description and use: Knauf Fugenfuller Advanced is a gypsum joint-filler, intended for manual filling of Knauf gypsum plasterboard. In addition, Knauf gypsum-based joint-filler is suitable for filling cavities in gypsum plasterboards and for gluing corner or stucco channels.
It is designed for use in the residential sector and for building in general for internal use.
Declaration issued: 2023/02/14
Valid until: 2028/02/14
Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Località Treschi 50050, Gambassi Terme (FI). Tel. 0571 6307 - Fax 0571 678014, knauf-it@knauf.com.
EPD prepared by: Ergo S.r.l, www.ergosrl.net
Scope: The LCA is based on first semester 2022 production data for Gambassi Terme manufacturing site in Italy for gypsum-based joint-filler. This EPD covers information modules A1 to C4 (cradle to gate with module C1-C4, module D and optional modules) as defined in EN 15804:2012+A2:2019/AC:2021 for Knauf gypsum-based joint-fillersold and used in Italy.
The use stage (B1-B7) was not considered in this study.
Functional unit/declared unit: The declared unit (DU) is 1 kg of gypsum-based joint-filler (Fugenfüller Advanced) for joint filler with packaging (powder product, not mixed with water).

CEN standard EN 15804 served as the core Product Category Rules - PCR	
PCR:	PCR 2019:14 Construction products and construction services, Version 1.2.5.
Product group classification:	The UN CPC code of the product is 37530 Articles of plaster or of compositions based on plaster
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña. email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A. Via Corsica 12, Genova - Italy Tel +39 010-5385306 - www.rina.org ACCREDIA Registration number: 001H REV. 17
Accredited or approved by:	The International EPD® System

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 300 production facilities and sales organizations in over 90 countries, 40.000 employees worldwide, and sales of 12.5 billion Euro (in 2021), the Knauf Group is without doubt one of the big players on the market - in Europe, the USA, South America, Russia, Asia, Africa, and Australia. The company's headquarter in Italy is located in Castellina Marittima (Pisa), specialised for drywall systems production (plasterboards, metal profiles). Additionally, in Gambassi Terme (Florence) plant, Knauf develops, produces and sells traditional and performance premixed joint-fillers used in drywall systems.

3. PRODUCT INFORMATION

3.1 Product description and use

Studied product is a gypsum-based joint-filler for interior application. It is a bindable material ground to powder whose curing process is triggered by the addition of water. Knauf joint-filler Fugenfüller Advanced are intended for manual filling of Knauf gypsum plasterboard joints with HRAK (half-round flattened), HRAK (flat) and AK edges. Knauf fillers are also used for connecting drywall using reinforcing tape, for connecting gypsum fibre boards, for fixing elements based on plaster, as adhesive. In addition, the Fugenfüller Advanced version also has the "Eurofins Indoor Air Comfort Gold" certification which certifies compliance with the strictest European and international standards and belonging to class A+ (according to the French decree), i.e. the most virtuous level of the category in terms of emissions of VOCs (volatile organic compounds). The workability time of the product is 90 minutes.

3.2 Technical data

Technical data referred to Knauf gypsum-based joint-filler are given in Table 1.

Table 1 - Technical information.

UNI EN 13963 Classification	3B
Gross density	800 kg/m^3
Physical form	White powder
Class of reaction to fire performance (according to EN 13963)	A1

3.3 Delivery Status

The EPD refers to 1 kg of product delivered in powder form. The product can be procured in paper sack.

3.4 Base materials / Ancillary materials

The average composition of studied gypsum-based joint-filler, including the packaging materials, is reported in Table 2:

Product components	Weight %	Post-consumer material, weight %	Renewable material, weight %
Calcium sulfate half hydrate	69	0	0
Limestone	30	0	0
Additives[1]	1	0	0
Product components	**Weight %**	**Post-consumer material, weight %**	**Renewable material, weight %**
Sack (paper)	79	0	100
Layer (paperboard)	2	0	100
Plastic film and hood	7	0	0
Wooden pallet	12	0	100

Table 2
Content declaration of gypsum-based joint-filler and relative packaging.

Knauf gypsum joint-fillers do not contain SVHC (Substances of Very High Concern). No additives used are classed as substances of concern; substances are not listed specifically to protect proprietary information.

3.5 Packaging

Powder gypsum products must be protected from moisture absorption during transport and storage. The products are packaged in 10 kg paper sacks. Knauf gypsum joint-fillers are then piled up on wooden pallets, separated by cardboard layers, and are protected against damage by plastic film and plastic hood (polyethylene). Packing materials are externally recovered/disposed of.

3.6 Condition of use

If the joint-filler is correctly applied, it should not require any form of maintenance.

3.7 Reference service life

The product is intended for use as a construction product in interior areas. Knauf gypsum joint-filler is expected to last the service life of a building 50 years.

3.8 Recycling / Re-use phase

No recycled materials are used in the product. Waste processing (recycling or disposal) depends on the respective substrate due to the low material hardness displayed by the component.
The actual material is suitable for disposal on landfills.

3.9 Disposal

Knauf joint-fillers have to be disposed of in compliance with the following waste codes of the European Waste Catalogue /EWC/:17 08 02 gypsum-based construction materials.

3.10 Further information

Further information can be found through the enquiry desk:
+39 0571 6307 | E-mail: knauf-it@knauf.com | www.knauf.it

3.11 Manufacture

Knauf joint-filler is manufactured using a continuous production process, showed in the Figure 1 below:

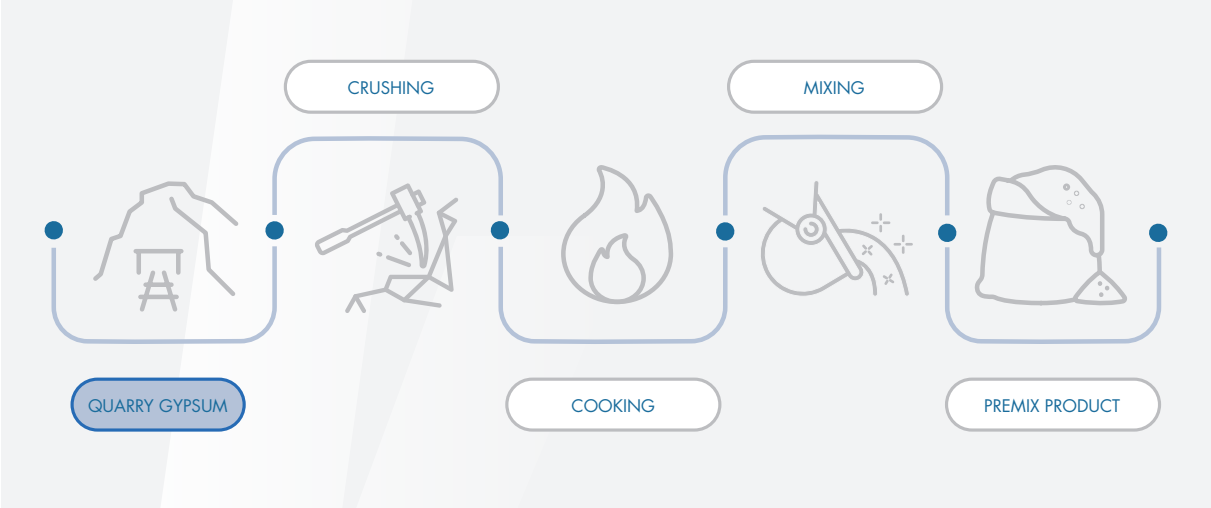


Figure 1 - Gypsum-based joint-filler manufacturing process.

The production process starts from raw materials, that are purchased from external and intercompany suppliers and stored in the plant. Bulk raw materials are stored in specific silos and added automatically in the production mixer, according to the formula of the product. Other raw materials, supplied in bags or big-bags, are stored in the warehouse and added automatically in the mixer. Minor additives are weighed, added and then blended with the gypsum powder to produce a finished product. Finished products are packed in paper sack and placed on a wooden pallet. The joint-filler sacks are weighed and printed with unique codes detailing location, date, time of manufacture and use by date. Then a cardboard layer, plastic film and plastic hood are used for the storage. The quality of final products is controlled before the sale.

3.11 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free. A target of zero accidents at work for employees, visitors and contractors is set by the business.
In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured.
To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 45001 certified systems.

4. LCA INFORMATION

Figure 2 shows a flow diagram of the system under study. The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'. In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4; benefits and loads beyond the system boundary, as module D). Accordingly, the EPD is a cradle-to-gate declaration with module C1-C4, module D and optional modules. The system boundaries in tabular form for all modules are shown in the Table 3 below.

Table 2 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

	Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
	Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
MODULE	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Module declared	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	EU, CN, IN	EU	EU	EU	EU	-	-	-	-	-	-	-	EU	EU	EU	EU	EU

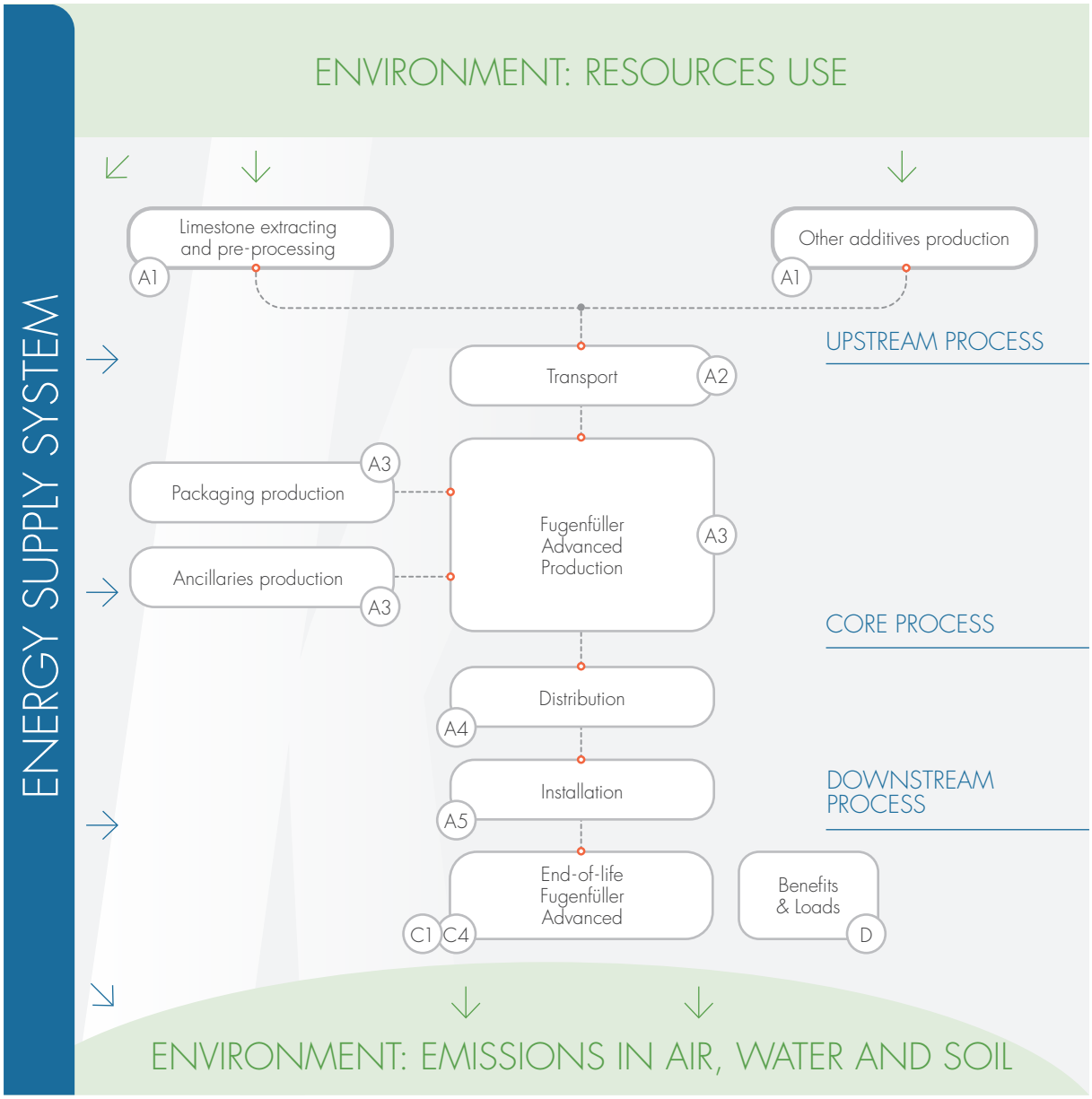


Figure 2 - Flow diagram of system boundary under assessment.

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 4.

Table 4 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 kg of gypsum-based joint filler (Fugenfüller Advanced) with the packaging (powder product, not mixed with water).
5.2	**System boundaries**	Cradle to gate with module C1-C4, module D and optional modules (A4, A5). The modularity and "polluter-pays" principles were followed.
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts. The gypsum joint-filler product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. The LCA calculation has been made taking into account the fact that Knauf Gambassi plant purchase 100% renewable electricity. The origin of the renewable electricity status is evidenced by Guarantee of Origin certificates (GOs), valid for the period chosen in the calculation (2022). For the production of additives and packaging materials (and their disposal), generic data have been used, make them country specific whenever possible. Since there is no waste processing at the end of life, module C3 is not applicable. The declared joint-filler is typically disposed of as construction waste which is declared in module C4, therefore module D is not applicable. Module D is only applied to main recovered materials from the packaging of the finished product.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2012+A2:2019/AC:2021 Clause 6.3.6 In compliance with these criteria, the infrastructure of the manufacturing site and personnel related activities (travel, office operations and supplies) are excluded from the study.
5.5	**Background data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Gambassi Terme plant. All secondary data was retrieved using SIMAPRO 9.4 software, with Ecoinvent 3.8 database.
5.6	**Data quality**	Primary data concern the first semester 2022 and represent the whole annual production. They have been collected at Knauf S.r.l. S.a.s. plant located in Gambassi Terme (IT), whereas selected generic data have been retrieved from Ecoinvent 3.8 database and using the most updated datasets and - as far as possible - those representatives for at least 5 years into the future. The quality level concerning datasets used in the EPD can be considered as "very good" or "good" according to Annex E of the EN 15804 (current version).
5.7	**Period under review**	The data is representative of the manufacturing processes of first semester of the 2022 year (January-June).
5.8	**Allocations**	According to ISO 14040 and 14044, for the allocation procedure physical properties are used to drive flow analysis.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries
This EPD evaluates the environmental impacts of 1 kg of gypsum-based joint filler (Fugenfüller Advanced) from cradle to gate with module C1-C4, module D and optional modules. Within the Life Cycle Assessment of the declared board, the following processes are considered:

Product stage, A1-A3

Description of the stage
The product stage of the joint-filler products is subdivided into three modules; A1, A2 and A3 respectively "raw material supply", "transport" and "manufacturing".

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

A2, transport to the manufacturer
Raw materials and additives (e.g. alpha gypsum, limestone, etc) are supplied by truck from manufacturers within Italy or from neighbouring countries.

A3, manufacturing
This module includes the manufacture of products and the production of packaging material. The processing of any waste arising from this stage is also included. Raw materials and additives are weighed, added and then blended with the gypsum powder to produce a finished product. The finished product is packed into sacks and piled up on pallet. Then polyethylene film and hoods is used for the storage.

Construction process stage, A4-A5

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

A4, transport to the building site
The Table 5 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO 5 and EURO 6 articulated trucks has been accounted for. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed. Transportation does not cause losses as product are packaged properly.

Table 5 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck >32 tons, EURO5, EURO 6
Distanceto central warehouse	360.28 km weighted average by truck to all markets 71.87 km weighted average by boat to all markets
Distance to construction site	30.48 km
Fuel/energy consumption	0.02 L diesel fuel per tkm (truck) 0.0002 L diesel fuel per tkm (boat)
Capacity utilization	100%
Bulk density of transported products	800 kg/m^3

A5, installation into the building

Installation into the building, including provision of all materials, products and energy, as well as waste processing up to the end of waste state or disposal of final residues during the construction process stage. These information modules also include all impacts and aspects related to any losses during this construction process stage (i.e. production, transport and waste processing and disposal of the lost products and materials). The accompanying Table 6 quantifies the parameters for installing the product at the building site.

Table 6 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/ declared unit)
Ancillary materials for installation (specified by materials)	None
Water use	0.00077 m^3
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Gypsum-based joint-filler: 0.0175 kg Packaging materials: Paper sack: 0.0068 kg Paperboard layer: 0.00020 kg Polyethylene hood: 0.00015 kg Polyethylene film: 0.00042 kg Wooden pallet: 0.0010 kg
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Gypsum-based joint-filler to landfill: 0.0175 kg Packaging materials to landfill: Paper sack: 0.00119 kg Paperboard layer: 0.00003 kg Polyethylene hood: 0.00007 kg Polyethylene film: 0.0002 kg Wooden pallet: 0.0004 kg Packaging materials to energy and material recovery: Paper sack: 0.0056 kg Paperboard layer: 0.00016 kg Polyethylene hood: 0.00008 kg Polyethylene film: 0.00022 kg

Use stage (excluding potential savings), B1-B7

Description of the stage
The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information
The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf joint-filler is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
Deconstruction includes dismantling or demolition of the product from the construction. No on-site sorting of the materials occurs. At the end-of-life, in the demolition phase 100% of the waste is assumed to be collected as mixed construction waste. The demolition process consumes energy in the form of diesel fuel used by building machines.
C2, transport to waste processing
This stage includes the transportation of the discarded joint-fillers to final disposal. Average distance from demolition site to waste processing site for final disposal is assumed to be 50 km.
C3, waste processing for reuse, recovery and/or recycling
Since there is no waste processing at the end of life, modules C3 is not applicable.
C4, disposal
Since gypsum-based joint-fillers cannot be physically separated from the applied surface, they go to the inert waste site with the applied surface or part. For this reason, 100% landfill scenario has been assumed. However, packaging materials can be recycled.

Table 7 - End-of-life stage.

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	1 kg collected with mixed deconstruction and demolition waste and transported by truck for landfill
C2) Assumption for scenario development (e.g. transportation)	Diesel consumption 0.04 L per tkm; 50 km from demolition site to waste handle
C3) Recovery system specified by type	None
C4) Disposal specified by type	100% of waste is landfilled

Reuse/recovery/recycling potential, D

Description of the stage
Module D, relating to information on the potential for reuse/recovery/recycling, is assessed considering the benefits of the avoided impact of future extractions and production of raw materials, brought about by the recycling of the packaging materials. The processes necessary to make the materials of the product (at the end of life) new raw materials for subsequent life cycles are considered. Module D for Knauf gypsum joint-filler is not applicable since it is disposed of in landfill.

6. LCA RESULTS

In the following tables, the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 4.0, March 2021) and those indicated in PCR 2019:14 version 1.2.5 for Construction Products and construction services. The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
EN 15804+A2 (adapted) method has been used as the impact model. The numbers reported in the following tables are the outcome of rounding. For this reason, total results could slightly differ from the sum of contributions of the different phases.

7. LCA RESULTS INTERPRETATION

The impact assessment phase of LCA is aimed at evaluating the significance of potential environmental impacts using the LCI results. In general, this process involves associating inventory data of specific environmental impact categories with category indicators, thereby attempting to quantify these impacts. The impact assessment and the interpretation of this study are performed according to the ISO 14040 and ISO 14044 guidelines. This document declares the results of Fugenfüller Advanced product.
The main contribution to the environmental impact categories in the product life cycle comes from extraction and processing of raw materials (module A1). Its relative contribution is over 70% in some categories (such as climate change-biogenic, climate change-land use, renewable primary energy resources used as raw material). The production stage (module A3) is relevant especially for the climate change-biogenic, with a negative contribution due to the packaging components, eutrophication freshwater, renewable primary energy resources used as energy carrier. In terms of climate change module A5 gives a relevant contribution especially in the biogenic carbon impact category. This is due to the disposal of the packaging that is the principal responsible of the biogenic carbon content. Distribution of finished product (transport in module A4) has relevant importance in terms of climate change-fossil, ozone depletion, photochemical ozone formation, depletion of abiotic resources- fossils, hazardous waste, radioactive waste.
By contrast, transport in module A2 has an average contribution of 14% whereas the module C2 contributes only 7% at maximum. The installation phase (module A5) has a negligible contribution to the impact categories, less than 2%, except for net use of fresh water and water use where it contributes up to a maximum of 48%. With regard to total energy consumption, the product stage (modules A1 - A3) has the highest contribution to this indicator, with a maximum percentage of 85%. The effect of disposal life cycle stage has a contribution less than 11% on life cycle impacts, except for non-hazardous waste where the contribution of gypsum joint-filler disposal (module C4) to the overall results is 90%.

Additional information

All requirements of German AgBB Testing and Evaluation Scheme (2018), are fully metwith regard to all test criteria:

- $TVOC_{28} \leq 1000\ \mu g/m^3$ (according to EN 16516);
- VOC_{28} without LCI $\leq 100\ \mu g/m^3$;
- Formaldehyde $\leq 10\ \mu g/m^3$.

Table 8 - LCA results of potential environmental impact - mandatory indicators according to EN 15804 referred to declared unit.

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Climate Change Total - kg CO_2 eq./DU	9.26E-02	3.55E-02	3.52E-03	-	-	-	-	-	-	-	3.14E-03	8.24E-03	-	5.28E-03	1.73E-02
Climate Change = potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Climate Change' covers three sub-categories: fossil, biogenic, land use and land use change															
Climate Change Fossil - kg CO2 eq./DU	1.16E-01	3.55E-02	5.90E-04	-	-	-	-	-	-	-	3.14E-03	8.23E-03	-	5.27E-03	-2.23E-03
Climate Change = potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Climate Change' covers three sub-categories: fossil, biogenic, land use and land use change.															
Climate Change biogenic - kg CO2 eq./DU	-2.46E-02	3.63E-05	2.93E-03	-	-	-	-	-	-	-	1.18E-06	7.46E-06	-	5.72E-06	1.96E-02
Climate Change-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).															
Climate Change Land use and Land use change kg CO_2 eq./DU	9.44E-04	1.33E-05	5.51E-07	-	-	-	-	-	-	-	3.13E-07	3.26E-06	-	4.97E-06	-1.13E-05
Climate Change-land use and land use change accounts for carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).															
Ozone Depletion (OD) – kg CFC11 eq. /DU	1.56E-08	8.64E-09	1.09E-10	-	-	-	-	-	-	-	6.71E-10	1.91E-09	-	2.13E-09	-4.38E-09
Ozone Depletio = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.															
Acidification - kg mol H+/DU	5.62E-04	1.43E-04	3.30E-06	-	-	-	-	-	-	-	3.26E-05	3.29E-05	-	4.95E-05	-2.65E-05
Acidification = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.															
Eutrophication acquatic freshwater - kg P eq. /DU	2.66E-06	2.47E-07	2.20E-08	-	-	-	-	-	-	-	1.04E-08	5.82E-08	-	5.52E-08	-2.86E-07
Eutrophication acquatic marine - kg N eq. /DU	1.84E-04	3.77E-05	2.86E-06	-	-	-	-	-	-	-	1.44E-05	9.64E-06	-	1.71E-05	-4.67E-06
Eutrophication terrestrial - mol N eq. /DU	1.81E-03	4.17E-04	9.11E-06	-	-	-	-	-	-	-	1.58E-04	1.06E-04	-	1.88E-04	-5.11E-05
Eutrophication = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.															

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Formation (POF)- kg NMVOC /DU	4.00E-04	1.42E-04	3.45E-06	-	-	-	-	-	-	-	4.36E-05	3.28E-05	-	5.48E-05	-1.54E-05
	Photochemical ozone formation = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use, m3 world eq deprived/DU	2.70E-02	1.93E-03	3.32E-02	-	-	-	-	-	-	-	6.74E-05	3.76E-04	-	6.62E-03	-4.04E-03
	Climate Change-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Depletion of abiotic resources-minerals and metals, kg Sb eq. /DU*	5.31E-07	8.28E-08	2.26E-09	-	-	-	-	-	-	-	1.62E-09	2.89E-08	-	1.20E-08	-2.51E-08
	Depletion of resources- minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Depletion of abiotic resources-fossils, MJ, net calorific value/DU*	1.69E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.70E-02
	Depletion of resources-fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

**Disclaimer: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experienced with the indicator.*

Table 9 - LCA results of potential environmental impact-additional mandatory and voluntary indicators referred to the declared unit.

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
GWP-GHG - kg CO_2 eq./DU	1.18E-01	3.55E-02	3.06E-03	-	-	-	-	-	-	-	3.14E-03	8.24E-03	-	5.27E-03	-2.16E-03
	The indicator includes all greenhouse gases included in Climate Change -total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.														

Table 10 - LCA results of use of resources referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	6.71E-01	7.17E-03	7.60E-04	-	-	-	-	-	-	-	2.43E-04	1.77E-03	-	1.28E-03	-1.84E-01
Use of renewable primary energy used as raw materials MJ/DU	8.20E-05	1.27E-06	1.16E-07	-	-	-	-	-	-	-	4.88E-08	3.35E-07	-	2.84E-07	-1.25E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	6.71E-01	7.17E-03	7.60E-04	-	-	-	-	-	-	-	2.43E-04	1.77E-03	-	1.28E-03	-1.84E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.67E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.51E-02
Use of non-renewable primary energy used as raw materials MJ/DU	2.10E-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-1.97E-03
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.69E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.70E-02
Use of secondary material kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels- MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels – MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of net fresh water m^3/DU	5.50E-04	5.52E-05	6.15E-04	-	-	-	-	-	-	-	2.21E-06	1.17E-05	-	1.55E-04	-1.03E-04

Table 11 - LCA results of waste categories referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	2.95E-06	1.36E-06	1.94E-08	-	-	-	-	-	-	-	1.18E-07	3.26E-07	-	2.22E-07	-8.10E-08
Non-hazardous (excluding inert) waste disposed kg/DU	3.50E-02	5.22E-02	1.96E-02	-	-	-	-	-	-	-	5.75E-05	6.46E-03	-	1.00E+00	-3.68E-04
Radioactive waste disposed kg/DU	5.37E-06	3.82E-06	6.77E-08	-	-	-	-	-	-	-	2.97E-07	8.44E-07	-	9.64E-07	-2.17E-07

Table 12 - LCA results of output flows referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling kg/DU	-	-	5.66E-03	-	-	-	-	-	-	-	-	-	-	-	-
Materials for energy recovery kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 13 - Information on biogenic carbon content at the factory gate referred to the declared unit.

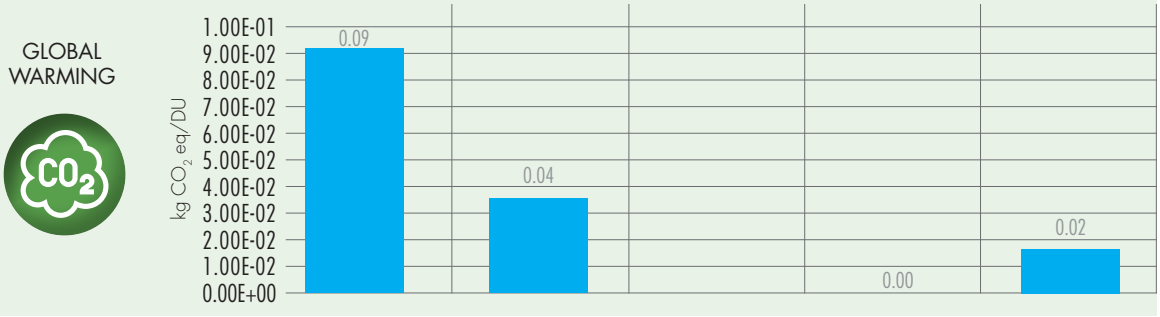
Biogenic Carbon Content**	**Unit**	**Quantity**
Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	3.70E-03

***Note: 1 Kg biogenic carbon is equivalent to 44/12 kg CO_2.*

The images below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of Fugenfüller Advanced.

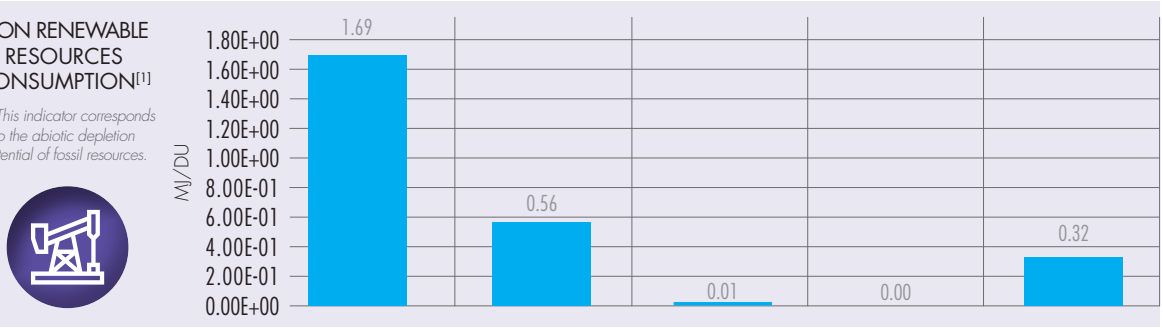
Gypsum-based joint-filler (Fugenfüller Advanced)	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



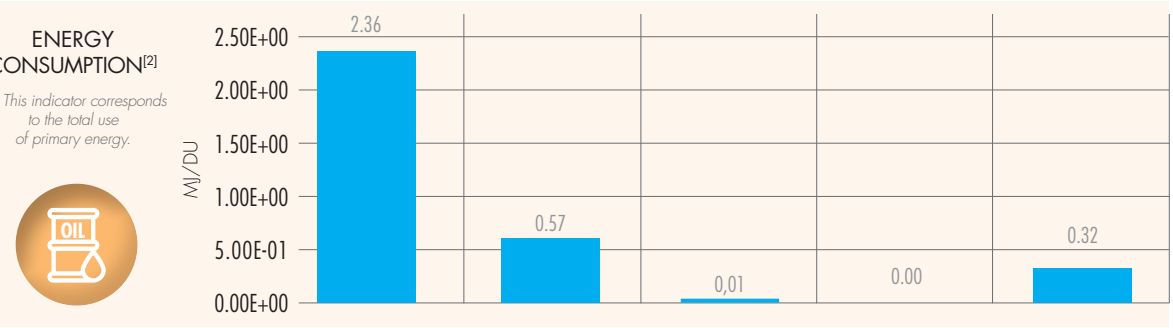
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



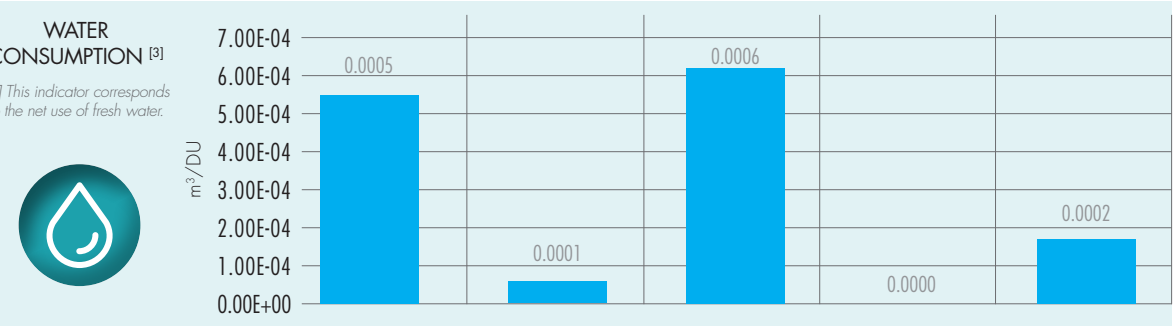
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



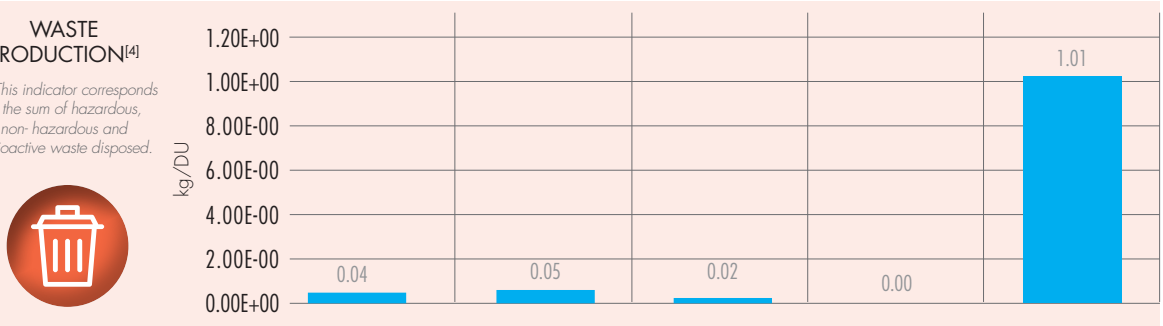
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



8. REFERENCES

Commission Recommendation (EU) 2021/2279
of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations.

Ecoinvent, 2021
Swiss Centre for Life Cycle Assessment, supplier of Ecoinvent v3.8 database (www.ecoinvent.ch).

General principles
EPD International (2021) General Programme Instructions for the International EPD® System. Version 4.0.

LCA study
Life Cycle Assessment della famiglia di stucchi per giunti, prodotti da Knauf di Knauf S.r.l. S.a.s. Gambassi Terme (FI), Italia (22/12/2022).

PCR
PCR 2019:14 version 1.2.5 for Construction Products and construction services. IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä. Swedish Wood Preservation Institute, Swedisol, SCDA. Svenskt Limträ AB. SSAB (2019).

Standards:
EN 15804:2012+A2:2019/AC:2021. "Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products".

ISO 14025:2011-10. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

BS:OHSAS 18001:2007- ISO 45001:2018. Occupational Health and Safety Management

ISO 14001:2015. Environmental management systems - Requirements with guidance for use

ISO 9001:2015. Quality management systems - Requirements

ISO 14040:2006. Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2018. Environmental management - Life cycle assessment - Requirements and guidelines.

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For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Gambassi Terme manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo S.r.l., spin off company of the Scuola Superiore Sant'Anna di Pisa, coordinated by Prof. Francesco Testa and composed of Andrea Fontanella and Fabiana Corcelli.

Le nostre certificazioni

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02/2023

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VOC EMISSION TEST REPORT
Indoor Air Comfort GOLD

6 September 2024

1 Sample Information

Sample name	Fugenfüller Advanced
Batch no.	6:34
Stated production date	01/07/2024
Product type	Wall filler
Sample reception	16/07/2024

2 Brief Evaluation of the Results

Regulation or protocol	Conclusion	Version of regulation or protocol
French VOC Regulation	A+	Decree of March 2011 (DEVL1101903D) and Arrêté of April 2011 (DEVL1104875A) modified in February 2012 (DEVL1133129A)
French CMR components	Pass	Regulation of April and May 2009 (DEVP0908633A and DEVP0910046A)
Italian CAM Edilizia	Pass	DM 23 giugno 2022 n. 256, GURI n. 183 del 6 agosto 2022
ABG/AgBB §	Pass	Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (June 2021)
Belgian Regulation	Pass	Royal decree of May 2014 (C-2014/24239)
EMICODE	EC 1 PLUS	September 2022
Indoor Air Comfort §	Pass	Indoor Air Comfort 9.0 of June 2023
Indoor Air Comfort GOLD §	Pass	Indoor Air Comfort GOLD 9.0 of June 2023
Blue Angel (DE-UZ 198)	Pass	DE-UZ 198 for “Low-Emission Internal Plasters”, January 2019
BREEAM International	Exemplary Level	BREEAM International New Construction v6.0 (2021)
BREEAM NOR	Exemplary Level	BREEAM NOR v6.1 New Construction (2023)
EU Taxonomy	Pass	Regulation (EU) 2020/852 of the European Parliament and of the Council

Full details based on the testing and direct comparison with limit values are available in the following pages
Regarding pass/fail decision rule please see appendix
§ See section 4.4 on deviations

Frederik Foged Haugaard
Analytical Service Manager

Rasmus Verdier
Analytical Service Manager

ICMQ
Certificazione di prodotto

CERTIFICAZIONE DI PRODOTTO
PRODUCT CERTIFICATION

CERTIFICATO N° **CERTIFICATE N°**

P637

AZIENDA ***COMPANY***

NUOVA SUPERSOLAIO S.r.l.

Via Mantova, 10 - 25017 Lonato (BS)

UNITA' PRODUTTIVA ***PRODUCTION UNIT***

Via Mantova, 10 - 25017 Lonato (BS)

OGGETTO DEL CERTIFICATO ***SCOPE OF THE CERTIFICATE***

CONTENUTO DI MATERIALE RICICLATO/RECUPERATO/SOTTOPRODOTTO
Content of recycled/recovered/by-product materials

NORME DI RIFERIMENTO ***REFERENCE STANDARDS***

Regolamento Particolare ICMQ per la certificazione di prodotto relativa a prodotti per le costruzioni con percentuale dichiarata di materiale riciclato/recuperato/sottoprodotto - CP DOC 262 rev. 2
Particular rules for recycled/recovered/by-product content of building products certification – CP DOC 262 rev. 2

SISTEMA DI CERTIFICAZIONE ***CERTIFICATION SYSTEM***

Sistema di Certificazione 3 - ISO/IEC 17067
Certification System 3 – ISO/IEC 17067

PRODOTTI ***PRODUCTS***

L'elenco dei prodotti oggetto della certificazione è allegato al presente certificato
The list of the certified products is annexed to this certificate

PRIMA EMISSIONE	EMISSIONE CORRENTE	SCADENZA
First issue	*Current issue*	*Expiry*
21/07/2023	*21/07/2023*	*21/07/2026*

IL PRESIDENTE E DIRETTORE GENERALE
LORENZO ORSENIGO

Allegato al Certificato di Prodotto P637 del 21/07/2023

Annex to the certificate P637 of 21/07/2023

CONTENUTO MINIMO DI MATERIALE RICICLATO, RECUPERATO, SOTTOPRODOTTO

Minimum content of recycled, recovered, by-product materials

TIPOLOGIA DI PRODOTTO *Product type*	**NOME PRODOTTO**[1] *Product name*		**MATERIALE RICICLATO** *Recycled material*			**MATERIALE RECUPERATO** *Recovered material*	**SOTTO PRODOTTO** *By-product material*	**CONTENUTO TOTALE DI RICICLATO, RECUPERATO, SOTTO PRODOTTO** *Total content of Recycled, Recovered, By-product material*
			Totale *Total*	**Pre-consumer**	**Post-consumer**			
			[%]	[%]	[%]	[%]	[%]	[%]
SOLAI PREFABBRICATI IN CALCESTRUZZO	**LASTRE PREDALLES**	≥	5,0	n.p.d.	n.p.d.	n.p.d.	n.p.d.	**5,0**
	TRAVETTI TRALICCIATI	≥	10,0	n.p.d.	n.p.d.	n.p.d.	n.p.d.	**10,0**
	EUROSOLAIO +	≥	5,0	n.p.d.	n.p.d.	n.p.d.	n.p.d.	**5,0**

Legenda:

n.p.d.: prestazione non dichiarata
n.p.d.: no performance determined

Note:

1) Tutti i prodotti di qualsiasi dimensione, colore e tipo di finitura.
(All products of whith any size and color, type of surface finishing/coating).