TechniStone®
A WILSONART COMPANY

VERIFIED by SCS Global Services
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner

Technistone, s.r.o.
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https://www.technistone.com

Products:

TechniStone® Engineered Stone

Declared Unit

Installed product which provides 1 m^2 of surface

EPD Number and Period of Validity

SCS-EPD-10492
EPD Valid: September 26, 2025 through September 25, 2030

Product Category Rule

Product Category Rule for Construction Products, PCR 2019:14. International EPD System, v. 2.0.1. Published 06-05-2025. Valid until 04-07-2030.

Program Operator

SCS Global Services
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An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see. https://www.scsglobalservices.com/certified-green-products-guide

SCSglobal SERVICES

Declaration owner:	Technistone, s.r.o.
Address:	Bratri Stefanu 1070/75a Slezske Predmesti, Hradec Kralove, Czech Republic
Declaration Number:	SCS-EPD-10492
Declaration Validity Period:	September 26, 2025 through September 25, 2030
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Connor Mikre and Asifur Rahman, SCS Global Services
LCA Software and LCI database:	OpenLCA 2.3.0 software and the Ecoinvent EN 15804 v3.10 database
Product's Intended Application:	Engineered Stone Products
Markets of Applicability:	Global
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Gate with Options
LCIA Method and Version:	EN 15804:2012+A2:2019/AC:2021
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Part A Product Category Rule:	Product Category Rule for Construction Products, PCR 2019:14. International EPD System, v. 2.0.1 April 07, 2030.
Part A PCR Review conducted by:	The Technical Committee of the International EPD System.
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025:2006, 14040, 14044, and EN 15804:2012+A2:2019/AC:2021. The owner of the declaration shall be liable for the underlying information and evidence; SCS shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence supplied or made available to SCS.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. EPDs within the same product category but published in different EPD programmes, may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same first-digit 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 identical scope in terms of included life-cycle stages (unless the excluded life-cycle stage is demonstrated to be insignificant); apply identical impact assessment methods (including the same version of characterisation factors); and be valid at the time of comparison.*

When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

The owner of the declaration shall be liable for the underlying information and evidence; SCS shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence supplied or made available to SCS.

Abbreviations

EPA = Environmental Protection Agency
EPD = Environmental Product Declaration
GHG = Greenhouse Gas
GLO = Global
LCA = Life Cycle Assessment
LCI = Life Cycle Inventory
LCIA = Life Cycle Impact Assessment
PCR = Product Category Rule
RER = Europe
RoW = Rest of World
UN CPC = United Nations Central Product Classification

1. Declaration Owner

1.1 TECHNISTONE

Technistone, s.r.o. is a producer of premium quality engineered stone surfaces founded in 1991 and headquartered in the Czech Republic. The company specializes in the development and manufacture of compact, non-porous slabs made from natural raw materials, bound with high-quality polyester resins.

Technistone operates an advanced production facility that utilizes Breton technology and rigorous quality, and environmental management systems certified in accordance with ISO 9001 and ISO 14001. With distribution networks across Europe, North America, and Asia, and subsidiaries in Germany, Poland, and the United Kingdom, Technistone exports approximately 97% of its production to international markets.

Technistone is a modern company with a clear vision of a sustainable future. Our goal is constant innovation, improving our production processes, and a responsible approach to the environment. People are an important part of our success: our employees, customers, suppliers, partners, and the community in which we work.

Our values are reflected in our approach to sustainability, which is based on three pillars — Environmental, Social, and Governance — known as ESG.

Since 2019, Technistone has been a subsidiary of Wilsonart® Engineered Surfaces, a global leader in the production of decorative materials for interiors. As a member of the Wilsonart group of companies, we uphold Wilsonart's ESG initiatives and strategies. Our mother company regularly publishes detailed reports on sustainability that reflect the commitment of the entire group.

2. Product Description

2.1 PRODUCT DESCRIPTION

TechniStone® material is composed of high-quality raw materials like feldspar, non-quartz silicates, polishable natural rocks, siliceous sand, particles of clear glass and mirror chips, and a small dose of pigments. Everything is bonded together with high-quality polyester resin and machined into highly durable slabs.

Thanks to carefully selected raw materials and original Breton production technology, TechniStone® achieves excellent properties, especially high strength and compactness.

TechniStone® surfaces offer:

- High mechanical strength and durability.
- Low water absorption and resistance to staining.
- Hygienic, non-porous surfaces suitable for direct food contact.
- A wide range of colors and patterns inspired by natural stone and contemporary design trends.

The relevant UN CPC scheme is 37690 (Other worked monumental or building stone and articles thereof; other artificially coloured granules, chippings and powder of natural stone; articles of agglomerated slate).

TechniStone® current range of designs is available at:
https://www.technistone.com/int/color-range/.

Surface Finishes

The standard surface finishes are polished and matt. Special surface finish is terra.

The polished finish (P) is a compact, absolutely smooth surface with high gloss, essentially non-porous, with intense color. The material is polished with abrasives of increasing fineness until a mirror finish is achieved. The degree of glossiness depends on the type of polishing material used.

The matt finish (M) is a finely textured, low-gloss surface. The degree of texture depends on the size of the grains used to produce the surface and is noticeable to the touch. In the first phase the finish is prepared with abrasives. After this basic preparation, a second phase of brushing is performed to achieve the desired texture and matt look.

Terra (T) is a specific textured surface with a fine 3D matt finish.

The relevant UN CPC scheme is 37690 (Other worked monumental or building stone and articles thereof; other artificially coloured granules, chippings and powder of natural stone; articles of agglomerated slate).

Product Designs

TechniStone® surfaces are available in a wide variety of designs to suit different styles, from minimalist and timeless to bold and expressive. The full color range is divided into three main color groups, as described below:

Table 1. *The main color groups of TechniStone® surfaces*

Designs	Description
Light	Clean, bright colors with a subtle structure — ideal for minimalist and modern interiors
Dark	Deep, elegant tones with simple patterns — perfect for a refined and balanced look
Unique	Visually rich styles — including marble-inspired veined patterns and concrete looks

In addition to color, each product is also classified based on the structure and appearance of the surface:

Table 2. *Descriptions of TechniStone® product structures*

Structure	Description
Solid	Uniform structure with a clean, single-color appearance
Grain	Grainy material with visible structure, where the particles create a textured look
Granite	Mixture of larger particles of various sizes, inspired by natural granite or terrazzo
Short Vein Full Slab	Short veins evenly spread across the whole surface of the slab
Short Vein Shaped	Short veins grouped into more concentrated bands
Concrete	Surface with patina-like structure and a cloudy, mottled effect — typical of an industrial style
Sparkling	Material with shiny mirror and glass chips that create a sparkling, eye-catching finish
Natural Look	Complex structure combining different techniques and effects to create a sophisticated natural appearance
Plotter Long Lines	Pattern characterized by long, fine veins crossed with shorter bands of veining
Bold Calacatta	Strong, wide veins inspired by natural calacatta marble, for a bold and dramatic effect
Thin Calacatta	Branching pattern with fine contrasting lines, inspired by natural calacatta marble

Detailed information on Technistone's current range of colors and designs is available at: www.technistone.com/int/color-range.

Product Composition

TechniStone® engineered stone is produced from inert materials (filler; granulates – crushed polishable rock, feldspar, crushed mirrors, crushed clear glass, siliceous sand, non-quartz silicates, etc.), a binder (polyester resin with additives), and color pigments.

TechniStone® is categorized into five basic production groups according to the predominant granulate, as shown below

Table 3. *Production groups of the TechniStone® products*

Production Group	Type of Granulate
Crystal	Clear Glass / Non-quartz Silicates / Feldspar / Siliceous Sand
Granite	Polishable Natural Rocks / Non-quartz Silicates / Feldspar / Siliceous Sand
Marble	Marble / Non-quartz Silicates / Siliceous Sand
Sand	Clear Glass / Feldspar / Non-quartz Silicates / Siliceous Sand
Mirrors	Mirror Chips / Clear Glass / Feldspar / Non-quartz Silicates / Siliceous Sand

Product Sizes

TechniStone® material is produced in slabs, tile formats, and special formats.

Slabs - the basic machined product, produced in the form of slabs or plates with various thicknesses and surface finishes, and guaranteed usable areas:

- Basic jumbo: usable area 4,94 sq. m. (i.e. combination of width and length 318,5 x 155 cm) with possible tolerance,
- Super jumbo: usable area 5,12 sq. m. (i.e. combination of width and length 320 x 160 cm) with possible tolerance,
- Super plus jumbo: usable area 5,45 sq. m. (i.e. combination of width and length 330 x 165 cm) with possible tolerance.

Tiles – cut from basic slabs into tile formats of various thicknesses, sizes (max. 600 x 600 mm, bigger sizes are large formats), and surface finishes:

- The basic sizes of the tile formats are 30x30 cm, 60x30 cm, and 60x60 cm.
- Large formats — products with at least one side longer than 60 cm up to minimum size of the slab.
- Special products — these are products with at least one side shorter than 30 cm.

The products can be produced in thicknesses ranging from 10 to 30 mm: 10 mm for tiles, 12, 20 and 30 mm for slabs. Non-standard shapes, dimensions, sizes and physical-mechanical properties of the product can be agreed upon between the supplier and the customer.

2.2 RECOMMENDED USES

TechniStone® engineered stone is the ideal material for kitchen countertops and vanity tops. It can also be used for small or large-sized wall and floor tiles, interior components, construction elements, furniture, and accessories.

TechniStone® is produced in large size slabs in several thicknesses, which have a wide range of applications in both the private and commercial sectors. Technistone' s manufacturing process conforms to strict European standards that apply to both raw material inputs and the final product.

TechniStone® is durable, hygienic, and suitable for direct food contact. The final product does not contain any free volatile organic compounds (VOC). There are no risks associated with finished TechniStone® material that are identified in EU classification, labeling, and packaging (CLP) regulations.

All TechniStone® engineered stone products are suitable for use as interior components. The size of the product chosen must always be considered in relation to its physical-mechanical characteristics and the system to be used for mounting and

installation. Regarding resistance to aggressive influences (e.g., exposure to chemicals), special consideration for product characteristics and the surrounding environment is extremely important. The surface finish of the product should be chosen to correspond with the expected usage of the product.

2.3 BASIC USAGE

TechniStone® products are recommended for interior use only. They easily withstand common household cleaning substances as well as foods, beverages, and spices used in cooking.

Nevertheless, the gloss and color of the product may be affected by exposure to some very strong chemicals. In particular, the surface of the product is not resistant to strong alkalis (NaOH, KOH), strong acids (HCl, H_2SO_4) and cannot withstand exposure to hydrofluoric acid (HF) even for a short time. Some strong artificial coloring substances (organic pigments) can change the color of the product in places.

Figure 1. *Example product images of the Engineered Stone Products.*

2.4 FURTHER INFORMATION

Further information on the product can be found on the manufacturer's website at https://www.technistone.com.

3. Scope of the Study

3.1 FUNCTIONS OF THE PRODUCT SYSTEM

TechniStone® Engineered Stone Products provide both large and small surfaces and are used in indoor settings, for commercial, industrial, and residential construction projects. They are categorized into six basic groups in this Environmental Product Declaration, based on the type of granulate used:

Table 4. *EPD groups of the TechniStone® products*

Group No.	EPD Group	Production Group
1	Feldspar / Cristobalite / Siliceous Sand	Crystal / Sand
2	Feldspar / Cristobalite / Glass / Siliceous Sand	Crystal / Sand
3	Feldspar / Cristobalite / Glass / Mirrors / Siliceous Sand	Mirrors / Crystal
4	Feldspar / Cristobalite / Mirrors / Siliceous Sand	Crystal / Mirrors
5	Feldspar / Cristobalite / Natural Stone/ Siliceous Sand	Crystal / Granite
6	Feldspar / Cristobalite / Natural Stone / Glass/ Siliceous Sand	Granite

Following guidance provided in the PCR, a declared unit of installed product which provides 1 m^2 of surface is used. The results presented in this report are based on the weighted average thickness for each of the six TechniStone® products, calculated according to the production output of the manufacturing facility over the period of data collection. LCI and LCIA results for all product thicknesses are reported in Appendix A.

The reference flow for the modeling of this system, along with each of TechniStone's product's density, average weighted thickness, and the equivalent mass of the reference flow for each TechniStone® product, is shown in Table 5 below.

Table 5. *Declared unit and technical specification of each type of TechniStone® product.*

Parameter	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Declared Unit (m^2)	1	1	1	1	1	1
Reference Flow (kg)	52	53	52	54	49	41
Density of reference flow (kg/m^3)	2,294	2,356	2,359	2,375	2,394	2,484
Thickness of reference flow (mm)	22.5	22.4	21.9	22.6	20.4	16.3

3.2 Product Variations

TechniStone® engineered stone products are available in a range of thicknesses, as indicated in Tables 6-11 below.

Table 6. *Product weight of Group 1 surface product by product thickness.*

Thickness (mm)	Product weight (kg/m^2)
22.5 (weighted average)	52
12	28
20	46
30	69

Table 7. *Product weight of Group 2 surface product by product thickness.*

Thickness (mm)	Product weight (kg/m^2)
22.4 (weighted average)	53
12	28
20	47
30	71

Table 8. *Product weight of Group 3 surface product by product thickness.*

Thickness (mm)	Product weight (kg/m^2)
21.9 (weighted average)	52
12	28
20	47
30	71

Table 9. *Product weight of Group 4 surface product by product thickness.*

Thickness (mm)	Product weight (kg) /m^2
22.6 (weighted average)	54
12	29
20	48
30	71

Table 10. *Product weight of Group 5 surface product by product thickness.*

Thickness (mm)	Product weight (kg/m^2)
20.4 (weighted average)	49
12	29
20	48
30	70

Table 11. *Product weight of Group 6 surface product by product thickness.*

Thickness (mm)	Product weight (kg/m^2)
16.3 (weighted average)	41
12	30
20	50

3.3 PRODUCT MATERIAL COMPOSITION

The engineered stone surfaces include natural stone, quartz, feldspar, polyester resin, and other additives. The material composition of each of the engineered stone products is shown in Table 12 based on technical specifications provided by TechniStone. There are no known ingredients which are in the list of the European Chemicals Agency Candidate List of Substances of Very High Concern (SVHC).

Table 12. *The percentage material composition by weight of each TechniStone® engineered stone surface products. All percentages shown are rounded to three significant figures.*

Raw Material	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Natural Stone	0.00%	0.00%	0.00%	0.00%	31.4%	38.4%
Feldspar	5.78%	10.7%	10.8%	0.92%	8.23%	14.0%
Silica Sand	26.2%	25.6%	24.6%	25.4%	17.6%	11.5%
Glass	0.00%	18.2%	27.7%	0.00%	0.00%	7.61%
Mirrors	0.00%	0.00%	13.3%	2.83%	0.00%	0.00%
Quartz	55.6%	34.6%	14.1%	59.8%	32.9%	19.5%
Polyester Resin	11.4%	9.94%	8.40%	10.7%	9.10%	8.27%
Additives	0.33%	0.29%	0.24%	0.29%	0.24%	0.22%
Pigments	0.74%	0.65%	0.84%	0.04%	0.52%	0.49%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Following the PCR, biogenic carbon content of the product and packaging must be declared if the biogenic carbon containing material is 5% or more of the total mass of the product and packaging, respectively. As the TechniStone® engineered stone products are composed of inorganic materials and are packaged using polyethylene film, there is no biogenic carbon content in either the product or the packaging.

3.4 SYSTEM BOUNDARY

The system boundary includes the cradle-to-gate with options life cycle of TechniStone® engineered stone products, which includes all inputs required and outputs generated from each life cycle stage (production, construction, installation, and end-of-life (EOL). Each life cycle stage is subdivided into information modules. This module approach has been adopted by the PCR. The modules are summarized in Table 13 and each module with description, geography and share of data are provided in Table 14. A flow diagram illustrating the processes involved within each life cycle module is shown in Figure 2.

Table 13. *A summary of the life cycle phases included in the TechniStone® engineered stone products system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Benefits and loads beyond the system boundary
x	x	x	x	x	x	MND	MND	MND	MND	x	x	x	x	x	x	x

X = Module Included | MND = Module Not Declared

Table 14. *Description of the life cycle phases included in the TechniStone® engineered stone products system boundary.*

Module	Module Description	Geography	Share of specific data
A1	Raw Material extraction and upstream production, which includes generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport; raw material extraction and processing, as well as processing of secondary material inputs (e.g., recycled or reused materials)	Global	>90%
A2	Transport to factory, which covers transport of raw materials and other inputs to the factory and internal transport	Global	
A3	Manufacturing, which includes water used in manufacturing the product; the extraction and upstream production, transport to factory, and manufacturing of product packaging; transport and treatment of all waste generated at the manufacturing facility	Czech Republic	
A4	Transport to the building site, includes transport from the manufacturing facility to a central or intermediate storage site (if relevant) and transport to the construction site	Global	-
A5	Installation covers installation of the product into any type of construction works. This includes any wastage of the product that occurs during installation (including the A1 to A4 inputs required for that wastage). The transport and treatment of product packaging waste. And the manufacture and transportation of ancillary materials, as well as energy or freshwater consumed, to install the product at the construction site.	Global	-
B1	Use stage, which would account for impacts occurring through use of the product. There is no resource required for the use of TechniStone quartz surface products.	Global	-
B2 – B5	Maintenance, repair, replacement, and refurbishment; When installed correctly, quartz surface products require no maintenance, repair, replacement, or refurbishment during the lifetime of product, which is consistent with a building lifetime.	MND	-
B6 – B7	Operational energy and water use. There is no resource required for the use of TechniStone quartz surface products.	Global	-
C1	Deconstruction/demolition, which includes dismantling or demolition, of the construction product from the construction works and the energy use for this, including initial on-site sorting of the materials	Global	-
C2	Transport to waste processing or disposal, which includes the transportation of the discarded construction product as part of the waste processing, for example to a recycling site and transportation of waste, to final disposal	Global	-
C3	Waste processing for generation of secondary materials (i.e. recycling)	Global	-
C4	Disposal of waste, which includes physical pre-treatment and management of the disposal site, including provision and transport of all materials, products and related energy and water use	Global	-
D	Supplementary information about the potential net benefits from reuse, recycling and energy recovery beyond the system boundary of the studied product system	Global	-

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

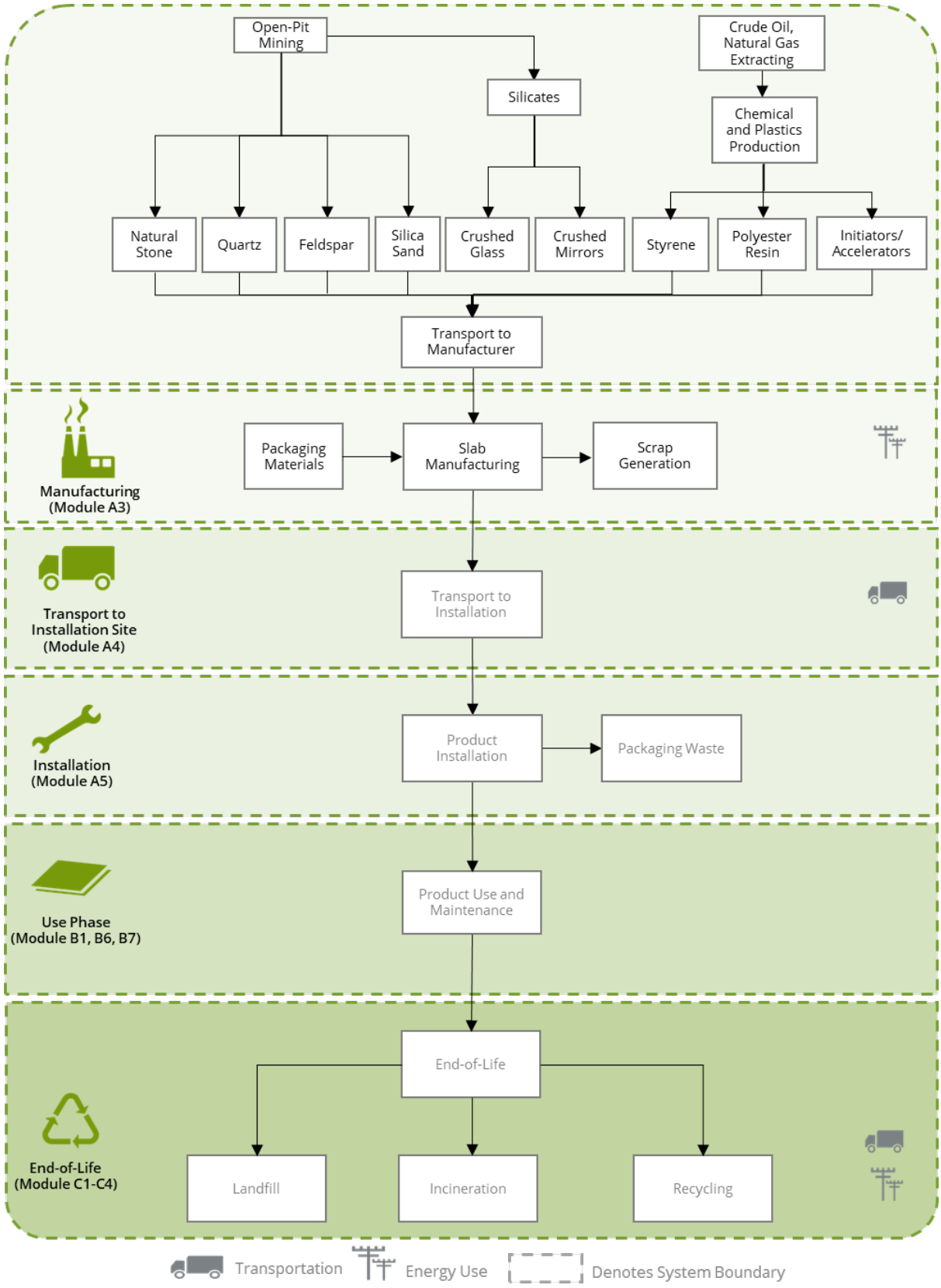

Figure 2. *Flow diagram representing the major processes over the life cycle of the engineered stone products.*

4. Technical Information and Scenarios

4.1 LIFE CYCLE MODULES

Raw Material Extraction, Transport, & Manufacturing (A1-A3)

These modules include the steps required to extract, process, and transport the raw materials used to the Hradec Králové, Czech Republic manufacturing facility. In the A1 stage, raw material extraction accounts for the additional materials required due to the scrap generated during manufacturing, stage A3. Transport of the raw materials to the manufacturing facility is done by freight truck, rail, and cargo ship. The related technical information for the transport of the raw materials are included in the tables below. The A1 stage also includes the upstream impacts associated with generation of electricity, fuel and heat.

Table 15. *The weight-distance transported per declared unit and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the A2 module of the TechniStone® engineered stone products.*

Transport Specifications	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
EURO 4, 16-32 MT Freight Lorry						
Weight-distance per declared unit (metric ton*km)	34.0	28.5	29.3	16.8	20.3	26.1
Capacity Utilization (%)	% assumed in the Ecoinvent database					

Table 16. *The weight-distance transported per declared unit and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the A2 module of the TechniStone® engineered stone products.*

Transport Specifications	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
43,000 MT Sea Container Ship						
Weight-distance per declared unit (metric ton*km)	78.6	72.4	24.6	58.3	12.0	5.23
Capacity Utilization (%)	% assumed in the Ecoinvent database					

Table 17. *The weight-distance transported per declared unit and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the A2 module of the TechniStone® engineered stone products.*

Transport Specifications	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
1,000 Gt Freight Train						
Weight-distance per declared unit (metric ton*km)	12.8	13.3	5.89	19.7	3.17	1.02
Capacity Utilization (%)	% assumed in the Ecoinvent database					

The processing steps used to manufacture the product are described below:

- Raw materials delivered in bags or silo trucks are inspected before being used in production. Glass shards, mirrors shards, and polishable rocks are inspected, crushed, and sorted on sieves directly at the TechniStone facility.
- Granulates, fillers, and pigments are added to mixing machines with polyester resin. The prepared mixture is transported to special spreading equipment and poured either into a rubber mold or between two paper sheets before being evenly spread.

- Using vibration, a special vibro-press machine mixes the materials in a vacuum to eliminate any gaps or bubbles in the slab. The slab is loaded into a curing oven where it is heated on both sides to the appropriate temperature, leading to the setting of the polyester resin through polymerization.
- The slab is removed from the curing oven and cooled down in the cooling tower.
- The slab is measured and calibrated to the correct dimensions.
- Final surface treatment is completed using a polishing machine and other special tools to provide a polished, matte, or honed surface depending on customer demands.
- The finished product is packaged.

Production

The Technistone manufacturing process conserves natural resources, minimizes waste, and prioritizes renewable energy sources. It follows strict European standards that are applicable to both raw material inputs and the final product.

ISO 14001 certification confirms that we have put into place an effective system of environmental management and are constantly reducing our impact on the environment.

TechniStone® products are produced in large size slabs in several thicknesses, which have a wide range of applications in both the private and the commercial sectors.

The production process consists of two basic steps - the production of the semi-finished product and then its final processing. The manufacturing process of semi-finished products involves preparation of raw material, mixing, spreading, then pressing and finally curing. Final processing involves calibrating to the required thickness and the polishing of slabs. Eventually, to produce tiles, the slabs are cut down.

Raw material preparation: Raw materials used for production are carefully inspected, graded and cleaned. Glass, mirrors and polishable natural rocks are crushed in a crusher and sorted through sieves to separate the required fractions. Raw materials are stored in silos, boxes, tanks, ISO-tanks, barrels, big bags or paper bags.

Mixing and spreading: According to the TechniStone® proprietary formula, raw materials flow into the mixing machines, where chips (granulates), fillers and pigments are mixed with additive polyester resin. The resulting mixture is transported to special spreading equipment. The mixture of material is either filled into a rubber mold or between two paper sheets. Next, it is evenly spread. The whole process is computerized to secure the thickness of the final slab.

Pressing and curing: A special vibro-press machine compresses the mixed materials in a vacuum environment into a compact mass using vibration. The resulting slab is free of any gaps or bubbles between individual particles. The soft slab is carefully put into a curing kiln, where it is heated on both sides to the appropriate temperature. This leads to the polymerization of the polyester resin in the slab and its complete curing. The slab is then cooled in a cooling tower.

Calibrating and polishing: The slabs are measured, calibrated for the required thickness, and finalized. The product surface is then finished step by step in a polishing machine using special tools. Based on the customer's requirements, surface treatment is performed to obtain a polished, matt, or honed surface finish. Final processing is carried out underwater and recapture of the water used in the operation is an integral part of the production process.

Tile cutting: For tiles, the slabs can be cut to the most common sizes (30 x 30, 30 x 60, 40 x 40, 60 x 60 cm). Tiles edges can be beveled up to size 60 – 61 cm.

Quality control: All slabs are inspected and sorted according to quality by trained personnel. Each slab is measured by objective color measurement technology to determine its exact color shade. The result is a high quality product and satisfied customers.

Storage and Expedition: Self-adhesive foil is applied to the front side of the slabs. Tiles are packed in cardboard and stacked on a pallet. The pallet is wrapped in foil. Finally, the slabs and tiles are safely stored in a warehouse and dispatched at regular intervals to customers.

The electricity and natural gas are recorded at a facility level, which are then allocated to each TechniStone® product using mass-based allocation. The electricity used at the Hradec Králové manufacturing facility is assumed to come from the Czech grid and is modeled using 2020 data from the International Energy Administration within the Ecoinvent database. Table 18 includes the mass of packaging required to package each type of engineered stone surface product. Table 19 includes the upstream transport parameters for the packaging used for each product.

The upstream electricity used in the manufacturing process is **0.63** kg CO_2-eq/kWh (using the supplementary GWP-GHG indicator).

Table 18. *The quantity of packaging consumed to manufacture each declared unit as well as the mass of waste generated per declared unit.*

Inputs and Outputs	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Self-adhesive Foil Packaging (kg)	$8.37x10^{-2}$	$8.37x10^{-2}$	$8.37x10^{-2}$	$8.37x10^{-2}$	$8.37x10^{-2}$	$8.37x10^{-2}$

Table 19. *The weight-distance transported per declared unit and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the packaging used in the A3 stage of the TechniStone® products.*

Transport Specifications	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
EURO 4, 16-32 MT Freight Lorry						
Weight-distance per declared unit (metric ton*km)	$6.23x10^{-2}$	$6.23x10^{-2}$	$6.23x10^{-2}$	$6.23x10^{-2}$	$6.23x10^{-2}$	$6.23x10^{-2}$
Capacity Utilization (%)	% assumed in the Ecoinvent database					

Trucks are assumed to transport the waste to a landfill 100 kilometers away and come back empty. The truck transport parameters for the waste are provided in Table 20.

Table 20. *The one-way distance and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the waste transported from TechniStone facility to a nearby landfill.*

Transport Specifications	
EURO 4, 16-32 MT Freight Lorry	
One-way Distance (km)	100
Capacity Utilization (%)	% assumed in the Ecoinvent database
Return transport	Empty return

Transport to Installation Site (A4)

This module includes all transport from the manufacturing facility to the installation site. This module is based on primary global distribution data provided by TechniStone. The one-way distance, weight-distance, and capacity utilization of the truck, rail, and ship transport modeled in this module is shown below, in Table 21.

Table 21. *The average one-way distance, capacity, and volume capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for the A4 stage of TechniStone® products.*

Transport Specifications	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
EURO 4, 16-32 MT Freight Lorry						
One-way average Distance (km)	1,260	1,260	1,260	1,260	1,260	1,260
Weight-distance per DU (metric ton*km)	65.2	66.6	65.3	67.9	61.6	51.2
Capacity Utilization (%)	% assumed in the Ecoinvent database					
Return transport	None. Vehicles are deployed elsewhere following transport of products.					
43,000 MT Sea Container Ship						
One-way average Distance (km)	3,420	3,420	3,420	3,420	3,420	3,420
Weight-distance per DU (metric ton*km)	$5.18x10^{-2}$	$5.29x10^{-2}$	$5.19x10^{-2}$	$5.39x10^{-2}$	$4.89x10^{-2}$	$4.07x10^{-2}$
Capacity Utilization (%)	% assumed in the Ecoinvent database					
Return transport	None. Vehicles are deployed elsewhere following transport of products.					

Installation (A5)

Installation of the TechniStone® products is done manually and requires the use of both sealant and adhesive. In the absence of quantitative guidance from TechniStone on installation, consumption of sealant and adhesive were each assumed to be 1% of the product's mass. Installation of the product does not require electricity or water and does not generate product waste. As per the manufacturer, The amount of product loss at installation for residential use is assumed as 5%. It is less than 30% as suggested by the PCR because the fabricators use the rest for cutting samples, and cutting small slabs (e.g. for vanity tops, windowsills, small tables, etc.).

Impacts from the production, transport and disposal of waste material associated with installation are included in this stage in addition to impacts from packaging disposal. The packaging disposal rates are taken from the UL Part A v4.0 and v3.2 packaging statistics by material and are averaged across the geographic regions to which the product is distributed. Transportation for end-of-life scenarios was modeled using the assumption of 100 km from the point of product use to a landfill, material recovery center, or waste incinerator. The same type of truck transport used in module A4 is used in module A5 with an assumed one-way distance of 100km to a landfill facility. Table 22 includes the parameters used within the A5 module.

Table 22. *The mass of packaging disposed per declared unit.*

Inputs and Outputs	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Mass Product Recycled Landfilled per declared unit (kg)	$1.89x10^{-2}$	$1.89x10^{-2}$	$1.89x10^{-2}$	$1.89x10^{-2}$	$1.89x10^{-2}$	$1.89x10^{-2}$
Mass Product Packaging Landfilled per declared unit (kg)	$5.08x10^{-2}$	$5.08x10^{-2}$	$5.08x10^{-2}$	$5.08x10^{-2}$	$5.08x10^{-2}$	$5.08x10^{-2}$
Mass Product Packaging Incinerated per declared unit (kg)	$1.40x10^{-2}$	$1.40x10^{-2}$	$1.40x10^{-2}$	$1.40x10^{-2}$	$1.40x10^{-2}$	$1.40x10^{-2}$

The final TechniStone® product is flat slabs of engineered (agglomerate) stone of various thicknesses, sizes and surface finishes (gloss, matt, terra), which are then fabricated by cutting and machining from the basic size of the slab and fulfill various purposes in the interior: kitchen countertops and bathroom vanity tops (production in stone workshops), flooring, staircases, or wall covering.

Fabrication and installation should be carried out by professional stonemasonry workshops or other certified and trained partners.

Before processing TechniStone® material, fabricators are obliged to familiarize themselves with the documents related to the correct and safe method of processing the TechniStone® material on the website of Technistone, s.r.o. at this link: https://documents.technistone.com/technical-service.

The dust produced during the TechniStone® manufacturing and fabrication processes contains respirable crystalline silica (SiO_2) particles of less than 10 µm in diameter. The content of crystalline silica in Technistone products varies depending on the specifics of the natural stone used to produce them. Although following the rules for proper processing of slabs in fabricators' workshops (including wet cutting, mask wearing, and other protective measures) eliminates the health risks resulting from inhaling dust containing natural crystalline silica, our goal is to constantly reduce the natural crystalline silica content in our products. Some of our products contain less than 5 percent natural crystalline silica content. TechniStone® material is a safe product when properly handled during processing and fabrication, just like any other product made from natural stone. Exposure of workers to dust should be minimized by performing certain operations underwater. Avoid cleaning with compressed air.

For further information, see the instructions in the Guide to Good Practice for Fabrication published by Technistone on its website: www.technistone.com

You can obtain further information in http://www.nepsi.eu/ and in the Guide to Good Practice on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing It, published by the European Network for Silica (NEPSI). The Worldwide Agglomerated Stone Manufacturer's Association (ASTA) is voluntarily participating in the NEPSI social dialogue agreement on respirable silica.

If dust-generating operations are unavoidable at the installation site, use saws and abrasive tools with an integrated water supply or an efficient integrated dust extractor with a HEPA filter.

As in any place where professional or technical work is carried out, no person other than a professional worker may be present in the area during such work.

For end users and normal everyday use in the form of countertops and other interior installations, TechniStone® products are completely safe materials, as attested by the above-mentioned certifications.

Use Phase (B1-B7)

Modules B1 to B7 includes any impacts from product use. The TechniStone® engineered stone products are not expected to have any impact in the use stage. These include:

- B1: There is no resource requirements associated with use of TechniStone® engineered stone products. The default environmental impacts are assumed to be zero.
- B2: Module not declared.
- B3: Module not declared.
- B4: Module not declared.
- B5: Module not declared.
- B6: TechniStone® engineered stone products require no energy use during its operation and the environmental impact are assumed to be zero.
- B7: TechniStone® engineered stone products require no water use during its operation and the environmental impact are assumed to be zero.

Demolition (C1)

This module includes the demolition of the engineered stone products from the building, including on-site sorting of the materials. Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts, hence, it is assumed that no resource use is required for this module.

Waste Transport (C2)

Transport of the waste material at end-of-life is assumed to be 130 km and 80 km for incineration and non-incinerator waste treatment pathways respectively based on Table 4 of the PCR. The truck transport fuel and capacity utilization are also according to Table 4 of the PCR.

Waste Processing (C3)

This module includes any collection of waste fraction and processing required before the product can be reused, recycled, or recovered for energy. No waste processing is required for the disposal of the product to landfill, recycle, or incineration, thus no resource use is required for this module.

Waste Treatment (C4)

In the absence of primary data on end-of-life disposal of the engineered stone products, an average disposal scenario was designed based on the primary regions in which the stone products are sold. Regional statistics for the disposal pathways are modeled in line with UL Part A v4.0. This study assumed all of the recycled product is processed into gravel for use in road construction, with global average recycling rates based on UL Part A v4.0.

Table 23. *End-of-Life summary for TechniStone® stone products.*

End-of-life		Unit	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Assumptions for scenario development			Average disposal scenario based on waste treatment statistics from primary regions products sold into					
Collection process	Collected separately	kg	0.00	0.00	0.00	0.00	0.00	0.00
	Collected with mixed construction waste	kg	52	53	52	54	49	41
Recovery	All scenario	kg	n/a	n/a	n/a	n/a	n/a	n/a
Disposal	Recycle	kg	7.11	7.26	7.12	7.40	6.72	5.58
	Landfill	kg	42.93	43.83	42.99	44.68	40.55	33.69
	Incineration	kg	1.68	1.72	1.68	1.75	1.59	1.32
Removals of biogenic carbon (excluding packaging)		kg CO_2	n/a	n/a	n/a	n/a	n/a	n/a

Benefits and loads beyond the product system boundary (D)

Information module D aims at transparency for the environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system. Although the thermosetting of raw materials during manufacturing prohibits the recycling of the product into engineered stone surfaces, the crushing of the product into gravel for use in road construction can be assumed to offset some production of virgin gravel beyond the product system boundary.

The net burden or credit for the product is estimated using the end-of-life formulae in Annex D of EN 15804. No specific data are available regarding the recycling rate of materials of the TechniStone® products at end-of-life. End-of-life disposal pathways necessary for Module D calculation are modeled by material according to global average recycling rates based on UL Part A v4.0. The benefits of recycling the product can be assumed to offset some production of gravel beyond the product system boundary. Resource use and emissions associated with the processing of the recycled materials are included and modeled using Ecoinvent data. Energy recovery from incineration of the waste material is assumed negligible.

The specific EOL recycling rates and the relevant ecoinvent process datasets used for each material are summarized in Table 23. Datasets representing secondary gravel material are modified to contain 100% scrap material input upstream.

Table 24. *Modeling parameters for Module D.*

Material	Recycled Content	EOL Recycling Rate	Secondary Material	Primary Material
Product	0%	14%	rock crushing | rock crushing | EN15804GD, U - RoW* *Including electricity consumption and particulate emissions from: limestone production, crushed, washed | limestone, crushed, washed | Cutoff, U	gravel production, crushed | gravel, crushed | EN15804GD, U - RoW

Additional information on release of dangerous substances to indoor air, soil, and water during the use stage

This product is Greenguard Gold certified by UL and SCS Indoor Advantage Gold by SCS Global Services.
During the use phase, the product contributes to a healthier indoor environment by emitting very low levels of volatile organic compounds (VOCs), meeting criteria suitable for sensitive settings such as schools and healthcare facilities.

No Volatile Organic Compounds Released into the Atmosphere

TechniStone® engineered stone countertops and surfaces do not release ANY volatile substances into the air and are therefore suitable for use indoors (houses, schools, offices, hospitals...). They do not cause any adverse reactions with prolonged use.

TechniStone® products are GREENGUARD and GREENGUARD GOLD certified. Product compliance is determined by an accredited indoor air quality testing laboratory using the Certification Program Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers. They conform to the UL 2818-2022 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.
TechniStone® products are SCS Indoor Advantage certified. Product compliance is determined by using the reported emission factors calculated during laboratory testing and applying standard modeling parameters for office, classroom, and/or residential environments. They conform to the California Department of Public Health Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Test Chambers (CA1350).

Table 25. *List of certifications on indoor air quality for TechniStone® products*

Certification / Institution	Certified by / Published by	Standard	Certificate / Database
GREENGUARD	UL	UL 2818 – 2022	GREENGUARD Certificates (Technistone)
GREENGUARD GOLD	UL	UL 2818 - 2022 Gold	GREENGUARD GOLD Certificates (Technistone)
SCS Indoor Advantage™ Gold	SCS Global Services	Section 01350 of California Department of Public Health Specifications, v1.2-2017	SCS Indoor Advantage™ Gold Certificate (Technistone)

Environmental Friendliness and Sustainability

TechniStone® products conform to SCS Recycled Content Standard V7-0 for a minimum 20%, 30%, 40%, or 70% pre-consumer recycled raw materials content (mirrors, glass, feldspar filler and natural stone content). Material quantification and mass-balance calculations are based on dry weight. In that way, Technistone is helping to recycle waste produced by others.

Table 26. *List of certifications on recycled content for TechniStone® products*

Certification - SCS Recycled Content		
Certified by	Standard	Certificate
SCS Global Services	SCS Recycled Content Standard V7-0	SCS Recycled Content Certificates (Technistone)

Min. 20%	Min. 30%	Min. 40%	Min. 70%
			

Healthy House - Healthy Kitchen - Healthy Home - Healthy Projects with Countertops and Surfaces — Food Safety and Quality

Engineered stone countertops and surfaces are safe and suitable for direct food contact.

Engineered stone countertops and surfaces are prepared under supervision of the Kashruth Division of the Orthodox Union Kosher Certification Service.

TechniStone® products are certified by the NSF public health and safety organization. Our products have passed a stringent set of evaluations to ensure they meet food safety requirements and other relevant standards.

Table 27. *List of certifications on public health/safety for TechniStone® products*

Certification	Certified by	Standard	Certificate
NSF Certification	NSF International	NSF/ANSI 51	NSF Listing (Technistone)
Kosher Certification	Orthodox Union Kosher Certification Service	-	Letter of Certification (Brand: Technistone)

Defined and Guaranteed Composition

Engineered stone countertops and surfaces from Technistone have a well-defined, guaranteed composition and do not contain any non-compliant, dangerous, or prohibited substances, regarding both health and the environment.

In conformity with the Health Product Declaration Collaborative (HPDC) Protocol, Technistone examines the chemical substances in its products and compares them with the hazardous substance list published by government and scientific institutions. TechniStone® products do not contain any unauthorized chemicals.

TechniStone® products and their ingredients are screened for chemicals listed on the Living Building Challenge Red List. They do not contain any listed chemicals in quantities greater than the allowable ppm.

TechniStone® products are made from raw materials approved by the NSF. Inputs are tested and evaluated regularly to ensure that the final products meet strict NSF standards.

Table 28. *List of certifications on chemical screening for TechniStone® products*

Institution	Published by	Standard	Certificate / Self Declaration
HPD Collaborative (HPDC)	HPD Collaborative	V2.3	Published Health Product Declaration — Self Declaration (Technistone)
Living Building Challenge	Technistone	2025 LBC Red List	Red List Free Declaration — Self Declaration (Technistone)
NSF International	NSF International	NSF/ANSI 51	NSF Listing (Technistone)

Hygienic Properties of Technistone Products

The Centre of Toxicology and Health Safety of the National Institute of Public Health of the Czech Republic has issued a certificate of "harmlessness to health" for TechniStone® products. TechniStone® is certified by NSF International to be in compliance with the 51 NSF/ANSI Standard for Food Equipment Materials — Solid Surfaces for Splash Zone. The Centre of Toxicology and Health Safety of the National Institute of Public Health of the Czech Republic has also issued a laboratory report, "Resistance of TechniStone® Polished Surface Products to Cleaning Agents and Disinfectants Used in the Preservation of Public Health"; TechniStone® materials are resistant to these substances.


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Table 29. *List of certifications on hygienic properties of TechniStone® products*

Source	Applied Standard	Results
National Institute of Public Health, Czech Republic	Regulation ES 1935/2004 and EU nr. 10/2011	No volatile organic compounds were found in product
Tile Council of North America, Inc. and Applied Materials & Engineering, Inc., USA	California Specification 01350*	No volatile organic compounds were found in product
SCS Global Services, USA	SCS EC 10.3 - 2014 Indoor Air Quality Performance Standard and CA 01350 (Standard Method v1.1)	No volatile organic compounds were found in product
UL, USA	GREENGUARD Gold Certification (Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings Using Dynamic Environmental Chamber)	No volatile organic compounds were found in product

Basic Physical and Mechanical Properties

In the Tables 29-34, the range of values corresponds to the lowest and the highest result achieved by all products in the production group. Average values do not correspond to any specific value within the range but is the average of all products' results in the production group.

Table 30. *Tested Average Value and Range of Values (in Parentheses) According to European Standards: Density, Water Absorption, and Flexural Strength*

Production group	Density (minimal)	Water Absorption (maximal)	Flexural Strength (minimal)
	(g / cm^3)	(% by weight)	(MPa)
Crystal (Noble, Noble Pro)	2,31 (2,07 – 2,37)	0,03 (0,01 – 0,05)	79 (63 – 93)
Crystal (grains < 2,5 mm)	2,38 (2,1 – 2,44)	0,03 (0,01 – 0,05)	66 (50 – 97)
Crystal (grains ≥ 2,5 mm)	2,41 (2,39 – 2,47)	0,02 (0,01 – 0,4)	43 (31 – 54)
Granite	2,46 (240 – 2,58)	0,04 (0,01 – 0,07)	43 (31 – 50)
Marble	2,52 (2,51 – 2,55)	0,09 ((0,08 – 0,09)	33 (28 – 34)
Mirrors	2,38 (2,31 – 2,45)	0,02 (0,01 – 0,05)	49 (36 – 68)
Sand	2,39 (2,35 – 2,44)	0,03 (0,01 – 0,5)	58 (44 – 71)
Applied standard	*EN 14617-1*	*EN 14617-1*	*EN 14617-2*

Table 31. *Tested Values for Thermal Expansion, Frost Resistance, and Abrasion Resistance According to European Standards.*

Production group	Thermal Expansion Coefficient (+30 to +60°C) (maximal)	Thermal Expansion Coefficient (+20 to +130°C) (maximal)	Frost Resistance Coefficient (minimal)	Abrasion Resistance (maximal)
	(10^{-6} / °C)	(10^{-6} / °C)	-	(mm^3)
Crystal	17,5 – 34,6	22,7 – 40,2	90 - 110	7 900
Granite	13,4	17,3	90 - 110	8 125
Marble	18,5	25,4	90 - 110	11 000
Mirrors	17,5	22,7	90 - 110	7 900
Sand	21,8	30,0	90 - 110	6 840
Applied standard	*EN 14617-11*	*EN 14617-11*	*EN 14617-5*	*EN 14157 (B)*

Table 32. *Tested Values for Various Characteristics According to American Society for Testing and Materials (ASTM) Standards*

Staining Agent	Test Solution	Visual Test (Affected?)	Pencil Test (Affected?)
Common Household and Cleaning Chemicals	Acetic acid, 3% (v/v)	No	No
	Acetic acid, 10% (v/v)	No	No
	Ammonium chloride, 100 g/L	No	No
	Citric acid solution, 30 g/L	No	No
	Citric acid solution, 100 g/L	No	No
	Lactic acid, 5% (v/v)	No	No
	Phosphoric acid, 3% (v/v)	No	No
	Phosphoric acid, 10% (v/v)	No	No
	Sulfamic acid, 30 g/L	No	No
	Sulfamic acid, 100 g/L	No	No
Swimming Pool Chemicals	Sodium hypochlorite solution, 20 mg/L	No	No
Acids and Bases	Hydrochloric acid solution, 3% (v/v)	No	No
	Hydrochloric acid solution, 18% (v/v)	No	No
	Potassium hydroxide, 30 g/L	YES	N/A
	Potassium hydroxide, 100 g/L	YES	N/A

Table 33. *Tested Values for Various Characteristics According to American Society for Testing and Materials (ASTM) Standards*

Applied standard	Characteristic	Unit	Value
ASTM C97	Absorption	%	0,01 – 0,06
ASTM C97	Bulk Specific Gravity	lb/ft^3	138,6 - 151,3
ASTM C99	Modulus of Rupture	psi	5 699 – 9 776 (dry) 6 904 – 12 547 (wet)
ASTM C880	Flexural Strength	psi	5 761 – 10 063 (dry) 5 864 – 11 464 (wet)
ASTM C1378	Resistance to Staining	-	without effect
ASTM C650	Resistance to Chemical Substances	-	without effect (Class C)
ASTM C484	Thermal Shock Resistance	-	without visible effect
ASTM C648	Breaking Strength	lbf	937 - 1625
ASTM C1028	Static Coefficient of Friction by the Horizontal Dynamometer Pull-Meter Method	-	0,79 – 1,05 (dry) 0,57 – 0,71 (wet)
ASTM E84-10	Surface Burning Characteristics	-	class A
ASTM C241-09	Abrasion Resistance to Foot Traffic	-	79,16 – 110,5
ASTM E228	Linear Thermal Expansion (30 – 60 °C)	10^{-6} C^{-1}	18,2 – 30,9

Table 34. Chemical resistance according to EN 14617-10 - Agglomerated stone. *The effect of chemicals is expressed in terms of loss of reflectivity (gloss). Resistance class C4 (change in % reflectivity from 100 to max. 80%) is the highest possible resistance class according to EN 14617-10.*

Production Group	Resistance Class / Weak Acids	Resistance Class / Weak Bases
Crystal (Noble)	C4	C4
Crystal	C4	C4
Sand	C4	C4
Mirrors	C4	C4
Granite	C4	C4

Table 35. *Tested Values for flammability of TechniStone® products.*

Applied Standard	Characteristic	Value
EN 13501-1	Reaction to fire EN 13501-1 -slabs	B-s2, d0
EN 13501-1	Reaction to fire EN 13501-1 - tiles	B_{fl}, s1*
ASTM E84-10	Surface Burning Characteristics	class A

Further Information

More detailed product information can be found in Technistone's General Terms and Conditions, available on the Technistone website (www.technistone.com).

4.2 DATA SOURCES

Table 36. *LCI datasets from the Ecoinvent v3.10 EN15804 (2023) database used to model the product system for TechniStone.*

Flow	Dataset
Raw Materials	
Polyester Resin	market for polyester resin, unsaturated | polyester resin, unsaturated | EN15804GD, U - RoW
Accelerator	market for solvent, organic | solvent, organic | EN15804GD, U - GLO
Initiator	market for 2,5-dimethylhexane-2,5-dihydroperoxide | 2,5-dimethylhexane-2,5-dihydroperoxide | EN15804GD, U - GLO
Styrene	styrene production | styrene | EN15804GD, U - RoW
Feldspar	market for feldspar | feldspar | EN15804GD, U - GLO
Silica Sand	silica sand production | silica sand | EN15804GD, U - RoW
Glass	flat glass production, uncoated | flat glass, uncoated | EN15804GD, U - RER market for rock crushing | rock crushing | EN15804GD, U - GLO
Mirrors	flat glass production, coated | flat glass, coated | EN15804GD, U - RER market for rock crushing | rock crushing | EN15804GD, U - GLO
Natural Stone	market for gravel, crushed | gravel, crushed | EN15804GD, U - RoW
Quartz	market for feldspar | feldspar | EN15804GD, U - GLO
All Transport	
Truck Transport	market for transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | EN15804GD, U - RoW
Ship Transport	market for transport, freight, sea, container ship | transport, freight, sea, container ship | EN15804GD, U - GLO
Rail Transport	market for transport, freight train | transport, freight train | EN15804GD, U - RoW
Energy and Water	
Electricity	market for electricity, medium voltage | electricity, medium voltage | EN15804GD, U - CZ
Natural Gas	market group for heat, central or small-scale, natural gas | heat, central or small-scale, natural gas | EN15804GD, U - GLO
Tap water	market for tap water | tap water | EN15804GD, U - Europe without Switzerland
Product Packaging	
Self-Adhesive LDPE Foil	market for packaging film, low density polyethylene | packaging film, low density polyethylene | EN15804GD, U - GLO
Ancillary Manufacturing Materials	
Paper	market for kraft paper | kraft paper | EN15804GD, U - RoW
LDPE	market for packaging film, low density polyethylene | packaging film, low density polyethylene | EN15804GD, U - GLO
Installation Materials	
Adhesive	market for epoxy resin, liquid | epoxy resin, liquid | EN15804GD, U - RER
Sealant	market for silicone product | silicone product | EN15804GD, U - RoW
Product Waste Treatment	
Waste to Landfill	market for inert waste, for final disposal | inert waste, for final disposal | EN15804GD, U - RoW
Waste to Recycle	Waste to recycling
Waste to Incineration	treatment of municipal solid waste, municipal incineration | municipal solid waste | EN15804GD, U - RoW
Recovery	
Virgin Gravel	gravel production, crushed | gravel, crushed | EN15804GD, U - RoW
Recycled Gravel	rock crushing | rock crushing | EN15804GD, U - RoW* *Including electricity consumption and particulate emissions from: limestone production, crushed, washed | limestone, crushed, washed | Cutoff, U

4.3 DATA QUALITY

The data quality assessment is discussed in the table below for each of the data quality parameters. No data gaps were allowed which were expected to significantly affect the outcome of the impact indicator or LCI resource results.

Table 37. *Data quality assessment of the product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old (typically 2015 or more recent). All the data used represented an average of at least one year's worth of data collection. Manufacturer-supplied data (primary data) are based on production from January 1, 2023 to June 30, 2024.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Manufacturing and raw material data are specific to the manufacturing site. Upstream surrogate data used in the assessment represent "rest of world" operations, which is applicable to the Czech Republic. Electricity data used in the manufacturing process is specific to the Czech Republic. Data representing product disposal are based on country/regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Upstream production data from secondary databases are using similar technology and considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of TechniStone® engineered stone products. No known processes or activities are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is high. All secondary inventory data are from the Ecoinvent v3.10 database and of similar quality and age. Different portions of the product life cycle are equally considered; however, it must be noted that final disposal of the product is based on assumptions of current practices in TechniStone.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy and resource use at the TechniStone manufacturing facility represent an average over the period of collection and are considered of high quality due to the length of time over which these data are collected (18 months), as compared to a snapshot that may not accurately reflect fluctuations in production. The Ecoinvent v3.10 database is used for secondary LCI datasets.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the TechniStone® engineered stone products is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) and were generally geographically representative. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

4.4 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR and minimized the use of allocation wherever possible.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of the TechniStone® engineered stone surfaces products. Primary data for resource use (e.g., electricity, natural gas, water) are allocated on a mass-basis as a fraction of total production over the data collection period.

The transportation from primary producer of material components (e.g., the raw materials required for manufacturing) to the manufacturing facility is based on primary data provided by TechniStone, including modes, distances, and amount of material transported from each supplier. Transportation was allocated based on the mass and distance of the material transported.

4.5 CUT-OFF RULES

According to the PCR, processes contributing greater than 1% of the total mass input or primary energy usage of the unit process must be included in the inventory. In the present study, all known materials and processes were included in the life cycle inventory. Any data gaps are filled with representative data and documented.

4.6 SUMMARY OF ASSUMPTIONS

- Representative inventory data for raw materials was modeled with unit process data taken from Ecoinvent (Table 19)
- Representative inventory data from Ecoinvent, detailed in Table 19, was used to model the production of electricity. The Czech Republic's grid mix for the TechniStone manufacturing facility is modeled based on 2020 IEA data.
- Representative inventory data from Ecoinvent was used to model all transport (Table 19).
- The disposal method (landfilling) of product packaging and the disposal of the product at end-of-life is based on secondary data. The transport distance for all waste is also based on secondary data, with an assumption of 100 km from the point of waste generation to a landfill. Ecoinvent datasets are used to model the impacts associated with landfilling, recycling, and incineration which does not include energy recovery from landfill gas (Table 19).
- Lacking detailed supplier information, much of the upstream raw materials extraction and processing could not be modeled with actual process information. Representative data from the Ecoinvent database was utilized as appropriate.
- As a specific dataset for quartz is not available in Ecoinvent 3.10, a dataset for feldspar was used as a proxy due to its similar material composition, extraction/processing methods, and industrial applications.
- No specific data were available to estimate the final disposition of the product and packaging at end-of-life. For end-of-life treatment, recycled material was assumed to be processed into gravel for use in road construction, in line with common end-of-life practices. Disposal statistics, including recycling rates for the remaining durable goods and packaging were based on disposal rates from UL Part A v4.0 and UL Part A v3.2 using primary distribution data provided by TechniStone.
- No specific data were available to estimate the distribution of the product to the global market for module A4. For products distributed overseas, distance for distribution is assumed to include the distance from the manufacturing facility to the nearest major port (Port of Rotterdam), an average global shipping distance, and the distance from port to the site of installation, which was assumed to be 500 km. For products distributed within Europe, transportation from the manufacturing gate to the site of installation was assumed to be 500 km, consisting of 50 km by truck to a train terminal, 400 km by rail, and 50 km by truck from the rail terminal to the installation site.
- Assumed all hazardous waste generated during manufacturing is disposed of through incineration.
- Energy use and emissions were allocated to the product based on the mass of the product as a fraction of the total production at the Hradec Králové facility. Total electricity and fuel (natural gas) consumption data for the collection period were provided by the manufacturer.

- To represent the recycling of the product into crushed gravel in Module D, the ecoinvent dataset "rock crushing | rock crushing | EN15804GD, U – RoW" is used. Per the ecoinvent documentation for this dataset, additional flows including electricity consumption, rock input, and particulate emissions must be accounted for by the user. In the absence of primary data for these inputs and outputs, data from the dataset "limestone production, crushed, washed | limestone, crushed, washed | Cutoff, U – RoW" are utilized.
- As >98% of the non-renewable primary energy resources used as raw materials are polyester resin (by mass), it is assumed that all materials contributing to the PENRM indicator are polyester resin. To represent polyester resin for the calculation of PENRM, the lower heating value provided in the ecoinvent v3.10 (EN 15804) dataset "treatment of waste polyethylene terephthalate, municipal incineration | heat, for reuse in municipal waste incineration only" was used.

4.7 PERIOD UNDER REVIEW

The period of review is January 1, 2023 to June 30, 2024.

4.8 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

5. LCA Results

In accordance with the PCR, the core environmental impact category indicators are reported using the characterization methods required by EN 15804:2012+A2:2019/AC:2021. Furthermore, the additional environmental impact category indicators are reported in a separately published appendix (appendix B) to the EPD. Both the core and additional indicators are preceded by information on disclaimers, as applicable to specific indicators.

Table 37 presents disclaimers regarding the declaration of relevant core environmental impact indicators according to the relevant classification.

Table 38. *Information on disclaimers for environmental indicators as required by the PCR*

Classification	Indicator	Disclaimer
ILCD Type 1	Global warming potential (GWP)	none
	Depletion potential of the stratospheric ozone layer (ODP)	none
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	none
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	none
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	none
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	none
	Formation potential of tropospheric ozone (POCP)	none
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2

Disclaimer 1: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nu-clear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2: The results of this environmental impact indicator shall be used with case as uncertainties on these results are high or as there is limited experience with the indicator.

The carbon footprint in an Environmental Product Declaration (EPD) is expressed according to standards for EPD as Global Warming Potential (GWP). GWP represents the total amount of greenhouse gas emissions associated with a product, calculated over specific stages of its life cycle. These emissions are measured in kilograms of CO_2-equivalent (kg CO_2e), allowing the impact of various greenhouse gases to be compared on a common scale. Total Global Warming Potential (GWP) is divided into these categories: fossil (emissions from fossil fuels), biogenic (emissions and uptake from biomass, e.g. wood), luluc (emissions from land use and land use change). Table 38 presents the name, unit, and abbreviation of all core impact categories.

Table 39. *The name, unit, abbreviation, and description of all core impact categories required by the PCR.*

Impact Category	Indicator and Units	Impact Category and Environmental Mechanism
Climate change - GWP-GHG/IOBC	Global Warming Potential (GWP-GHG)	This is a specific requirement of the PCR. The supplementary indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product.
Climate change - total	Global Warming Potential (GWP -total) kg CO_2 eq.	Anthropogenic emissions of greenhouse gases and short-lived climate forcers have led to increased radiative forcing, which has in turn increased the global mean temperature by above 0.99°C since pre-industrial times. All IPCC scenarios project an increase to 1.5°C in the near term, occurring between 2021 to 2040. The projection for the SSP2-4.5 scenario estimates an increase of 2.0°C occurring between 2043-2062, with 3°C occurring between 2061-2080. As global mean temperatures continue to climb, global climate change will result. Some of the predicted impacts include reductions in food and food supplies, water supplies, and sea level rise.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil) kg CO_2 eq.	Identical to the description for GWP-total, except that it only accounts for the climate change impacts from fossil fuels.
Climate change – biogenic	Global Warming Potential biogenic (GWP-biogenic) kg CO_2 eq.	This indicator accounts for GWP from removals of CO_2 into biomass from all sources except native forests, as transfer of carbon, sequestered by living biomass, from nature into the product system declared as GWP-biogenic. This indicator also accounts for GWP from transfers of biogenic carbon into the product system. This indicator also accounts for biogenic emissions to air from biomass from all sources except native forests due to oxidation or degradation as well as all transfers of biogenic carbon from biomass from all sources except native forests into subsequent product systems in the form of biogenic $CO2_2$. The characterization factors used to calculate this indicator's results conform to EN 15804:2012+A2:2019/AC:2021
Climate change – land use and land-use changes	GWP-LULUC kg CO_2 eq.	The GWP-LULUC indicator covers greenhouse gas emissions and removals resulting from changes in carbon stocks caused by land use and land-use changes. The indicator includes biogenic carbon changes that result from, e.g. the loss of forests or other soil-related changes, including soil carbon emissions.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP) kg CFC-11 eq.	Emissions of ozone depleting substances such as chlorofluorocarbons contribute to a thinning of the stratospheric ozone layer. This can lead to increased cases of skin cancer, and effects on crops, other plants, marine life, and human-built materials. All chlorinated and brominated compounds stable enough to reach the stratosphere can have an effect. CFCs, halons and HCFCs are the major causes of ozone depletion. Damage to the ozone layer reduces its ability to prevent ultraviolet (UV) light entering the earth's atmosphere, increasing the amount of carcinogenic UVB light reaching the earth's surface. Due to the international ban on ozone depleting chemicals, the stratospheric ozone layer has begun to recover; U.S. EPA projects that the ozone layer will recover within about 50 years.
Photochemical Ozone Formation	Formation potential of tropospheric ozone (POCP)	Photochemical ozone, also called "ground level ozone", is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. If ozone concentrations reach above certain critical

Impact Category	Indicator and Units	Impact Category and Environmental Mechanism
	kg NMVOC eq.	thresholds, health effects in humans can result, including bronchitis, asthma, and emphysema. The impact category depends largely on the amounts of carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxide (NO), ammonium and NMVOC (non-methane volatile organic compounds).
Acidification	Acidification potential, Accumulated Exceedance (AP) mol H^+ eq.	Acidification is the increasing concentration of hydrogen ion (H^+) within the local environmental and occurs because of adding acids such as nitric acid and sulfuric acids into the environment. Acid precursor emissions transport in the atmosphere and deposit as acids. These acids may deposit in soils which are sensitive, or insensitive, to the increased acid burden; sensitivity can depend on several factors. In acid-sensitive soils, the deposition can decrease the soil pH (acidification) and increase the mobility of heavy metals in the environment, such as aluminum. This acidification can affect the pH of local soils and freshwater bodies, by increasing local hydrogen ion concentrations, causing endpoints such as tree die-offs and dead lakes. Emissions of sulfur dioxide and nitrogen oxides from the combustion of fossil fuels have been the greatest contributor to acid rain.
Eutrophication freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) kg P eq.	Eutrophication is the build-up of a concentration of chemical nutrients in an ecosystem which leads to abnormal productivity. In some regions, emissions of excess nutrients (including phosphorus and nitrogen) into water can lead to increased algal blooms. These blooms can reach such a severity that waterways become choked, with no other plant life able to establish itself. If algal blooms are intense enough, the decaying algae consumes dissolved oxygen in the water column starving other organisms of needed oxygen. Whereas phosphorous is mainly responsible for eutrophication in freshwater systems, nitrogen is mainly responsible for eutrophication in ocean water bodies. Emissions of ammonia, nitrates, nitrogen oxides and phosphorous to air or water all have an impact on eutrophication.
Eutrophication marine	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-marine) kg. N eq.	
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial) mol N eq.	
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP) m^3 (world eq. deprived)	AWARE is a water use midpoint indicator representing the relative available water remaining per area in a watershed, after the demand of humans and aquatic ecosystems has been met. It assesses the potential of water deprivation, to either humans or ecosystems, building on the assumption that the less water remaining available per area, the more likely another user will be deprived.
Depletion of abiotic resources – minerals and metals	Abiotic depletion potential for non-fossil resources (ADP-minerals & metals) kg Sb eq	This impact category refers to the consumption of non-biological resources such as minerals and metals. The value of the abiotic resource consumption of a substance is a measure of the scarcity of a substance and depends on the amount of resources and the extraction rate. The indicator is calculated as the amount of resources that are depleted and measured in antimony equivalents for mineral depletion.
Depletion of abiotic resources – fossil fuels	Abiotic depletion potential for fossil resources (ADP-fossil) MJ, net calorific value	This impact category refers to the consumption of fossil fuels. The value of the abiotic resource consumption of a substance (e.g., lignite or coal) is a measure of the scarcity of a substance and depends on the amount of resources and the extraction rate. It is calculated as the amount of resources that are depleted and measured in equivalent MJ of fossil fuels.

The cradle-to-gate with options LCIA results of the product are presented the tables 39-50, which display the absolute values and percentage contributions for each impact indicator by life cycle stage for each engineered stone surface product. Environmental Impacts for the modules: B1, B6, and B7 are assumed to be zero for the TechniStone products and

are not shown in the tables. Embodied carbon refers to greenhouse gas emissions associated with the extraction of raw materials, transportation to the manufacturing site, and manufacturing of a product. In this EPD, embodied carbon is represented by the GWP-Total indicator for the Production Stage (A1–A3) in the results tables.

Table 40. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for* **Group 1** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to Disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	67.1	1.81	5.06	1.00	2.86	$-6.67x10^{-2}$
	86.3%	2.3%	6.5%	1.3%	3.7%	-
GWP – Fossil (kg CO2 eq)	67.8	1.81	5.01	1.00	1.64	$-6.66x10^{-2}$
	87.5%	2.3%	6.5%	1.3%	2.1%	-
GWP – Biogenic (kg CO2 eq)	-3.01	$-5.74x10^{-4}$	$4.81x10^{-2}$	$2.96x10^{-5}$	1.22	$-8.29x10^{-5}$
	170%	0.033%	-2.8%	-0.0017%	-70%	-
GWP-LULUC (kg CO2 eq)	2.28	$9.52x10^{-4}$	$3.30x10^{-3}$	$4.03x10^{-4}$	$2.10x10^{-3}$	$-5.72x10^{-5}$
	99.28%	0.042%	0.14%	0.018%	0.092%	-
GWP-GHG (kg CO2)	70.2	1.82	5.04	1.00	1.64	$-6.67x10^{-2}$
	88.4%	2.3%	6.3%	1.3%	2.1%	-

Table 41. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for* **Group 2** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	77.8	1.95	8.96	1.02	2.93	$-6.81x10^{-2}$
	83.9%	2.1%	9.7%	1.1%	3.2%	-
GWP – Fossil (kg CO2 eq)	78.3	1.95	8.94	1.02	1.68	$-6.79x10^{-2}$
	85.2%	2.1%	9.7%	1.1%	1.8%	-
GWP – Biogenic (kg CO2 eq)	-2.72	$-6.15x10^{-4}$	$-8.07x10^{-2}$	$3.02x10^{-5}$	1.25	$-8.46x10^{-5}$
	172%	0.04%	5.2%	-0.0019%	-81%	-
GWP-LULUC (kg CO2 eq)	2.14	$1.02x10^{-3}$	0.105	$4.12x10^{-4}$	$2.14x10^{-3}$	$-5.84x10^{-5}$
	95.28%	0.045%	4.7%	0.018%	0.095%	-
GWP-GHG (kg CO2)	80.6	1.95	9.07	1.02	1.68	$-6.81x10^{-2}$
	86%	2.1%	9.6%	1.1%	1.8%	-

Table 42. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for* **Group 3** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	87.1	1.90	9.31	1.00	2.87	$-6.68x10^{-2}$
	85.2%	1.9%	9.1%	0.98%	2.8%	-
GWP – Fossil (kg CO2 eq)	87.5	1.90	9.27	1.00	1.64	$-6.67x10^{-2}$
	86.5%	1.9%	9.2%	0.99%	1.6%	-
GWP – Biogenic (kg CO2 eq)	-2.16	$-6.02x10^{-4}$	$-5.47x10^{-2}$	$2.96x10^{-5}$	1.22	$-8.31x10^{-5}$
	219%	0.061%	5.5%	-0.003%	-120%	-
GWP-LULUC (kg CO2 eq)	1.81	$9.99x10^{-4}$	$8.94x10^{-2}$	$4.04x10^{-4}$	$2.10x10^{-3}$	$-5.73x10^{-5}$
	95.3%	0.053%	4.7%	0.021%	0.11%	-
GWP-GHG (kg CO2)	89.6	1.91	9.40	1.01	1.64	$-6.68x10^{-2}$
	86.4%	1.8%	9.1%	0.97%	1.6%	-

Table 43. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for* **Group 4** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	69.0	1.99	8.64	1.04	2.98	$-6.94x10^{-2}$
	82.3%	2.4%	10%	1.2%	3.6%	-
GWP – Fossil (kg CO2 eq)	69.7	1.99	8.63	1.04	1.71	$-6.93x10^{-2}$
	83.7%	2.4%	10%	1.3%	2.1%	-
GWP – Biogenic (kg CO2 eq)	-3.07	$-6.28x10^{-4}$	$-9.64x10^{-2}$	$3.08x10^{-5}$	1.27	$-8.64x10^{-5}$
	160%	0.033%	5.1%	-0.0016%	-67%	-
GWP-LULUC (kg CO2 eq)	2.35	$1.04x10^{-3}$	0.115	$4.20x10^{-4}$	$2.19x10^{-3}$	$-5.96x10^{-5}$
	95.22%	0.042%	4.7%	0.017%	0.089%	-
GWP-GHG (kg CO2)	72.2	1.99	8.77	1.04	1.71	$-6.94x10^{-2}$
	84.4%	2.3%	10%	1.2%	2%	-

Table 44. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for* **Group 5** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	56.0	1.79	7.53	0.947	2.71	$-6.30x10^{-2}$
	81%	2.6%	11%	1.4%	3.9%	-
GWP – Fossil (kg CO2 eq)	56.6	1.79	7.51	0.946	1.55	$-6.29x10^{-2}$
	82.4%	2.6%	11%	1.4%	2.3%	-
GWP – Biogenic (kg CO2 eq)	-2.46	$-5.67x10^{-4}$	$-7.12x10^{-2}$	$2.79x10^{-5}$	1.16	$-7.83x10^{-5}$
	184%	0.041%	5.2%	-0.002%	-84%	-
GWP-LULUC (kg CO2 eq)	1.86	$9.41x10^{-4}$	$9.16x10^{-2}$	$3.81x10^{-4}$	$1.98x10^{-3}$	$-5.40x10^{-5}$
	96.24%	0.048%	4.7%	0.02%	0.1%	-
GWP-GHG (kg CO2)	58.6	1.79	7.63	0.947	1.55	$-6.30x10^{-2}$
	83.1%	2.5%	11%	1.3%	2.2%	-

Table 45. *Cradle-to-gate with options results for Global Warming Potential (GWP) impact category indicators for Group 6 surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	52.6	1.50	6.55	0.788	2.25	$-5.24x10^{-2}$
	82.1%	2.4%	10%	1.2%	3.5%	-
GWP – Fossil (kg CO2 eq)	53.1	1.50	6.53	0.787	1.29	$-5.23x10^{-2}$
	83.5%	2.4%	10%	1.2%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.97	$-4.73x10^{-4}$	$-5.40x10^{-2}$	$2.32x10^{-5}$	0.960	$-6.51x10^{-5}$
	188.983%	0.044%	5.1%	-0.0022%	-90%	-
GWP-LULUC (kg CO2 eq)	1.49	$7.85x10^{-4}$	$7.34x10^{-2}$	$3.17x10^{-4}$	$1.65x10^{-3}$	$-4.49x10^{-5}$
	95.3%	0.05%	4.7%	0.02%	0.11%	-
GWP-GHG (kg CO2)	54.7	1.50	6.63	0.788	1.29	$-5.24x10^{-2}$
	84.3%	2.3%	10%	1.2%	2%	-

Table 46. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* **Group 1** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.46x10^{-6}$	$2.60x10^{-8}$	$7.86x10^{-7}$	$1.49x10^{-8}$	$1.68x10^{-8}$	$-5.20x10^{-10}$
	62.9%	1.1%	34%	0.65%	0.73%	-
AP (molc H+ eq)	0.306	$5.33x10^{-2}$	$2.15x10^{-2}$	$4.19x10^{-3}$	$4.70x10^{-3}$	$-4.09x10^{-4}$
	79.1%	14%	5.5%	1.1%	1.2%	-
EP – fw (kg P eq)	$3.09x10^{-2}$	$5.74x10^{-5}$	$1.32x10^{-3}$	$7.88x10^{-5}$	$1.41x10^{-4}$	$-2.00x10^{-5}$
	95%	0.18%	4.1%	0.24%	0.43%	-
EP – m (kg N eq)	$8.21x10^{-2}$	$1.33x10^{-2}$	$4.17x10^{-3}$	$1.53x10^{-3}$	$1.87x10^{-3}$	$-9.73x10^{-5}$
	80.4%	13%	4.1%	1.5%	1.8%	-
EP – t (molc N eq)	0.712	0.147	$4.35x10^{-2}$	$1.66x10^{-2}$	$1.96x10^{-2}$	$-1.18x10^{-3}$
	75.7%	16%	4.6%	1.8%	2.1%	-
POCP (kg NMVOC eq)	0.514	$3.99x10^{-2}$	$1.88x10^{-2}$	$5.80x10^{-3}$	$6.67x10^{-3}$	$-3.26x10^{-4}$
	87.8%	6.8%	3.2%	0.99%	1.1%	-
ADP – mm (kg Sb-Eq)	$3.93x10^{-4}$	$1.77x10^{-6}$	$4.91x10^{-5}$	$3.32x10^{-6}$	$2.22x10^{-6}$	$-3.65x10^{-7}$
	87.3%	0.4%	11%	0.74%	0.49%	-
ADP – ff (MJ, LHV)	1,170	22.2	86.8	14.2	14.3	-0.796
	89.2%	1.7%	6.6%	1.1%	1.1%	-
WDP (m3 world eq. deprived)	18.3	$6.06x10^{-2}$	3.27	$6.36x10^{-2}$	0.168	-0.102
	83.2%	0.28%	15%	0.29%	0.77%	-

Table 47. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* Group 2 *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.65x10^{-6}$	$2.79x10^{-8}$	$8.82x10^{-7}$	$1.52x10^{-8}$	$1.72x10^{-8}$	$-5.31x10^{-10}$
	63.8%	1.1%	34%	0.59%	0.66%	-
AP (molc H+ eq)	0.423	$5.72x10^{-2}$	$4.48x10^{-2}$	$4.28x10^{-3}$	$4.80x10^{-3}$	$-4.17x10^{-4}$
	79.6%	11%	8.4%	0.8%	0.9%	-
EP – fw (kg P eq)	$3.30x10^{-2}$	$6.16x10^{-5}$	$2.92x10^{-3}$	$8.04x10^{-5}$	$1.44x10^{-4}$	$-2.04x10^{-5}$
	91.5%	0.17%	8.1%	0.22%	0.4%	-
EP – m (kg N eq)	$9.95x10^{-2}$	$1.42x10^{-2}$	$9.67x10^{-3}$	$1.56x10^{-3}$	$1.91x10^{-3}$	$-9.92x10^{-5}$
	78.1%	11%	7.6%	1.2%	1.5%	-
EP – t (molc N eq)	0.933	0.158	$9.64x10^{-2}$	$1.70x10^{-2}$	$2.00x10^{-2}$	$-1.21x10^{-3}$
	76.2%	13%	7.9%	1.4%	1.6%	-
POCP (kg NMVOC eq)	0.555	$4.28x10^{-2}$	$4.77x10^{-2}$	$5.92x10^{-3}$	$6.81x10^{-3}$	$-3.33x10^{-4}$
	84.6%	6.5%	7.2%	0.9%	1%	-
ADP – mm (kg Sb-Eq)	$4.68x10^{-4}$	$1.90x10^{-6}$	$7.25x10^{-5}$	$3.39x10^{-6}$	$2.27x10^{-6}$	$-3.73x10^{-7}$
	85.6%	0.35%	13%	0.62%	0.41%	-
ADP – ff (MJ, LHV)	1,270	23.8	150	14.5	14.6	-0.813
	86.3%	1.6%	10%	0.98%	0.99%	-
WDP (m3 world eq. deprived)	20.8	$6.50x10^{-2}$	4.33	$6.50x10^{-2}$	0.172	-0.104
	81.5%	0.26%	17%	0.26%	0.68%	-

Table 48. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* **Group 3** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.80x10^{-6}$	$2.73x10^{-8}$	$8.74x10^{-7}$	$1.49x10^{-8}$	$1.69x10^{-8}$	$-5.21x10^{-10}$
	66.1%	1%	32%	0.55%	0.62%	-
AP (molc H+ eq)	0.541	$5.60x10^{-2}$	$5.00x10^{-2}$	$4.20x10^{-3}$	$4.71x10^{-3}$	$-4.10x10^{-4}$
	82.7%	8.5%	7.6%	0.64%	0.72%	-
EP – fw (kg P eq)	$3.35x10^{-2}$	$6.03x10^{-5}$	$2.92x10^{-3}$	$7.89x10^{-5}$	$1.41x10^{-4}$	$-2.01x10^{-5}$
	91.2%	0.16%	8%	0.22%	0.38%	-
EP – m (kg N eq)	0.113	$1.39x10^{-2}$	$1.02x10^{-2}$	$1.53x10^{-3}$	$1.87x10^{-3}$	$-9.74x10^{-5}$
	80.5%	9.9%	7.3%	1.1%	1.3%	-
EP – t (molc N eq)	1.14	0.155	0.105	$1.67x10^{-2}$	$1.97x10^{-2}$	$-1.18x10^{-3}$
	79.1%	11%	7.3%	1.2%	1.4%	-
POCP (kg NMVOC eq)	0.567	$4.19x10^{-2}$	$4.79x10^{-2}$	$5.81x10^{-3}$	$6.69x10^{-3}$	$-3.27x10^{-4}$
	85.2%	6.3%	7.2%	0.87%	1%	-
ADP – mm (kg Sb-Eq)	$5.77x10^{-4}$	$1.86x10^{-6}$	$7.68x10^{-5}$	$3.33x10^{-6}$	$2.23x10^{-6}$	$-3.66x10^{-7}$
	87.6%	0.28%	12%	0.5%	0.34%	-
ADP – ff (MJ, LHV)	1,330	23.3	151	14.2	14.3	-0.798
	86.4%	1.5%	9.9%	0.93%	0.93%	-
WDP (m3 world eq. deprived)	22.9	$6.37x10^{-2}$	4.37	$6.38x10^{-2}$	0.168	-0.102
	83%	0.23%	16%	0.23%	0.61%	-

Table 49. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* **Group 4** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.50x10^{-6}$	$2.85x10^{-8}$	$8.90x10^{-7}$	$1.55x10^{-8}$	$1.75x10^{-8}$	$-5.42x10^{-10}$
	61.8%	1.2%	36%	0.63%	0.71%	-
AP (molc H+ eq)	0.323	$5.84x10^{-2}$	$4.06x10^{-2}$	$4.36x10^{-3}$	$4.90x10^{-3}$	$-4.26x10^{-4}$
	74.8%	14%	9.4%	1%	1.1%	-
EP – fw (kg P eq)	$3.30x10^{-2}$	$6.29x10^{-5}$	$2.95x10^{-3}$	$8.20x10^{-5}$	$1.47x10^{-4}$	$-2.09x10^{-5}$
	91.1%	0.17%	8.1%	0.23%	0.4%	-
EP – m (kg N eq)	$8.36x10^{-2}$	$1.45x10^{-2}$	$9.02x10^{-3}$	$1.59x10^{-3}$	$1.95x10^{-3}$	$-1.01x10^{-4}$
	75.4%	13%	8.1%	1.4%	1.8%	-
EP – t (molc N eq)	0.725	0.161	$8.75x10^{-2}$	$1.73x10^{-2}$	$2.04x10^{-2}$	$-1.23x10^{-3}$
	71.7%	16%	8.7%	1.7%	2%	-
POCP (kg NMVOC eq)	0.523	$4.37x10^{-2}$	$4.66x10^{-2}$	$6.03x10^{-3}$	$6.95x10^{-3}$	$-3.40x10^{-4}$
	83.1%	7%	7.4%	0.96%	1.1%	-
ADP – mm (kg Sb-Eq)	$4.19x10^{-4}$	$1.94x10^{-6}$	$7.11x10^{-5}$	$3.45x10^{-6}$	$2.32x10^{-6}$	$-3.80x10^{-7}$
	83.8%	0.39%	14%	0.69%	0.47%	-
ADP – ff (MJ, LHV)	1,200	24.3	149	14.7	14.9	-0.829
	85.7%	1.7%	11%	1%	1.1%	-
WDP (m3 world eq. deprived)	19.4	$6.64x10^{-2}$	4.33	$6.62x10^{-2}$	0.175	-0.106
	80.3%	0.28%	18%	0.28%	0.73%	-

Table 50. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* **Group 5** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.19x10^{-6}$	$2.57x10^{-8}$	$7.99x10^{-7}$	$1.41x10^{-8}$	$1.59x10^{-8}$	$-4.92x10^{-10}$
	58.2%	1.3%	39%	0.69%	0.78%	-
AP (molc H+ eq)	0.238	$5.27x10^{-2}$	$3.42x10^{-2}$	$3.95x10^{-3}$	$4.44x10^{-3}$	$-3.86x10^{-4}$
	71.3%	16%	10%	1.2%	1.3%	-
EP – fw (kg P eq)	$2.90x10^{-2}$	$5.68x10^{-5}$	$2.63x10^{-3}$	$7.44x10^{-5}$	$1.33x10^{-4}$	$-1.89x10^{-5}$
	91.1%	0.18%	8.2%	0.23%	0.42%	-
EP – m (kg N eq)	$6.31x10^{-2}$	$1.31x10^{-2}$	$7.57x10^{-3}$	$1.44x10^{-3}$	$1.77x10^{-3}$	$-9.19x10^{-5}$
	72.9%	15%	8.7%	1.7%	2%	-
EP – t (molc N eq)	0.529	0.146	$7.32x10^{-2}$	$1.57x10^{-2}$	$1.85x10^{-2}$	$-1.12x10^{-3}$
	67.3%	19%	9.4%	2%	2.4%	-
POCP (kg NMVOC eq)	0.404	$3.95x10^{-2}$	$3.89x10^{-2}$	$5.47x10^{-3}$	$6.30x10^{-3}$	$-3.08x10^{-4}$
	82%	8%	7.9%	1.1%	1.3%	-
ADP – mm (kg Sb-Eq)	$3.20x10^{-4}$	$1.76x10^{-6}$	$6.16x10^{-5}$	$3.13x10^{-6}$	$2.10x10^{-6}$	$-3.45x10^{-7}$
	82%	0.45%	16%	0.81%	0.54%	-
ADP – ff (MJ, LHV)	987	22.0	130	13.4	13.5	-0.752
	84.4%	1.9%	11%	1.1%	1.2%	-
WDP (m3 world eq. deprived)	16.0	$6.00x10^{-2}$	3.85	$6.01x10^{-2}$	0.159	$-9.64x10^{-2}$
	79.6%	0.3%	19%	0.3%	0.79%	-

Table 51. *Cradle-to-gate with options results for core environmental impact indicators excluding Global Warming Potential (GWP) indicators for* **Group 6** *surfaces. Zero environmental impacts assumed for B1, B6, B7, C1, and C3.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
ODP (kg CFC11 eq)	$1.09x10^{-6}$	$2.15x10^{-8}$	$6.70x10^{-7}$	$1.17x10^{-8}$	$1.32x10^{-8}$	$-4.09x10^{-10}$
	60.7%	1.2%	37%	0.65%	0.73%	-
AP (molc H+ eq)	0.246	$4.40x10^{-2}$	$3.07x10^{-2}$	$3.29x10^{-3}$	$3.69x10^{-3}$	$-3.21x10^{-4}$
	74.8%	13%	9.4%	1%	1.1%	-
EP – fw (kg P eq)	$2.55x10^{-2}$	$4.74x10^{-5}$	$2.26x10^{-3}$	$6.19x10^{-5}$	$1.11x10^{-4}$	$-1.57x10^{-5}$
	90.7%	0.17%	8.1%	0.22%	0.39%	-
EP – m (kg N eq)	$6.13x10^{-2}$	$1.09x10^{-2}$	$6.72x10^{-3}$	$1.20x10^{-3}$	$1.47x10^{-3}$	$-7.64x10^{-5}$
	75.9%	13%	8.2%	1.5%	1.8%	-
EP – t (molc N eq)	0.547	0.122	$6.60x10^{-2}$	$1.31x10^{-2}$	$1.54x10^{-2}$	$-9.28x10^{-4}$
	71.1%	16%	8.7%	1.7%	2%	-
POCP (kg NMVOC eq)	0.360	$3.29x10^{-2}$	$3.35x10^{-2}$	$4.55x10^{-3}$	$5.24x10^{-3}$	$-2.56x10^{-4}$
	82.8%	7.5%	7.7%	1%	1.2%	-
ADP – mm (kg Sb-Eq)	$2.99x10^{-4}$	$1.46x10^{-6}$	$5.29x10^{-5}$	$2.61x10^{-6}$	$1.75x10^{-6}$	$-2.87x10^{-7}$
	83.4%	0.41%	15%	0.73%	0.49%	-
ADP – ff (MJ, LHV)	891	18.3	111	11.1	11.2	-0.625
	85.6%	1.8%	11%	1.1%	1.1%	-
WDP (m3 world eq. deprived)	14.5	$5.00x10^{-2}$	3.26	$5.00x10^{-2}$	0.132	$-8.01x10^{-2}$
	80.4%	0.28%	18%	0.28%	0.73%	-

The EN 15804:2012+A2:2019/AC:2021 impact methods for Global Warming Potential (GWP) follows the IPCC 2013 – 100-year global warming potential method, which assess global warming potential within a 100-year time frame. Results shown above are based on that time frame. However, the EN 15804:2012+A2:2019/AC:2021 standard also states that the degradation of a product's biogenic carbon content in a solid waste disposal site, declared as GWP-biogenic, shall be calculated without time limit. Following the PCR, biogenic carbon content of the product and packaging must be declared if the biogenic carbon containing material is 5% or more of the total mass of the product and packaging, respectively. As the TechniStone® engineered stone products are composed of inorganic materials and are packaged using polyethylene film, there is no biogenic carbon content in either the product or the packaging.

6. LCI Results

The following life cycle inventory (LCI) parameters specified by the PCR are shown in Table 52 below. The LCI results by module are reported in Tables 52 – 57. Resource use for the modules: B1, B6, and B7 are assumed to be zero for the TechniStone products and are not shown in the tables.

Table 52. *The full name, abbreviation, and unit of additional LCI indicators required by the PCR.*

Resources	Unit	Waste and Outflows	Unit
PERE: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**FW:** Use of net freshwater resources	m^3
PERM: Renewable primary resources with energy content used as material	MJ, LHV	**HWD:** Hazardous waste disposed	kg
PERT: Total use of renewable primary energy resource	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
PENRE: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**RWD** Radioactive waste disposed	kg
PENRM: Non-renewable primary resources with energy content used as material	MJ, LHV	**CRU:** Components for re-use	kg
PENRT: Total use of non-renewable primary energy resources	MJ, LHV	**MFR:** Materials for recycling	kg
SM: Secondary materials	MJ, LHV	**MER:** Materials for energy recovery	kg
RSF: Renewable secondary fuels	MJ, LHV	**EEE:** Recovered energy exported from the product system	MJ, LHV
NRSF: Non-renewable secondary fuels	MJ, LHV	-	-

Table 53. *Cradle-to-gate with options results for all inventory indicators for* **Group 1** *surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	101	0.164	5.60	0.186	0.181	-6.17×10^{-2}
	94.4%	0.15%	5.20%	0.17%	0.17%	-
PERM (MJ, LHV)	7.85	0.00	0.00	0.00	0.00	0.00
	100.1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	101	0.164	5.60	0.186	0.181	-6.17×10^{-2}
	94.4%	0%	5%	0%	0%	-
PENRE (MJ, LHV)	1,130	20.0	81.7	12.8	13.0	-0.765
	89.6%	2%	7%	1%	1%	-
PENRM (MJ, LHV)	180	0.00	0.00	0.00	0.00	0.00
	100%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,180	22.2	86.8	14.2	14.3	-0.796
	89.2%	2%	7%	1%	1%	-
SM (kg)	1.99	1.45×10^{-2}	0.159	1.05×10^{-2}	1.04×10^{-2}	-2.09×10^{-3}
	91.6%	1%	7%	0%	0%	-
RSF (MJ, LHV)	1.03	1.46×10^{-3}	7.83×10^{-2}	1.34×10^{-3}	1.46×10^{-3}	-5.06×10^{-4}
	92.7%	0%	7%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.488	1.48×10^{-3}	8.02×10^{-2}	1.87×10^{-3}	9.72×10^{-3}	-2.42×10^{-3}
	83.6%	0%	14%	0%	2%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.239	1.01×10^{-3}	4.59×10^{-2}	1.01×10^{-3}	1.02×10^{-3}	-4.27×10^{-4}
	83.5%	0%	16%	0%	0%	-
MER (kg)	4.63×10^{-4}	6.57×10^{-7}	3.52×10^{-5}	6.00×10^{-7}	6.57×10^{-7}	-2.27×10^{-7}
	92.7%	0%	7%	0%	0%	-
MFR (kg)	1.89	1.45×10^{-2}	0.148	9.25×10^{-3}	2.71×10^{-2}	-1.55×10^{-3}
	90.8%	1%	7%	0%	1%	-
HWD (kg)	1.97	2.32×10^{-2}	0.186	1.69×10^{-2}	8.12×10^{-2}	-3.60×10^{-3}
	86.1%	1%	8%	1%	4%	-
NHWD (kg)	56.5	0.167	2.02	0.133	2.25	-2.10×10^{-2}
	92.8%	0%	3%	0%	4%	-
RWD (kg)	1.98×10^{-3}	2.46×10^{-6}	7.96×10^{-5}	2.84×10^{-6}	2.77×10^{-6}	-1.32×10^{-6}
	95.3%	0%	4%	0%	0%	-

Table 54. *Cradle-to-gate with options results for all inventory indicators for* **Group 2** *surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	105	0.176	10.7	0.190	0.185	-6.29×10^{-2}
	90%	0%	9%	0%	0%	-
PERM (MJ, LHV)	7.00	0.00	0.00	0.00	0.00	0.00
	100.2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	105	0.176	10.7	0.190	0.185	-6.29×10^{-2}
	90%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,220	21.5	143	13.1	13.2	-0.781
	86.9%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	161	0.00	0.00	0.00	0.00	0.00
	100.2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,280	23.8	151	14.5	14.6	-0.813
	86.3%	2%	10%	1%	1%	-
SM (kg)	2.35	1.56×10^{-2}	0.274	1.07×10^{-2}	1.06×10^{-2}	-2.13×10^{-3}
	88.2%	1%	10%	0%	0%	-
RSF (MJ, LHV)	1.22	1.57×10^{-3}	0.138	1.37×10^{-3}	1.49×10^{-3}	-5.16×10^{-4}
	89.24%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.544	1.59×10^{-3}	0.108	1.91×10^{-3}	9.93×10^{-3}	-2.47×10^{-3}
	81.6%	0%	16%	0%	2%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.316	1.08×10^{-3}	6.20×10^{-2}	1.03×10^{-3}	1.04×10^{-3}	-4.36×10^{-4}
	82.8%	0%	16%	0%	0%	-
MER (kg)	5.50×10^{-4}	7.05×10^{-7}	6.21×10^{-5}	6.13×10^{-7}	6.71×10^{-7}	-2.32×10^{-7}
	89.24%	0%	10%	0%	0%	-
MFR (kg)	2.23	1.55×10^{-2}	0.258	9.45×10^{-3}	2.77×10^{-2}	-1.58×10^{-3}
	87.6%	1%	10%	0%	1%	-
HWD (kg)	2.01	2.49×10^{-2}	0.286	1.73×10^{-2}	8.31×10^{-2}	-3.68×10^{-3}
	83.2%	1%	12%	1%	3%	-
NHWD (kg)	63.2	0.179	5.08	0.136	2.30	-2.14×10^{-2}
	89.5%	0%	7%	0%	3%	-
RWD (kg)	2.16×10^{-3}	2.64×10^{-6}	1.84×10^{-4}	2.90×10^{-6}	2.83×10^{-6}	-1.35×10^{-6}
	91.96%	0%	8%	0%	0%	-

Table 55. *Cradle-to-gate with options results for all inventory indicators for* **Group 3** *surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	105	0.173	10.6	0.186	0.181	-6.17×10^{-2}
	90.7%	0%	9%	0%	0%	-
PERM (MJ, LHV)	5.87	0.00	0.00	0.00	0.00	0.00
	100.4%	0%	0%	0%	0%	-
PERT (MJ, LHV)	105	0.173	10.6	0.186	0.181	-6.17×10^{-2}
	90.7%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,270	21.0	143	12.9	13.0	-0.767
	87.1%	1%	10%	1%	1%	-
PENRM (MJ, LHV)	135	0.00	0.00	0.00	0.00	0.00
	100.4%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,330	23.3	151	14.2	14.3	-0.798
	86.4%	2%	10%	1%	1%	-
SM (kg)	2.72	1.53×10^{-2}	0.289	1.05×10^{-2}	1.04×10^{-2}	-2.10×10^{-3}
	89%	1%	10%	0%	0%	-
RSF (MJ, LHV)	1.42	1.54×10^{-3}	0.146	1.34×10^{-3}	1.47×10^{-3}	-5.07×10^{-4}
	90.81%	0%	9%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.587	1.55×10^{-3}	0.108	1.87×10^{-3}	9.74×10^{-3}	-2.43×10^{-3}
	83.1%	0%	15%	0%	1%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.428	1.06×10^{-3}	6.64×10^{-2}	1.01×10^{-3}	1.02×10^{-3}	-4.28×10^{-4}
	86.4%	0%	13%	0%	0%	-
MER (kg)	6.39×10^{-4}	6.90×10^{-7}	6.57×10^{-5}	6.02×10^{-7}	6.59×10^{-7}	-2.28×10^{-7}
	90.81%	0%	9%	0%	0%	-
MFR (kg)	2.57	1.52×10^{-2}	0.272	9.27×10^{-3}	2.71×10^{-2}	-1.55×10^{-3}
	88.6%	1%	9%	0%	1%	-
HWD (kg)	1.95	2.43×10^{-2}	0.280	1.69×10^{-2}	8.13×10^{-2}	-3.61×10^{-3}
	82.6%	1%	12%	1%	4%	-
NHWD (kg)	67.8	0.176	5.26	0.134	2.25	-2.10×10^{-2}
	89.2%	0%	7%	0%	3%	-
RWD (kg)	2.27×10^{-3}	2.58×10^{-6}	1.88×10^{-4}	2.85×10^{-6}	2.78×10^{-6}	-1.32×10^{-6}
	91.75%	0%	8%	0%	0%	-

Table 56. *Cradle-to-gate with options results for all inventory indicators for Group 4 surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	106	0.180	10.9	0.194	0.189	-6.42×10^{-2}
	90.6%	0%	9%	0%	0%	-
PERM (MJ, LHV)	7.67	0.00	0.00	0.00	0.00	0.00
	100.1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	106	0.180	10.9	0.194	0.189	-6.42×10^{-2}
	90.6%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,160	21.9	141	13.4	13.5	-0.797
	86.3%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	176	0.00	0.00	0.00	0.00	0.00
	100.1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,200	24.3	149	14.7	14.9	-0.829
	85.7%	2%	11%	1%	1%	-
SM (kg)	2.17	1.59×10^{-2}	0.269	1.09×10^{-2}	1.08×10^{-2}	-2.18×10^{-3}
	87.9%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.14	1.60×10^{-3}	0.136	1.39×10^{-3}	1.52×10^{-3}	-5.27×10^{-4}
	89.26%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.518	1.62×10^{-3}	0.108	1.95×10^{-3}	1.01×10^{-2}	-2.52×10^{-3}
	80.6%	0%	17%	0%	2%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.270	1.10×10^{-3}	6.07×10^{-2}	1.05×10^{-3}	1.06×10^{-3}	-4.45×10^{-4}
	81.1%	0%	18%	0%	0%	-
MER (kg)	5.12×10^{-4}	7.20×10^{-7}	6.10×10^{-5}	6.25×10^{-7}	6.85×10^{-7}	-2.37×10^{-7}
	89.26%	0%	11%	0%	0%	-
MFR (kg)	2.06	1.59×10^{-2}	0.253	9.63×10^{-3}	2.82×10^{-2}	-1.61×10^{-3}
	87.3%	1%	11%	0%	1%	-
HWD (kg)	2.02	2.54×10^{-2}	0.291	1.76×10^{-2}	8.46×10^{-2}	-3.75×10^{-3}
	83.1%	1%	12%	1%	4%	-
NHWD (kg)	61.2	0.183	5.02	0.139	2.34	-2.19×10^{-2}
	88.2%	0%	7%	0%	3%	-
RWD (kg)	2.14×10^{-3}	2.69×10^{-6}	1.85×10^{-4}	2.96×10^{-6}	2.89×10^{-6}	-1.38×10^{-6}
	91.88%	0%	8%	0%	0%	-

Table 57. *Cradle-to-gate with options results for all inventory indicators for* **Group 5** *surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	86.4	0.163	9.41	0.176	0.171	-5.82×10^{-2}
	90.02%	0%	10%	0%	0%	-
PERM (MJ, LHV)	6.08	0.00	0.00	0.00	0.00	0.00
	100.4%	0%	0%	0%	0%	-
PERT (MJ, LHV)	86.4	0.163	9.41	0.176	0.171	-5.82×10^{-2}
	90.02%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	954	19.8	123	12.1	12.2	-0.723
	85%	2%	11%	1%	1%	-
PENRM (MJ, LHV)	139	0.00	0.00	0.00	0.00	0.00
	100.4%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	989	22.0	130	13.4	13.5	-0.752
	84.4%	2%	11%	1%	1%	-
SM (kg)	1.91	1.44×10^{-2}	0.241	9.92×10^{-3}	9.78×10^{-3}	-1.98×10^{-3}
	87.6%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.02	1.45×10^{-3}	0.122	1.26×10^{-3}	1.38×10^{-3}	-4.78×10^{-4}
	89.16%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.409	1.46×10^{-3}	9.52×10^{-2}	1.77×10^{-3}	9.18×10^{-3}	-2.29×10^{-3}
	79.6%	0%	18%	0%	2%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.221	9.97×10^{-4}	5.39×10^{-2}	9.51×10^{-4}	9.59×10^{-4}	-4.03×10^{-4}
	79.3%	0%	19%	0%	0%	-
MER (kg)	4.56×10^{-4}	6.50×10^{-7}	5.49×10^{-5}	5.67×10^{-7}	6.21×10^{-7}	-2.15×10^{-7}
	89.16%	0%	11%	0%	0%	-
MFR (kg)	1.82	1.43×10^{-2}	0.227	8.73×10^{-3}	2.56×10^{-2}	-1.46×10^{-3}
	87.1%	1%	11%	0%	1%	-
HWD (kg)	1.62	2.29×10^{-2}	0.253	1.60×10^{-2}	7.68×10^{-2}	-3.40×10^{-3}
	81.1%	1%	13%	1%	4%	-
NHWD (kg)	53.0	0.165	4.44	0.126	2.13	-1.98×10^{-2}
	89%	0%	7%	0%	4%	-
RWD (kg)	1.90×10^{-3}	2.43×10^{-6}	1.66×10^{-4}	2.68×10^{-6}	2.62×10^{-6}	-1.25×10^{-6}
	91.76%	0%	8%	0%	0%	-

Table 58. *Cradle-to-gate with options results for all inventory indicators for* **Group 6** *surfaces. Resource use for B1, B6, B7, C1, and C3 are assumed to be zero.*

Impact Category	Production (A1-A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources						
PERE (MJ, LHV)	74.8	0.136	7.96	0.146	0.142	$-4.84x10^{-2}$
	90.2%	0%	10%	0%	0%	-
PERM (MJ, LHV)	4.87	0.00	0.00	0.00	0.00	0.00
	99.7%	0%	0%	0%	0%	-
PERT (MJ, LHV)	74.8	0.136	7.96	0.146	0.142	$-4.84x10^{-2}$
	90.2%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	858	16.5	106	10.1	10.2	-0.601
	86.1%	2%	11%	1%	1%	-
PENRM (MJ, LHV)	112	0.00	0.00	0.00	0.00	0.00
	99.7%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	893	18.3	112	11.1	11.2	-0.625
	85.6%	2%	11%	1%	1%	-
SM (kg)	1.77	$1.20x10^{-2}$	0.209	$8.25x10^{-3}$	$8.13x10^{-3}$	$-1.64x10^{-3}$
	88.3%	1%	10%	0%	0%	-
RSF (MJ, LHV)	0.937	$1.21x10^{-3}$	0.106	$1.05x10^{-3}$	$1.15x10^{-3}$	$-3.97x10^{-4}$
	89.51%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
FW (m3)	0.367	$1.22x10^{-3}$	$8.05x10^{-2}$	$1.47x10^{-3}$	$7.63x10^{-3}$	$-1.90x10^{-3}$
	80.3%	0%	18%	0%	2%	-
Waste						
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.216	$8.32x10^{-4}$	$4.64x10^{-2}$	$7.91x10^{-4}$	$7.98x10^{-4}$	$-3.35x10^{-4}$
	81.8%	0%	17%	0%	0%	-
MER (kg)	$4.21x10^{-4}$	$5.42x10^{-7}$	$4.77x10^{-5}$	$4.71x10^{-7}$	$5.16x10^{-7}$	$-1.79x10^{-7}$
	89.51%	0%	10%	0%	0%	-
MFR (kg)	1.69	$1.20x10^{-2}$	0.198	$7.27x10^{-3}$	$2.13x10^{-2}$	$-1.22x10^{-3}$
	87.7%	1%	10%	0%	1%	-
HWD (kg)	1.39	$1.91x10^{-2}$	0.213	$1.33x10^{-2}$	$6.38x10^{-2}$	$-2.83x10^{-3}$
	81.9%	1%	13%	1%	4%	-
NHWD (kg)	46.6	0.138	3.81	0.105	1.77	$-1.65x10^{-2}$
	88.4%	0%	7%	0%	3%	-
RWD (kg)	$1.68x10^{-3}$	$2.03x10^{-6}$	$1.43x10^{-4}$	$2.23x10^{-6}$	$2.18x10^{-6}$	$-1.04x10^{-6}$
	92.06%	0%	8%	0%	0%	-

7. References

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9. Product Category Rules for Building Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements V4.0. March 2022. UL Environment Standard.
10. Product Category Rules for Building Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements V3.2. July 2018. UL Environment Standard.

Appendix A: Life Cycle Inventory by Module

Table A1. *Group 1 – 12 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	39.2	5.52	1.42	1.02	4.94	0.533	1.52	-3.55×10^{-2}
	72%	10%	3%	2%	9%	1%	3%	-
GWP – Fossil (kg CO2 eq)	39.5	5.52	1.64	1.02	4.94	0.533	0.873	-3.54×10^{-2}
	73%	10%	3%	2%	9%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.94	2.66×10^{-4}	-0.223	-3.21×10^{-4}	-7.26×10^{-2}	1.57×10^{-5}	0.651	-4.41×10^{-5}
	120%	0%	14%	0%	5%	0%	-41%	-
GWP-LULUC (kg CO2 eq)	1.56	2.47×10^{-3}	2.09×10^{-3}	5.33×10^{-4}	7.62×10^{-2}	2.15×10^{-4}	1.12×10^{-3}	-3.04×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	41.1	5.52	1.65	1.02	5.03	0.534	0.874	-3.55×10^{-2}
	74%	10%	3%	2%	9%	1%	2%	-
ODP (kg CFC11 eq)	8.89×10^{-7}	8.02×10^{-8}	3.55×10^{-8}	1.46×10^{-8}	4.66×10^{-7}	7.93×10^{-9}	8.95×10^{-9}	-2.77×10^{-10}
	59%	5%	2%	1%	31%	1%	1%	-
AP (molc H+ eq)	0.164	3.90×10^{-2}	6.96×10^{-3}	2.98×10^{-2}	2.29×10^{-2}	2.23×10^{-3}	2.50×10^{-3}	-2.18×10^{-4}
	61%	15%	3%	11%	9%	1%	1%	-
EP – fw (kg P eq)	2.02×10^{-2}	4.55×10^{-4}	5.89×10^{-4}	3.22×10^{-5}	1.72×10^{-3}	4.19×10^{-5}	7.49×10^{-5}	-1.07×10^{-5}
	87%	2%	3%	0%	7%	0%	0%	-
EP – m (kg N eq)	4.20×10^{-2}	1.25×10^{-2}	2.01×10^{-3}	7.43×10^{-3}	5.26×10^{-3}	8.12×10^{-4}	9.94×10^{-4}	-5.18×10^{-5}
	59%	18%	3%	10%	7%	1%	1%	-
EP – t (molc N eq)	0.333	0.137	2.00×10^{-2}	8.25×10^{-2}	5.04×10^{-2}	8.85×10^{-3}	1.04×10^{-2}	-6.29×10^{-4}
	52%	21%	3%	13%	8%	1%	2%	-
POCP (kg NMVOC eq)	0.301	4.32×10^{-2}	8.79×10^{-3}	2.23×10^{-2}	2.79×10^{-2}	3.08×10^{-3}	3.55×10^{-3}	-1.74×10^{-4}
	73%	11%	2%	6%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	2.46×10^{-4}	1.66×10^{-5}	7.99×10^{-6}	9.93×10^{-7}	3.90×10^{-5}	1.77×10^{-6}	1.18×10^{-6}	-1.94×10^{-7}
	78%	5%	3%	0%	12%	1%	0%	-
ADP – ff (MJ, LHV)	702	76.1	32.0	12.4	85.3	7.53	7.58	-0.424
	76%	8%	4%	1%	9%	1%	1%	-
WDP (m3 world eq. deprived)	11.7	0.364	0.621	3.39×10^{-2}	2.35	3.38×10^{-2}	8.96×10^{-2}	-5.43×10^{-2}
	77%	2%	4%	0%	15%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	62.5	1.16	8.73	$9.20x10^{-2}$	6.43	$9.89x10^{-2}$	$9.63x10^{-2}$	$-3.28x10^{-2}$
	79%	2%	11%	0%	8%	0%	0%	-
PERM (MJ, LHV)	5.06	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	62.5	1.16	8.73	$9.20x10^{-2}$	6.43	$9.89x10^{-2}$	$9.63x10^{-2}$	$-3.28x10^{-2}$
	79%	2%	11%	0%	8%	0%	0%	-
PENRE (MJ, LHV)	681	69.2	29.6	11.2	81.2	6.83	6.88	-0.407
	77%	8%	3%	1%	9%	1%	1%	-
PENRM (MJ, LHV)	116	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	703	76.1	32.0	12.4	85.4	7.53	7.59	-0.424
	76%	8%	4%	1%	9%	1%	1%	-
SM (kg)	1.26	$6.50x10^{-2}$	$4.59x10^{-2}$	$8.14x10^{-3}$	0.150	$5.59x10^{-3}$	$5.50x10^{-3}$	$-1.11x10^{-3}$
	82%	4%	3%	1%	10%	0%	0%	-
RSF (MJ, LHV)	0.684	$8.41x10^{-3}$	$1.82x10^{-2}$	$8.19x10^{-4}$	$7.55x10^{-2}$	$7.11x10^{-4}$	$7.78x10^{-4}$	$-2.69x10^{-4}$
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.363	$1.03x10^{-2}$	$-2.61x10^{-2}$	$8.28x10^{-4}$	$5.92x10^{-2}$	$9.95x10^{-4}$	$5.17x10^{-3}$	$-1.29x10^{-3}$
	88%	3%	-6%	0%	14%	0%	1%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.150	$6.22x10^{-3}$	$9.52x10^{-3}$	$5.65x10^{-4}$	$3.24x10^{-2}$	$5.36x10^{-4}$	$5.40x10^{-4}$	$-2.27x10^{-4}$
	75%	3%	5%	0%	16%	0%	0%	-
MER (kg)	$3.07x10^{-4}$	$3.78x10^{-6}$	$8.16x10^{-6}$	$3.68x10^{-7}$	$3.39x10^{-5}$	$3.19x10^{-7}$	$3.49x10^{-7}$	$-1.21x10^{-7}$
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.21	$5.59x10^{-2}$	$3.81x10^{-2}$	$8.11x10^{-3}$	0.141	$4.92x10^{-3}$	$1.44x10^{-2}$	$-8.24x10^{-4}$
	82%	4%	3%	1%	10%	0%	1%	-
HWD (kg)	1.19	0.102	$6.87x10^{-2}$	$1.30x10^{-2}$	0.164	$8.99x10^{-3}$	$4.33x10^{-2}$	$-1.92x10^{-3}$
	75%	6%	4%	1%	10%	1%	3%	-
NHWD (kg)	12.6	0.769	22.8	$9.37x10^{-2}$	2.81	$7.09x10^{-2}$	1.20	$-1.12x10^{-2}$
	31%	2%	57%	0%	7%	0%	3%	-
RWD (kg)	$1.32x10^{-3}$	$1.80x10^{-5}$	$2.13x10^{-5}$	$1.38x10^{-6}$	$1.07x10^{-4}$	$1.51x10^{-6}$	$1.47x10^{-6}$	$-7.03x10^{-7}$
	90%	1%	2%	0%	7%	0%	0%	-

Table A2. *Group 1 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	54.6	7.69	1.74	1.68	7.60	0.887	2.52	$-5.89x10^{-2}$
	71%	10%	2%	2%	10%	1%	3%	-
GWP – Fossil (kg CO2 eq)	55.1	7.69	1.93	1.68	7.59	0.886	1.45	$-5.88x10^{-2}$
	72%	10%	3%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.70	$3.71x10^{-4}$	-0.195	$-5.32x10^{-4}$	$-9.43x10^{-2}$	$2.61x10^{-5}$	1.08	$-7.32x10^{-5}$
	140%	0%	10%	0%	5%	0%	-56%	-
GWP-LULUC (kg CO2 eq)	2.17	$3.44x10^{-3}$	$2.61x10^{-3}$	$8.82x10^{-4}$	0.107	$3.57x10^{-4}$	$1.85x10^{-3}$	$-5.05x10^{-5}$
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	57.3	7.70	1.94	1.68	7.72	0.887	1.45	$-5.89x10^{-2}$
	73%	10%	3%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	$1.24x10^{-6}$	$1.12x10^{-7}$	$4.07x10^{-8}$	$2.41x10^{-8}$	$7.62x10^{-7}$	$1.32x10^{-8}$	$1.49x10^{-8}$	$-4.60x10^{-10}$
	56%	5%	2%	1%	35%	1%	1%	-
AP (molc H+ eq)	0.229	$5.44x10^{-2}$	$8.18x10^{-3}$	$4.94x10^{-2}$	$3.53x10^{-2}$	$3.70x10^{-3}$	$4.15x10^{-3}$	$-3.61x10^{-4}$
	60%	14%	2%	13%	9%	1%	1%	-
EP – fw (kg P eq)	$2.82x10^{-2}$	$6.35x10^{-4}$	$6.27x10^{-4}$	$5.32x10^{-5}$	$2.57x10^{-3}$	$6.96x10^{-5}$	$1.24x10^{-4}$	$-1.77x10^{-5}$
	87%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	$5.85x10^{-2}$	$1.74x10^{-2}$	$2.48x10^{-3}$	$1.23x10^{-2}$	$8.01x10^{-3}$	$1.35x10^{-3}$	$1.65x10^{-3}$	$-8.59x10^{-5}$
	58%	17%	2%	12%	8%	1%	2%	-
EP – t (molc N eq)	0.464	0.191	$2.48x10^{-2}$	0.137	$7.73x10^{-2}$	$1.47x10^{-2}$	$1.73x10^{-2}$	$-1.04x10^{-3}$
	50%	21%	3%	15%	8%	2%	2%	-
POCP (kg NMVOC eq)	0.420	$6.02x10^{-2}$	$1.05x10^{-2}$	$3.70x10^{-2}$	$4.18x10^{-2}$	$5.12x10^{-3}$	$5.89x10^{-3}$	$-2.88x10^{-4}$
	72%	10%	2%	6%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	$3.43x10^{-4}$	$2.32x10^{-5}$	$8.72x10^{-6}$	$1.64x10^{-6}$	$6.13x10^{-5}$	$2.93x10^{-6}$	$1.96x10^{-6}$	$-3.23x10^{-7}$
	77%	5%	2%	0%	14%	1%	0%	-
ADP – ff (MJ, LHV)	978	106	35.9	20.6	131	12.5	12.6	-0.703
	75%	8%	3%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	16.3	0.508	0.644	$5.62x10^{-2}$	3.73	$5.62x10^{-2}$	0.148	$-9.01x10^{-2}$
	76%	2%	3%	0%	17%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	87.1	1.62	8.78	0.152	9.60	0.164	0.160	$-5.44x10^{-2}$
	81%	2%	8%	0%	9%	0%	0%	-
PERM (MJ, LHV)	7.05	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	87.1	1.62	8.78	0.152	9.60	0.164	0.160	$-5.44x10^{-2}$
	81%	2%	8%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	950	96.4	33.2	18.5	125	11.4	11.4	-0.676
	76%	8%	3%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	162	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	981	106	35.9	20.6	131	12.5	12.6	-0.703
	75%	8%	3%	2%	10%	1%	1%	-
SM (kg)	1.76	$9.07x10^{-2}$	$4.89x10^{-2}$	$1.35x10^{-2}$	0.231	$9.29x10^{-3}$	$9.14x10^{-3}$	$-1.85x10^{-3}$
	81%	4%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	0.954	$1.17x10^{-2}$	$1.86x10^{-2}$	$1.36x10^{-3}$	0.116	$1.18x10^{-3}$	$1.29x10^{-3}$	$-4.47x10^{-4}$
	86%	1%	2%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.507	$1.44x10^{-2}$	$-5.27x10^{-2}$	$1.37x10^{-3}$	$9.32x10^{-2}$	$1.65x10^{-3}$	$8.58x10^{-3}$	$-2.14x10^{-3}$
	88%	3%	-9%	0%	16%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.210	$8.67x10^{-3}$	$9.86x10^{-3}$	$9.35x10^{-4}$	$5.15x10^{-2}$	$8.91x10^{-4}$	$8.97x10^{-4}$	$-3.77x10^{-4}$
	74%	3%	4%	0%	18%	0%	0%	-
MER (kg)	$4.29x10^{-4}$	$5.27x10^{-6}$	$8.37x10^{-6}$	$6.09x10^{-7}$	$5.22x10^{-5}$	$5.31x10^{-7}$	$5.81x10^{-7}$	$-2.01x10^{-7}$
	86%	1%	2%	0%	11%	0%	0%	-
MFR (kg)	1.69	$7.80x10^{-2}$	$4.07x10^{-2}$	$1.34x10^{-2}$	0.218	$8.18x10^{-3}$	$2.39x10^{-2}$	$-1.37x10^{-3}$
	82%	4%	2%	1%	11%	0%	1%	-
HWD (kg)	1.66	0.143	$8.00x10^{-2}$	$2.15x10^{-2}$	0.255	$1.49x10^{-2}$	$7.16x10^{-2}$	$-3.18x10^{-3}$
	74%	6%	4%	1%	11%	1%	3%	-
NHWD (kg)	17.5	1.07	34.9	0.155	4.34	0.118	1.98	$-1.86x10^{-2}$
	29%	2%	58%	0%	7%	0%	3%	-
RWD (kg)	$1.84x10^{-3}$	$2.51x10^{-5}$	$2.23x10^{-5}$	$2.28x10^{-6}$	$1.60x10^{-4}$	$2.51x10^{-6}$	$2.45x10^{-6}$	$-1.17x10^{-6}$
	90%	1%	1%	0%	8%	0%	0%	-

Table A3. *Group 1 – 30 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	75.6	10.7	2.14	2.54	11.1	1.34	3.82	-8.89×10^{-2}
	71%	10%	2%	2%	10%	1%	4%	-
GWP – Fossil (kg CO2 eq)	76.3	10.7	2.30	2.54	11.1	1.34	2.19	-8.88×10^{-2}
	72%	10%	2%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-3.74	5.14×10^{-4}	-0.158	-8.02×10^{-4}	-0.125	3.95×10^{-5}	1.63	-1.11×10^{-4}
	160%	0%	7%	0%	5%	0%	-68%	-
GWP-LULUC (kg CO2 eq)	3.01	4.77×10^{-3}	3.29×10^{-3}	1.33×10^{-3}	0.148	5.38×10^{-4}	2.80×10^{-3}	-7.63×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	79.4	10.7	2.31	2.54	11.2	1.34	2.19	-8.89×10^{-2}
	72%	10%	2%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	1.72×10^{-6}	1.55×10^{-7}	4.74×10^{-8}	3.64×10^{-8}	1.14×10^{-6}	1.99×10^{-8}	2.25×10^{-8}	-6.94×10^{-10}
	55%	5%	2%	1%	36%	1%	1%	-
AP (molc H+ eq)	0.318	7.54×10^{-2}	9.73×10^{-3}	7.45×10^{-2}	5.14×10^{-2}	5.59×10^{-3}	6.28×10^{-3}	-5.45×10^{-4}
	59%	14%	2%	14%	10%	1%	1%	-
EP – fw (kg P eq)	3.91×10^{-2}	8.80×10^{-4}	6.77×10^{-4}	8.03×10^{-5}	3.70×10^{-3}	1.05×10^{-4}	1.88×10^{-4}	-2.67×10^{-5}
	87%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	8.10×10^{-2}	2.41×10^{-2}	3.08×10^{-3}	1.85×10^{-2}	1.16×10^{-2}	2.04×10^{-3}	2.50×10^{-3}	-1.30×10^{-4}
	57%	17%	2%	13%	8%	1%	2%	-
EP – t (molc N eq)	0.642	0.264	3.09×10^{-2}	0.206	0.113	2.22×10^{-2}	2.62×10^{-2}	-1.58×10^{-3}
	49%	20%	2%	16%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.581	8.34×10^{-2}	1.26×10^{-2}	5.58×10^{-2}	6.00×10^{-2}	7.74×10^{-3}	8.91×10^{-3}	-4.35×10^{-4}
	72%	10%	2%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	4.75×10^{-4}	3.21×10^{-5}	9.66×10^{-6}	2.48×10^{-6}	9.02×10^{-5}	4.43×10^{-6}	2.97×10^{-6}	-4.87×10^{-7}
	77%	5%	2%	0%	15%	1%	0%	-
ADP – ff (MJ, LHV)	1,350	147	41.0	31.0	191	18.9	19.0	-1.06
	75%	8%	2%	2%	11%	1%	1%	-
WDP (m3 world eq. deprived)	22.6	0.703	0.674	8.48×10^{-2}	5.51	8.49×10^{-2}	0.224	-0.136
	76%	2%	2%	0%	18%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	121	2.24	8.86	0.230	13.8	0.248	0.242	-8.22×10^{-2}
	83%	2%	6%	0%	9%	0%	0%	-
PERM (MJ, LHV)	9.77	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	121	2.24	8.86	0.230	13.8	0.248	0.242	-8.22×10^{-2}
	83%	2%	6%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,320	134	37.8	28.0	181	17.1	17.3	-1.02
	76%	8%	2%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	224	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,360	147	41.0	31.0	191	18.9	19.1	-1.06
	75%	8%	2%	2%	11%	1%	1%	-
SM (kg)	2.44	0.126	5.27×10^{-2}	2.03×10^{-2}	0.337	1.40×10^{-2}	1.38×10^{-2}	-2.79×10^{-3}
	81%	4%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.32	1.63×10^{-2}	1.92×10^{-2}	2.05×10^{-3}	0.169	1.78×10^{-3}	1.95×10^{-3}	-6.74×10^{-4}
	86%	1%	1%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.702	2.00×10^{-2}	-8.73×10^{-2}	2.07×10^{-3}	0.137	2.50×10^{-3}	1.30×10^{-2}	-3.23×10^{-3}
	89%	3%	-11%	0%	17%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.290	1.20×10^{-2}	1.03×10^{-2}	1.41×10^{-3}	7.62×10^{-2}	1.34×10^{-3}	1.36×10^{-3}	-5.69×10^{-4}
	74%	3%	3%	0%	19%	0%	0%	-
MER (kg)	5.94×10^{-4}	7.30×10^{-6}	8.64×10^{-6}	9.19×10^{-7}	7.60×10^{-5}	8.01×10^{-7}	8.78×10^{-7}	-3.03×10^{-7}
	86%	1%	1%	0%	11%	0%	0%	-
MFR (kg)	2.33	0.108	4.42×10^{-2}	2.02×10^{-2}	0.317	1.23×10^{-2}	3.62×10^{-2}	-2.06×10^{-3}
	81%	4%	2%	1%	11%	0%	1%	-
HWD (kg)	2.30	0.198	9.45×10^{-2}	3.24×10^{-2}	0.373	2.26×10^{-2}	0.108	-4.80×10^{-3}
	74%	6%	3%	1%	12%	1%	4%	-
NHWD (kg)	24.2	1.48	50.5	0.234	6.33	0.178	3.00	-2.80×10^{-2}
	28%	2%	59%	0%	7%	0%	4%	-
RWD (kg)	2.55×10^{-3}	3.47×10^{-5}	2.35×10^{-5}	3.44×10^{-6}	2.30×10^{-4}	3.80×10^{-6}	3.70×10^{-6}	-1.76×10^{-6}
	89%	1%	1%	0%	8%	0%	0%	-

Table A4. *Group 2 – 12 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	44.6	4.76	1.43	1.03	5.22	0.543	1.55	44.6
	75%	8%	2%	2%	9%	1%	3%	75%
GWP – Fossil (kg CO2 eq)	44.9	4.76	1.65	1.03	5.21	0.543	0.890	44.9
	76%	8%	3%	2%	9%	1%	2%	76%
GWP – Biogenic (kg CO2 eq)	-1.65	$2.71x10^{-4}$	-0.223	$-3.27x10^{-4}$	$-5.85x10^{-2}$	$1.60x10^{-5}$	0.663	-1.65
	130%	0%	18%	0%	5%	0%	-52%	130%
GWP-LULUC (kg CO2 eq)	1.39	$2.17x10^{-3}$	$2.10x10^{-3}$	$5.42x10^{-4}$	$6.82x10^{-2}$	$2.19x10^{-4}$	$1.14x10^{-3}$	1.39
	95%	0%	0%	0%	5%	0%	0%	95%
GWP-GHG (kg CO2)	46.4	4.77	1.66	1.03	5.29	0.543	0.891	46.4
	77%	8%	3%	2%	9%	1%	2%	77%
ODP (kg CFC11 eq)	$9.76x10^{-7}$	$6.90x10^{-8}$	$3.56x10^{-8}$	$1.48x10^{-8}$	$4.78x10^{-7}$	$8.08x10^{-9}$	$9.14x10^{-9}$	$-2.82x10^{-10}$
	61%	4%	2%	1%	30%	1%	1%	-
AP (molc H+ eq)	0.234	$3.49x10^{-2}$	$7.00x10^{-3}$	$3.04x10^{-2}$	$2.63x10^{-2}$	$2.27x10^{-3}$	$2.55x10^{-3}$	$-2.22x10^{-4}$
	69%	10%	2%	9%	8%	1%	1%	-
EP – fw (kg P eq)	$2.06x10^{-2}$	$4.00x10^{-4}$	$5.90x10^{-4}$	$3.27x10^{-5}$	$1.75x10^{-3}$	$4.27x10^{-5}$	$7.64x10^{-5}$	$-1.09x10^{-5}$
	88%	2%	3%	0%	7%	0%	0%	-
EP – m (kg N eq)	$5.19x10^{-2}$	$1.11x10^{-2}$	$2.02x10^{-3}$	$7.56x10^{-3}$	$5.72x10^{-3}$	$8.27x10^{-4}$	$1.02x10^{-3}$	$-5.28x10^{-5}$
	65%	14%	3%	9%	7%	1%	1%	-
EP – t (molc N eq)	0.468	0.122	$2.01x10^{-2}$	$8.40x10^{-2}$	$5.66x10^{-2}$	$9.01x10^{-3}$	$1.07x10^{-2}$	$-6.41x10^{-4}$
	61%	16%	3%	11%	7%	1%	1%	-
POCP (kg NMVOC eq)	0.316	$3.82x10^{-2}$	$8.83x10^{-3}$	$2.27x10^{-2}$	$2.86x10^{-2}$	$3.14x10^{-3}$	$3.62x10^{-3}$	$-1.77x10^{-4}$
	75%	9%	2%	5%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	$2.84x10^{-4}$	$1.42x10^{-5}$	$8.01x10^{-6}$	$1.01x10^{-6}$	$4.12x10^{-5}$	$1.80x10^{-6}$	$1.21x10^{-6}$	$-1.98x10^{-7}$
	81%	4%	2%	0%	12%	1%	0%	-
ADP – ff (MJ, LHV)	738	65.6	32.1	12.6	87.4	7.67	7.74	-0.432
	78%	7%	3%	1%	9%	1%	1%	-
WDP (m3 world eq. deprived)	12.8	0.319	0.621	$3.46x10^{-2}$	2.43	$3.45x10^{-2}$	$9.13x10^{-2}$	$-5.54x10^{-2}$
	78%	2%	4%	0%	15%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	61.7	1.03	8.73	$9.37x10^{-2}$	6.44	0.101	$9.83x10^{-2}$	$-3.35x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PERM (MJ, LHV)	4.50	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	61.7	1.03	8.73	$9.37x10^{-2}$	6.44	0.101	$9.83x10^{-2}$	$-3.35x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PENRE (MJ, LHV)	714	59.6	29.7	11.4	83.0	6.96	7.03	-0.415
	78%	7%	3%	1%	9%	1%	1%	-
PENRM (MJ, LHV)	103	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	740	65.6	32.1	12.6	87.5	7.67	7.75	-0.432
	78%	7%	3%	1%	9%	1%	1%	-
SM (kg)	1.44	$5.76x10^{-2}$	$4.60x10^{-2}$	$8.28x10^{-3}$	0.160	$5.69x10^{-3}$	$5.62x10^{-3}$	$-1.14x10^{-3}$
	84%	3%	3%	0%	9%	0%	0%	-
RSF (MJ, LHV)	0.777	$7.49x10^{-3}$	$1.82x10^{-2}$	$8.34x10^{-4}$	$8.06x10^{-2}$	$7.24x10^{-4}$	$7.95x10^{-4}$	$-2.75x10^{-4}$
	88%	1%	2%	0%	9%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.386	$9.00x10^{-3}$	$-2.68x10^{-2}$	$8.43x10^{-4}$	$6.10x10^{-2}$	$1.01x10^{-3}$	$5.28x10^{-3}$	$-1.31x10^{-3}$
	88%	2%	-6%	0%	14%	0%	1%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.193	$5.52x10^{-3}$	$9.53x10^{-3}$	$5.75x10^{-4}$	$3.48x10^{-2}$	$5.46x10^{-4}$	$5.52x10^{-4}$	$-2.32x10^{-4}$
	79%	2%	4%	0%	14%	0%	0%	-
MER (kg)	$3.49x10^{-4}$	$3.36x10^{-6}$	$8.17x10^{-6}$	$3.74x10^{-7}$	$3.62x10^{-5}$	$3.25x10^{-7}$	$3.57x10^{-7}$	$-1.23x10^{-7}$
	88%	1%	2%	0%	9%	0%	0%	-
MFR (kg)	1.37	$4.93x10^{-2}$	$3.81x10^{-2}$	$8.25x10^{-3}$	0.150	$5.01x10^{-3}$	$1.47x10^{-2}$	$-8.41x10^{-4}$
	84%	3%	2%	1%	9%	0%	1%	-
HWD (kg)	1.16	$9.02x10^{-2}$	$6.90x10^{-2}$	$1.32x10^{-2}$	0.164	$9.16x10^{-3}$	$4.41x10^{-2}$	$-1.95x10^{-3}$
	75%	6%	4%	1%	11%	1%	3%	-
NHWD (kg)	14.7	0.673	23.2	$9.54x10^{-2}$	2.94	$7.22x10^{-2}$	1.22	$-1.14x10^{-2}$
	34%	2%	54%	0%	7%	0%	3%	-
RWD (kg)	$1.38x10^{-3}$	$1.60x10^{-5}$	$2.13x10^{-5}$	$1.40x10^{-6}$	$1.11x10^{-4}$	$1.54x10^{-6}$	$1.50x10^{-6}$	$-7.17x10^{-7}$
	90%	1%	1%	0%	7%	0%	0%	-

Table A5. *Group 2 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	62.9	6.72	1.76	1.74	8.11	0.918	2.62	-6.11×10^{-2}
	74%	8%	2%	2%	10%	1%	3%	-
GWP – Fossil (kg CO2 eq)	63.3	6.72	1.95	1.74	8.09	0.917	1.50	-6.09×10^{-2}
	75%	8%	2%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.33	3.82×10^{-4}	-0.192	-5.50×10^{-4}	-7.52×10^{-2}	2.71×10^{-5}	1.12	-7.59×10^{-5}
	160%	0%	13%	0%	5%	0%	-76%	-
GWP-LULUC (kg CO2 eq)	1.96	3.06×10^{-3}	2.66×10^{-3}	9.12×10^{-4}	9.66×10^{-2}	3.69×10^{-4}	1.92×10^{-3}	-5.24×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	65.4	6.72	1.96	1.74	8.22	0.918	1.50	-6.10×10^{-2}
	76%	8%	2%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	1.38×10^{-6}	9.73×10^{-8}	4.12×10^{-8}	2.49×10^{-8}	7.92×10^{-7}	1.36×10^{-8}	1.54×10^{-8}	-4.76×10^{-10}
	58%	4%	2%	1%	34%	1%	1%	-
AP (molc H+ eq)	0.331	4.92×10^{-2}	8.28×10^{-3}	5.11×10^{-2}	4.06×10^{-2}	3.83×10^{-3}	4.31×10^{-3}	-3.74×10^{-4}
	68%	10%	2%	10%	8%	1%	1%	-
EP – fw (kg P eq)	2.91×10^{-2}	5.65×10^{-4}	6.31×10^{-4}	5.50×10^{-5}	2.65×10^{-3}	7.21×10^{-5}	1.29×10^{-4}	-1.83×10^{-5}
	88%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	7.32×10^{-2}	1.57×10^{-2}	2.52×10^{-3}	1.27×10^{-2}	8.77×10^{-3}	1.40×10^{-3}	1.71×10^{-3}	-8.90×10^{-5}
	63%	14%	2%	11%	8%	1%	2%	-
EP – t (molc N eq)	0.660	0.172	2.52×10^{-2}	0.141	8.73×10^{-2}	1.52×10^{-2}	1.80×10^{-2}	-1.08×10^{-3}
	59%	15%	2%	13%	8%	1%	2%	-
POCP (kg NMVOC eq)	0.445	5.39×10^{-2}	1.06×10^{-2}	3.82×10^{-2}	4.33×10^{-2}	5.30×10^{-3}	6.11×10^{-3}	-2.99×10^{-4}
	74%	9%	2%	6%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	4.01×10^{-4}	2.01×10^{-5}	8.78×10^{-6}	1.70×10^{-6}	6.55×10^{-5}	3.04×10^{-6}	2.04×10^{-6}	-3.34×10^{-7}
	80%	4%	2%	0%	13%	1%	0%	-
ADP – ff (MJ, LHV)	1,040	92.5	36.3	21.3	136	13.0	13.1	-0.729
	77%	7%	3%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	18.1	0.450	0.646	5.81×10^{-2}	3.91	5.82×10^{-2}	0.154	-9.34×10^{-2}
	77%	2%	3%	0%	17%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	87.0	1.45	8.79	0.158	9.76	0.170	0.166	-5.64×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PERM (MJ, LHV)	6.35	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	87.0	1.45	8.79	0.158	9.76	0.170	0.166	-5.64×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,010	84.0	33.5	19.2	129	11.8	11.9	-0.700
	78%	7%	3%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	146	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,040	92.5	36.3	21.3	136	13.0	13.1	-0.729
	77%	7%	3%	2%	10%	1%	1%	-
SM (kg)	2.03	8.12×10^{-2}	4.92×10^{-2}	1.39×10^{-2}	0.248	9.62×10^{-3}	9.49×10^{-3}	-1.91×10^{-3}
	83%	3%	2%	1%	10%	0%	0%	-
RSF (MJ, LHV)	1.10	1.06×10^{-2}	1.87×10^{-2}	1.40×10^{-3}	0.125	1.22×10^{-3}	1.34×10^{-3}	-4.63×10^{-4}
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.545	1.27×10^{-2}	-5.51×10^{-2}	1.42×10^{-3}	9.73×10^{-2}	1.71×10^{-3}	8.90×10^{-3}	-2.22×10^{-3}
	89%	2%	-9%	0%	16%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.273	7.78×10^{-3}	9.89×10^{-3}	9.66×10^{-4}	5.59×10^{-2}	9.22×10^{-4}	9.30×10^{-4}	-3.91×10^{-4}
	78%	2%	3%	0%	16%	0%	0%	-
MER (kg)	4.92×10^{-4}	4.75×10^{-6}	8.39×10^{-6}	6.30×10^{-7}	5.63×10^{-5}	5.49×10^{-7}	6.02×10^{-7}	-2.08×10^{-7}
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.94	6.95×10^{-2}	4.10×10^{-2}	1.39×10^{-2}	0.234	8.47×10^{-3}	2.48×10^{-2}	-1.42×10^{-3}
	83%	3%	2%	1%	10%	0%	1%	-
HWD (kg)	1.64	0.127	8.10×10^{-2}	2.22×10^{-2}	0.259	1.55×10^{-2}	7.45×10^{-2}	-3.30×10^{-3}
	74%	6%	4%	1%	12%	1%	3%	-
NHWD (kg)	20.7	0.949	36.0	0.160	4.60	0.122	2.06	-1.92×10^{-2}
	32%	2%	56%	0%	7%	0%	3%	-
RWD (kg)	1.94×10^{-3}	2.26×10^{-5}	2.23×10^{-5}	2.35×10^{-6}	1.68×10^{-4}	2.60×10^{-6}	2.54×10^{-6}	-1.21×10^{-6}
	90%	1%	1%	0%	8%	0%	0%	-

Table A6. *Group 2 – 30 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	86.5	9.24	2.18	2.61	11.7	1.37	3.92	-9.13×10^{-2}
	74%	8%	2%	2%	10%	1%	3%	-
GWP – Fossil (kg CO2 eq)	87.0	9.23	2.33	2.60	11.7	1.37	2.24	-9.11×10^{-2}
	75%	8%	2%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-3.20	5.25×10^{-4}	-0.155	-8.24×10^{-4}	-9.77×10^{-2}	4.05×10^{-5}	1.67	-1.13×10^{-4}
	180%	0%	9%	0%	6%	0%	-94%	-
GWP-LULUC (kg CO2 eq)	2.69	4.20×10^{-3}	3.34×10^{-3}	1.37×10^{-3}	0.133	5.53×10^{-4}	2.87×10^{-3}	-7.83×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	89.9	9.24	2.34	2.61	11.8	1.37	2.25	-9.13×10^{-2}
	75%	8%	2%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	1.89×10^{-6}	1.34×10^{-7}	4.79×10^{-8}	3.74×10^{-8}	1.18×10^{-6}	2.04×10^{-8}	2.30×10^{-8}	-7.12×10^{-10}
	57%	4%	1%	1%	35%	1%	1%	-
AP (molc H+ eq)	0.454	6.76×10^{-2}	9.85×10^{-3}	7.66×10^{-2}	5.84×10^{-2}	5.73×10^{-3}	6.43×10^{-3}	-5.60×10^{-4}
	67%	10%	2%	11%	9%	1%	1%	-
EP – fw (kg P eq)	4.00×10^{-2}	7.76×10^{-4}	6.80×10^{-4}	8.25×10^{-5}	3.79×10^{-3}	1.08×10^{-4}	1.93×10^{-4}	-2.74×10^{-5}
	88%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	0.101	2.15×10^{-2}	3.13×10^{-3}	1.91×10^{-2}	1.26×10^{-2}	2.09×10^{-3}	2.56×10^{-3}	-1.33×10^{-4}
	62%	13%	2%	12%	8%	1%	2%	-
EP – t (molc N eq)	0.906	0.236	3.14×10^{-2}	0.212	0.126	2.28×10^{-2}	2.68×10^{-2}	-1.62×10^{-3}
	58%	15%	2%	14%	8%	2%	2%	-
POCP (kg NMVOC eq)	0.612	7.40×10^{-2}	1.28×10^{-2}	5.73×10^{-2}	6.18×10^{-2}	7.94×10^{-3}	9.13×10^{-3}	-4.47×10^{-4}
	73%	9%	2%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	5.51×10^{-4}	2.76×10^{-5}	9.73×10^{-6}	2.55×10^{-6}	9.54×10^{-5}	4.55×10^{-6}	3.04×10^{-6}	-5.00×10^{-7}
	79%	4%	1%	0%	14%	1%	0%	-
ADP – ff (MJ, LHV)	1,430	127	41.4	31.9	197	19.4	19.5	-1.09
	77%	7%	2%	2%	11%	1%	1%	-
WDP (m3 world eq. deprived)	24.8	0.618	0.677	8.71×10^{-2}	5.73	8.71×10^{-2}	0.230	-0.140
	77%	2%	2%	0%	18%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	120	2.00	8.87	0.236	13.9	0.255	0.248	$-8.44x10^{-2}$
	82%	1%	6%	0%	10%	0%	0%	-
PERM (MJ, LHV)	8.72	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	120	2.00	8.87	0.236	13.9	0.255	0.248	$-8.44x10^{-2}$
	82%	1%	6%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	1,380	115	38.2	28.7	186	17.6	17.7	-1.05
	77%	7%	2%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	200	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,430	127	41.4	31.9	197	19.4	19.5	-1.09
	77%	7%	2%	2%	11%	1%	1%	-
SM (kg)	2.79	0.112	$5.30x10^{-2}$	$2.09x10^{-2}$	0.359	$1.44x10^{-2}$	$1.42x10^{-2}$	$-2.86x10^{-3}$
	83%	3%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.51	$1.45x10^{-2}$	$1.93x10^{-2}$	$2.10x10^{-3}$	0.181	$1.83x10^{-3}$	$2.00x10^{-3}$	$-6.93x10^{-4}$
	87%	1%	1%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.748	$1.74x10^{-2}$	$-8.92x10^{-2}$	$2.12x10^{-3}$	0.142	$2.56x10^{-3}$	$1.33x10^{-2}$	$-3.31x10^{-3}$
	89%	2%	-11%	0%	17%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.375	$1.07x10^{-2}$	$1.03x10^{-2}$	$1.45x10^{-3}$	$8.18x10^{-2}$	$1.38x10^{-3}$	$1.39x10^{-3}$	$-5.84x10^{-4}$
	78%	2%	2%	0%	17%	0%	0%	-
MER (kg)	$6.76x10^{-4}$	$6.52x10^{-6}$	$8.66x10^{-6}$	$9.44x10^{-7}$	$8.11x10^{-5}$	$8.22x10^{-7}$	$8.99x10^{-7}$	$-3.11x10^{-7}$
	87%	1%	1%	0%	10%	0%	0%	-
MFR (kg)	2.66	$9.55x10^{-2}$	$4.44x10^{-2}$	$2.08x10^{-2}$	0.338	$1.27x10^{-2}$	$3.71x10^{-2}$	$-2.12x10^{-3}$
	83%	3%	1%	1%	11%	0%	1%	-
HWD (kg)	2.25	0.175	$9.56x10^{-2}$	$3.33x10^{-2}$	0.376	$2.32x10^{-2}$	0.111	$-4.93x10^{-3}$
	73%	6%	3%	1%	12%	1%	4%	-
NHWD (kg)	28.5	1.30	51.4	0.240	6.64	0.183	3.08	$-2.88x10^{-2}$
	31%	1%	56%	0%	7%	0%	3%	-
RWD (kg)	$2.67x10^{-3}$	$3.11x10^{-5}$	$2.36x10^{-5}$	$3.53x10^{-6}$	$2.39x10^{-4}$	$3.89x10^{-6}$	$3.79x10^{-6}$	$-1.81x10^{-6}$
	90%	1%	1%	0%	8%	0%	0%	-

Table A7. *Group 3 – 12 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	51.2	4.27	1.43	1.04	5.53	0.547	1.56	-3.64×10^{-2}
	78%	7%	2%	2%	8%	1%	2%	-
GWP – Fossil (kg CO2 eq)	51.3	4.27	1.65	1.04	5.51	0.547	0.895	-3.63×10^{-2}
	79%	7%	3%	2%	9%	1%	1%	-
GWP – Biogenic (kg CO2 eq)	-1.28	2.02×10^{-4}	-0.222	-3.29×10^{-4}	-4.08×10^{-2}	1.61×10^{-5}	0.667	-4.52×10^{-5}
	150%	0%	25%	0%	5%	0%	-76%	-
GWP-LULUC (kg CO2 eq)	1.17	1.82×10^{-3}	2.11×10^{-3}	5.46×10^{-4}	5.78×10^{-2}	2.20×10^{-4}	1.14×10^{-3}	-3.12×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	52.6	4.27	1.66	1.04	5.59	0.547	0.896	-3.64×10^{-2}
	79%	6%	3%	2%	8%	1%	1%	-
ODP (kg CFC11 eq)	1.08×10^{-6}	6.27×10^{-8}	3.57×10^{-8}	1.49×10^{-8}	4.85×10^{-7}	8.14×10^{-9}	9.18×10^{-9}	-2.84×10^{-10}
	64%	4%	2%	1%	29%	0%	1%	-
AP (molc H+ eq)	0.323	2.31×10^{-2}	7.01×10^{-3}	3.06×10^{-2}	3.00×10^{-2}	2.28×10^{-3}	2.56×10^{-3}	-2.23×10^{-4}
	77%	6%	2%	7%	7%	1%	1%	-
EP – fw (kg P eq)	2.10×10^{-2}	3.49×10^{-4}	5.90×10^{-4}	3.29×10^{-5}	1.77×10^{-3}	4.30×10^{-5}	7.68×10^{-5}	-1.09×10^{-5}
	88%	2%	3%	0%	7%	0%	0%	-
EP – m (kg N eq)	6.41×10^{-2}	7.91×10^{-3}	2.02×10^{-3}	7.61×10^{-3}	6.17×10^{-3}	8.33×10^{-4}	1.02×10^{-3}	-5.30×10^{-5}
	71%	9%	2%	9%	7%	1%	1%	-
EP – t (molc N eq)	0.636	8.64×10^{-2}	2.01×10^{-2}	8.45×10^{-2}	6.32×10^{-2}	9.08×10^{-3}	1.07×10^{-2}	-6.44×10^{-4}
	70%	10%	2%	9%	7%	1%	1%	-
POCP (kg NMVOC eq)	0.333	2.85×10^{-2}	8.85×10^{-3}	2.29×10^{-2}	2.90×10^{-2}	3.16×10^{-3}	3.64×10^{-3}	-1.78×10^{-4}
	78%	7%	2%	5%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	3.56×10^{-4}	1.36×10^{-5}	8.01×10^{-6}	1.02×10^{-6}	4.48×10^{-5}	1.81×10^{-6}	1.21×10^{-6}	-1.99×10^{-7}
	83%	3%	2%	0%	11%	0%	0%	-
ADP – ff (MJ, LHV)	780	59.6	32.1	12.7	89.5	7.72	7.78	-0.434
	79%	6%	3%	1%	9%	1%	1%	-
WDP (m3 world eq. deprived)	14.2	0.280	0.621	3.48×10^{-2}	2.50	3.47×10^{-2}	9.18×10^{-2}	-5.57×10^{-2}
	80%	2%	4%	0%	14%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	61.5	0.862	8.73	$9.43x10^{-2}$	6.44	0.101	$9.88x10^{-2}$	$-3.36x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PERM (MJ, LHV)	3.76	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	61.5	0.862	8.73	$9.43x10^{-2}$	6.44	0.101	$9.88x10^{-2}$	$-3.36x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PENRE (MJ, LHV)	749	54.1	29.8	11.5	84.8	7.01	7.06	-0.417
	79%	6%	3%	1%	9%	1%	1%	-
PENRM (MJ, LHV)	86.4	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	781	59.6	32.1	12.7	89.5	7.72	7.79	-0.434
	79%	6%	3%	1%	9%	1%	1%	-
SM (kg)	1.68	$4.83x10^{-2}$	$4.60x10^{-2}$	$8.34x10^{-3}$	0.172	$5.73x10^{-3}$	$5.65x10^{-3}$	$-1.14x10^{-3}$
	86%	2%	2%	0%	9%	0%	0%	-
RSF (MJ, LHV)	0.906	$6.22x10^{-3}$	$1.82x10^{-2}$	$8.39x10^{-4}$	$8.70x10^{-2}$	$7.29x10^{-4}$	$7.98x10^{-4}$	$-2.76x10^{-4}$
	89%	1%	2%	0%	9%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.413	$8.07x10^{-3}$	$-2.70x10^{-2}$	$8.48x10^{-4}$	$6.26x10^{-2}$	$1.02x10^{-3}$	$5.30x10^{-3}$	$-1.32x10^{-3}$
	89%	2%	-6%	0%	13%	0%	1%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.267	$4.64x10^{-3}$	$9.54x10^{-3}$	$5.78x10^{-4}$	$3.84x10^{-2}$	$5.50x10^{-4}$	$5.54x10^{-4}$	$-2.33x10^{-4}$
	83%	1%	3%	0%	12%	0%	0%	-
MER (kg)	$4.07x10^{-4}$	$2.79x10^{-6}$	$8.17x10^{-6}$	$3.77x10^{-7}$	$3.91x10^{-5}$	$3.27x10^{-7}$	$3.59x10^{-7}$	$-1.24x10^{-7}$
	89%	1%	2%	0%	9%	0%	0%	-
MFR (kg)	1.60	$4.18x10^{-2}$	$3.82x10^{-2}$	$8.30x10^{-3}$	0.162	$5.05x10^{-3}$	$1.48x10^{-2}$	$-8.44x10^{-4}$
	86%	2%	2%	0%	9%	0%	1%	-
HWD (kg)	1.13	$7.66x10^{-2}$	$6.91x10^{-2}$	$1.33x10^{-2}$	0.163	$9.22x10^{-3}$	$4.43x10^{-2}$	$-1.96x10^{-3}$
	75%	5%	5%	1%	11%	1%	3%	-
NHWD (kg)	18.2	0.587	23.3	$9.59x10^{-2}$	3.12	$7.27x10^{-2}$	1.23	$-1.15x10^{-2}$
	39%	1%	50%	0%	7%	0%	3%	-
RWD (kg)	$1.45x10^{-3}$	$1.33x10^{-5}$	$2.14x10^{-5}$	$1.41x10^{-6}$	$1.14x10^{-4}$	$1.55x10^{-6}$	$1.51x10^{-6}$	$-7.20x10^{-7}$
	90%	1%	1%	0%	7%	0%	0%	-

Table A8. *Group 3 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	73.5	6.13	1.76	1.74	8.59	0.918	2.62	-6.09×10^{-2}
	77%	6%	2%	2%	9%	1%	3%	-
GWP – Fossil (kg CO2 eq)	73.6	6.13	1.95	1.74	8.56	0.917	1.50	-6.08×10^{-2}
	78%	7%	2%	2%	9%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.84	2.89×10^{-4}	-0.192	-5.50×10^{-4}	-5.20×10^{-2}	2.71×10^{-5}	1.12	-7.57×10^{-5}
	190%	0%	20%	0%	5%	0%	-120%	-
GWP-LULUC (kg CO2 eq)	1.68	2.62×10^{-3}	2.66×10^{-3}	9.12×10^{-4}	8.34×10^{-2}	3.69×10^{-4}	1.92×10^{-3}	-5.23×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	75.5	6.13	1.96	1.74	8.67	0.918	1.50	-6.09×10^{-2}
	78%	6%	2%	2%	9%	1%	2%	-
ODP (kg CFC11 eq)	1.55×10^{-6}	9.00×10^{-8}	4.12×10^{-8}	2.49×10^{-8}	8.00×10^{-7}	1.36×10^{-8}	1.54×10^{-8}	-4.75×10^{-10}
	61%	4%	2%	1%	32%	1%	1%	-
AP (molc H+ eq)	0.463	3.32×10^{-2}	8.28×10^{-3}	5.11×10^{-2}	4.62×10^{-2}	3.83×10^{-3}	4.31×10^{-3}	-3.74×10^{-4}
	76%	5%	1%	8%	8%	1%	1%	-
EP – fw (kg P eq)	3.01×10^{-2}	5.02×10^{-4}	6.31×10^{-4}	5.50×10^{-5}	2.70×10^{-3}	7.21×10^{-5}	1.29×10^{-4}	-1.83×10^{-5}
	88%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	9.20×10^{-2}	1.14×10^{-2}	2.52×10^{-3}	1.27×10^{-2}	9.46×10^{-3}	1.40×10^{-3}	1.71×10^{-3}	-8.89×10^{-5}
	70%	9%	2%	10%	7%	1%	1%	-
EP – t (molc N eq)	0.913	0.124	2.52×10^{-2}	0.141	9.72×10^{-2}	1.52×10^{-2}	1.80×10^{-2}	-1.08×10^{-3}
	68%	9%	2%	11%	7%	1%	1%	-
POCP (kg NMVOC eq)	0.478	4.10×10^{-2}	1.06×10^{-2}	3.82×10^{-2}	4.43×10^{-2}	5.30×10^{-3}	6.11×10^{-3}	-2.98×10^{-4}
	77%	7%	2%	6%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	5.11×10^{-4}	1.95×10^{-5}	8.78×10^{-6}	1.70×10^{-6}	7.07×10^{-5}	3.04×10^{-6}	2.04×10^{-6}	-3.34×10^{-7}
	83%	3%	1%	0%	11%	0%	0%	-
ADP – ff (MJ, LHV)	1,120	85.6	36.3	21.3	140	13.0	13.1	-0.728
	78%	6%	3%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	20.4	0.402	0.646	5.81×10^{-2}	4.02	5.82×10^{-2}	0.154	-9.33×10^{-2}
	79%	2%	3%	0%	16%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	88.3	1.24	8.79	0.158	9.81	0.170	0.166	-5.63×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PERM (MJ, LHV)	5.40	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	88.3	1.24	8.79	0.158	9.81	0.170	0.166	-5.63×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	1,080	77.7	33.5	19.2	132	11.8	11.9	-0.699
	79%	6%	3%	1%	10%	1%	1%	-
PENRM (MJ, LHV)	124	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,120	85.6	36.3	21.3	140	13.0	13.1	-0.728
	78%	6%	3%	2%	10%	1%	1%	-
SM (kg)	2.42	6.93×10^{-2}	4.92×10^{-2}	1.39×10^{-2}	0.267	9.62×10^{-3}	9.49×10^{-3}	-1.91×10^{-3}
	85%	2%	2%	0%	9%	0%	0%	-
RSF (MJ, LHV)	1.30	8.93×10^{-3}	1.87×10^{-2}	1.40×10^{-3}	0.135	1.22×10^{-3}	1.34×10^{-3}	-4.62×10^{-4}
	89%	1%	1%	0%	9%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.594	1.16×10^{-2}	-5.51×10^{-2}	1.42×10^{-3}	9.96×10^{-2}	1.71×10^{-3}	8.90×10^{-3}	-2.21×10^{-3}
	90%	2%	-8%	0%	15%	0%	1%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.383	6.66×10^{-3}	9.89×10^{-3}	9.66×10^{-4}	6.11×10^{-2}	9.22×10^{-4}	9.30×10^{-4}	-3.90×10^{-4}
	83%	1%	2%	0%	13%	0%	0%	-
MER (kg)	5.84×10^{-4}	4.01×10^{-6}	8.39×10^{-6}	6.30×10^{-7}	6.06×10^{-5}	5.49×10^{-7}	6.02×10^{-7}	-2.07×10^{-7}
	89%	1%	1%	0%	9%	0%	0%	-
MFR (kg)	2.30	6.00×10^{-2}	4.10×10^{-2}	1.39×10^{-2}	0.251	8.47×10^{-3}	2.48×10^{-2}	-1.41×10^{-3}
	85%	2%	2%	1%	9%	0%	1%	-
HWD (kg)	1.63	0.110	8.10×10^{-2}	2.22×10^{-2}	0.258	1.55×10^{-2}	7.45×10^{-2}	-3.29×10^{-3}
	74%	5%	4%	1%	12%	1%	3%	-
NHWD (kg)	26.1	0.843	36.0	0.160	4.85	0.122	2.06	-1.92×10^{-2}
	37%	1%	51%	0%	7%	0%	3%	-
RWD (kg)	2.08×10^{-3}	1.91×10^{-5}	2.23×10^{-5}	2.35×10^{-6}	1.74×10^{-4}	2.60×10^{-6}	2.54×10^{-6}	-1.21×10^{-6}
	90%	1%	1%	0%	8%	0%	0%	-

Table A9. *Group 3 – 30 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	101	8.43	2.18	2.61	12.4	1.38	3.92	$-9.14x10^{-2}$
	77%	6%	2%	2%	9%	1%	3%	-
GWP – Fossil (kg CO2 eq)	101	8.43	2.33	2.61	12.3	1.37	2.25	$-9.12x10^{-2}$
	78%	7%	2%	2%	9%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.54	$3.98x10^{-4}$	-0.155	$-8.24x10^{-4}$	$-6.59x10^{-2}$	$4.06x10^{-5}$	1.67	$-1.14x10^{-4}$
	230%	0%	14%	0%	6%	0%	-150%	-
GWP-LULUC (kg CO2 eq)	2.31	$3.60x10^{-3}$	$3.34x10^{-3}$	$1.37x10^{-3}$	0.115	$5.53x10^{-4}$	$2.88x10^{-3}$	$-7.84x10^{-5}$
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	104	8.44	2.34	2.61	12.5	1.38	2.25	$-9.14x10^{-2}$
	78%	6%	2%	2%	9%	1%	2%	-
ODP (kg CFC11 eq)	$2.13x10^{-6}$	$1.24x10^{-7}$	$4.79x10^{-8}$	$3.74x10^{-8}$	$1.19x10^{-6}$	$2.05x10^{-8}$	$2.31x10^{-8}$	$-7.13x10^{-10}$
	60%	4%	1%	1%	33%	1%	1%	-
AP (molc H+ eq)	0.637	$4.57x10^{-2}$	$9.85x10^{-3}$	$7.66x10^{-2}$	$6.62x10^{-2}$	$5.74x10^{-3}$	$6.44x10^{-3}$	$-5.60x10^{-4}$
	75%	5%	1%	9%	8%	1%	1%	-
EP – fw (kg P eq)	$4.14x10^{-2}$	$6.90x10^{-4}$	$6.81x10^{-4}$	$8.25x10^{-5}$	$3.85x10^{-3}$	$1.08x10^{-4}$	$1.93x10^{-4}$	$-2.74x10^{-5}$
	88%	2%	1%	0%	8%	0%	0%	-
EP – m (kg N eq)	0.127	$1.56x10^{-2}$	$3.13x10^{-3}$	$1.91x10^{-2}$	$1.35x10^{-2}$	$2.09x10^{-3}$	$2.56x10^{-3}$	$-1.33x10^{-4}$
	69%	9%	2%	10%	7%	1%	1%	-
EP – t (molc N eq)	1.26	0.171	$3.14x10^{-2}$	0.212	0.139	$2.28x10^{-2}$	$2.69x10^{-2}$	$-1.62x10^{-3}$
	68%	9%	2%	11%	8%	1%	1%	-
POCP (kg NMVOC eq)	0.657	$5.64x10^{-2}$	$1.28x10^{-2}$	$5.73x10^{-2}$	$6.32x10^{-2}$	$7.95x10^{-3}$	$9.14x10^{-3}$	$-4.47x10^{-4}$
	76%	7%	2%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	$7.03x10^{-4}$	$2.68x10^{-5}$	$9.73x10^{-6}$	$2.55x10^{-6}$	$1.03x10^{-4}$	$4.55x10^{-6}$	$3.05x10^{-6}$	$-5.01x10^{-7}$
	82%	3%	1%	0%	12%	1%	0%	-
ADP – ff (MJ, LHV)	1,540	118	41.4	31.9	201	19.4	19.5	-1.09
	78%	6%	2%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	28.0	0.553	0.677	$8.71x10^{-2}$	5.88	$8.73x10^{-2}$	0.230	-0.140
	79%	2%	2%	0%	17%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	121	1.70	8.87	0.236	14.0	0.255	0.248	$-8.44x10^{-2}$
	83%	1%	6%	0%	10%	0%	0%	-
PERM (MJ, LHV)	7.43	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	121	1.70	8.87	0.236	14.0	0.255	0.248	$-8.44x10^{-2}$
	83%	1%	6%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	1,480	107	38.2	28.7	191	17.6	17.8	-1.05
	79%	6%	2%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	171	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,540	118	41.4	31.9	202	19.4	19.6	-1.09
	78%	6%	2%	2%	10%	1%	1%	-
SM (kg)	3.33	$9.53x10^{-2}$	$5.30x10^{-2}$	$2.09x10^{-2}$	0.384	$1.44x10^{-2}$	$1.42x10^{-2}$	$-2.87x10^{-3}$
	85%	2%	1%	1%	10%	0%	0%	-
RSF (MJ, LHV)	1.79	$1.23x10^{-2}$	$1.93x10^{-2}$	$2.10x10^{-3}$	0.194	$1.83x10^{-3}$	$2.01x10^{-3}$	$-6.93x10^{-4}$
	89%	1%	1%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.817	$1.59x10^{-2}$	$-8.92x10^{-2}$	$2.12x10^{-3}$	0.145	$2.57x10^{-3}$	$1.33x10^{-2}$	$-3.32x10^{-3}$
	90%	2%	-10%	0%	16%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.527	$9.16x10^{-3}$	$1.03x10^{-2}$	$1.45x10^{-3}$	$8.90x10^{-2}$	$1.38x10^{-3}$	$1.39x10^{-3}$	$-5.85x10^{-4}$
	82%	1%	2%	0%	14%	0%	0%	-
MER (kg)	$8.04x10^{-4}$	$5.52x10^{-6}$	$8.66x10^{-6}$	$9.44x10^{-7}$	$8.72x10^{-5}$	$8.23x10^{-7}$	$9.01x10^{-7}$	$-3.11x10^{-7}$
	89%	1%	1%	0%	10%	0%	0%	-
MFR (kg)	3.16	$8.26x10^{-2}$	$4.44x10^{-2}$	$2.08x10^{-2}$	0.361	$1.27x10^{-2}$	$3.71x10^{-2}$	$-2.12x10^{-3}$
	85%	2%	1%	1%	10%	0%	1%	-
HWD (kg)	2.24	0.151	$9.56x10^{-2}$	$3.33x10^{-2}$	0.374	$2.32x10^{-2}$	0.111	$-4.93x10^{-3}$
	74%	5%	3%	1%	12%	1%	4%	-
NHWD (kg)	35.9	1.16	51.4	0.240	6.99	0.183	3.08	$-2.88x10^{-2}$
	36%	1%	52%	0%	7%	0%	3%	-
RWD (kg)	$2.86x10^{-3}$	$2.63x10^{-5}$	$2.36x10^{-5}$	$3.53x10^{-6}$	$2.48x10^{-4}$	$3.90x10^{-6}$	$3.80x10^{-6}$	$-1.81x10^{-6}$
	90%	1%	1%	0%	8%	0%	0%	-

Table A10. *Group 4 – 12 mm L LCI and LCIA CI results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	40.8	3.38	1.44	1.05	5.02	0.553	1.58	-3.68×10^{-2}
	76%	6%	3%	2%	9%	1%	3%	-
GWP – Fossil (kg CO2 eq)	41.1	3.38	1.66	1.05	5.01	0.553	0.905	-3.67×10^{-2}
	77%	6%	3%	2%	9%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.90	4.15×10^{-4}	-0.222	-3.33×10^{-4}	-6.98×10^{-2}	1.63×10^{-5}	0.674	-4.57×10^{-5}
	130%	0%	15%	0%	5%	0%	-44%	-
GWP-LULUC (kg CO2 eq)	1.54	1.69×10^{-3}	2.12×10^{-3}	5.52×10^{-4}	7.54×10^{-2}	2.22×10^{-4}	1.16×10^{-3}	-3.15×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	42.7	3.38	1.66	1.05	5.10	0.553	0.906	-3.68×10^{-2}
	77%	6%	3%	2%	9%	1%	2%	-
ODP (kg CFC11 eq)	9.13×10^{-7}	4.77×10^{-8}	3.58×10^{-8}	1.51×10^{-8}	4.81×10^{-7}	8.22×10^{-9}	9.30×10^{-9}	-2.87×10^{-10}
	60%	3%	2%	1%	32%	1%	1%	-
AP (molc H+ eq)	0.179	2.79×10^{-2}	7.03×10^{-3}	3.09×10^{-2}	2.35×10^{-2}	2.31×10^{-3}	2.60×10^{-3}	-2.25×10^{-4}
	66%	10%	3%	11%	9%	1%	1%	-
EP – fw (kg P eq)	2.09×10^{-2}	3.21×10^{-4}	5.91×10^{-4}	3.33×10^{-5}	1.77×10^{-3}	4.34×10^{-5}	7.76×10^{-5}	-1.10×10^{-5}
	88%	1%	3%	0%	7%	0%	0%	-
EP – m (kg N eq)	4.43×10^{-2}	8.94×10^{-3}	2.03×10^{-3}	7.69×10^{-3}	5.30×10^{-3}	8.42×10^{-4}	1.03×10^{-3}	-5.36×10^{-5}
	63%	13%	3%	11%	8%	1%	2%	-
EP – t (molc N eq)	0.361	9.80×10^{-2}	2.02×10^{-2}	8.54×10^{-2}	5.09×10^{-2}	9.17×10^{-3}	1.08×10^{-2}	-6.51×10^{-4}
	57%	15%	3%	13%	8%	1%	2%	-
POCP (kg NMVOC eq)	0.306	2.99×10^{-2}	8.88×10^{-3}	2.31×10^{-2}	2.79×10^{-2}	3.19×10^{-3}	3.69×10^{-3}	-1.80×10^{-4}
	76%	7%	2%	6%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	2.60×10^{-4}	9.70×10^{-6}	8.03×10^{-6}	1.03×10^{-6}	4.03×10^{-5}	1.83×10^{-6}	1.23×10^{-6}	-2.01×10^{-7}
	81%	3%	3%	0%	13%	1%	0%	-
ADP – ff (MJ, LHV)	720	45.9	32.2	12.9	86.5	7.80	7.88	-0.439
	79%	5%	4%	1%	10%	1%	1%	-
WDP (m3 world eq. deprived)	12.1	0.250	0.622	3.52×10^{-2}	2.42	3.51×10^{-2}	9.28×10^{-2}	-5.63×10^{-2}
	78%	2%	4%	0%	16%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	63.3	0.881	8.73	$9.53x10^{-2}$	6.56	0.103	0.100	$-3.40x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PERM (MJ, LHV)	4.99	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	63.3	0.881	8.73	$9.53x10^{-2}$	6.56	0.103	0.100	$-3.40x10^{-2}$
	79%	1%	11%	0%	8%	0%	0%	-
PENRE (MJ, LHV)	699	41.8	29.8	11.6	82.3	7.08	7.15	-0.422
	80%	5%	3%	1%	9%	1%	1%	-
PENRM (MJ, LHV)	114	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	721	45.9	32.2	12.9	86.5	7.80	7.88	-0.439
	79%	5%	4%	1%	10%	1%	1%	-
SM (kg)	1.35	$4.78x10^{-2}$	$4.61x10^{-2}$	$8.43x10^{-3}$	0.156	$5.79x10^{-3}$	$5.72x10^{-3}$	$-1.15x10^{-3}$
	83%	3%	3%	1%	10%	0%	0%	-
RSF (MJ, LHV)	0.731	$6.40x10^{-3}$	$1.82x10^{-2}$	$8.48x10^{-4}$	$7.92x10^{-2}$	$7.37x10^{-4}$	$8.08x10^{-4}$	$-2.79x10^{-4}$
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.376	$6.84x10^{-3}$	$-2.75x10^{-2}$	$8.58x10^{-4}$	$6.12x10^{-2}$	$1.03x10^{-3}$	$5.37x10^{-3}$	$-1.33x10^{-3}$
	89%	2%	-7%	0%	14%	0%	1%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.166	$4.65x10^{-3}$	$9.54x10^{-3}$	$5.85x10^{-4}$	$3.39x10^{-2}$	$5.55x10^{-4}$	$5.61x10^{-4}$	$-2.35x10^{-4}$
	77%	2%	4%	0%	16%	0%	0%	-
MER (kg)	$3.28x10^{-4}$	$2.88x10^{-6}$	$8.17x10^{-6}$	$3.81x10^{-7}$	$3.56x10^{-5}$	$3.31x10^{-7}$	$3.63x10^{-7}$	$-1.25x10^{-7}$
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.29	$3.96x10^{-2}$	$3.82x10^{-2}$	$8.40x10^{-3}$	0.147	$5.10x10^{-3}$	$1.50x10^{-2}$	$-8.54x10^{-4}$
	84%	3%	3%	1%	10%	0%	1%	-
HWD (kg)	1.20	$7.33x10^{-2}$	$6.93x10^{-2}$	$1.34x10^{-2}$	0.167	$9.32x10^{-3}$	$4.48x10^{-2}$	$-1.99x10^{-3}$
	76%	5%	4%	1%	11%	1%	3%	-
NHWD (kg)	13.2	0.523	23.5	$9.70x10^{-2}$	2.90	$7.35x10^{-2}$	1.24	$-1.16x10^{-2}$
	32%	1%	57%	0%	7%	0%	3%	-
RWD (kg)	$1.38x10^{-3}$	$1.39x10^{-5}$	$2.14x10^{-5}$	$1.43x10^{-6}$	$1.11x10^{-4}$	$1.57x10^{-6}$	$1.53x10^{-6}$	$-7.28x10^{-7}$
	90%	1%	1%	0%	7%	0%	0%	-

Table A11. *Group 4 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	56.0	4.65	1.77	1.75	7.70	0.921	2.63	-6.12×10^{-2}
	74%	6%	2%	2%	10%	1%	4%	-
GWP – Fossil (kg CO2 eq)	56.5	4.64	1.96	1.75	7.69	0.921	1.50	-6.11×10^{-2}
	75%	6%	3%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.61	5.70×10^{-4}	-0.192	-5.53×10^{-4}	-8.82×10^{-2}	2.72×10^{-5}	1.12	-7.61×10^{-5}
	150%	0%	11%	0%	5%	0%	-63%	-
GWP-LULUC (kg CO2 eq)	2.11	2.32×10^{-3}	2.66×10^{-3}	9.18×10^{-4}	0.104	3.71×10^{-4}	1.93×10^{-3}	-5.25×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	58.6	4.65	1.97	1.75	7.82	0.922	1.51	-6.12×10^{-2}
	76%	6%	3%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	1.25×10^{-6}	6.55×10^{-8}	4.12×10^{-8}	2.51×10^{-8}	7.88×10^{-7}	1.37×10^{-8}	1.55×10^{-8}	-4.78×10^{-10}
	57%	3%	2%	1%	36%	1%	1%	-
AP (molc H+ eq)	0.246	3.82×10^{-2}	8.29×10^{-3}	5.14×10^{-2}	3.62×10^{-2}	3.85×10^{-3}	4.32×10^{-3}	-3.76×10^{-4}
	63%	10%	2%	13%	9%	1%	1%	-
EP – fw (kg P eq)	2.88×10^{-2}	4.41×10^{-4}	6.31×10^{-4}	5.54×10^{-5}	2.64×10^{-3}	7.24×10^{-5}	1.29×10^{-4}	-1.84×10^{-5}
	88%	1%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	6.08×10^{-2}	1.23×10^{-2}	2.52×10^{-3}	1.28×10^{-2}	8.04×10^{-3}	1.40×10^{-3}	1.72×10^{-3}	-8.93×10^{-5}
	61%	12%	3%	13%	8%	1%	2%	-
EP – t (molc N eq)	0.496	0.135	2.52×10^{-2}	0.142	7.80×10^{-2}	1.53×10^{-2}	1.80×10^{-2}	-1.08×10^{-3}
	55%	15%	3%	16%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.421	4.11×10^{-2}	1.06×10^{-2}	3.85×10^{-2}	4.16×10^{-2}	5.32×10^{-3}	6.13×10^{-3}	-3.00×10^{-4}
	75%	7%	2%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	3.57×10^{-4}	1.33×10^{-5}	8.79×10^{-6}	1.71×10^{-6}	6.32×10^{-5}	3.05×10^{-6}	2.04×10^{-6}	-3.35×10^{-7}
	79%	3%	2%	0%	14%	1%	0%	-
ADP – ff (MJ, LHV)	988	63.0	36.3	21.4	133	13.0	13.1	-0.731
	78%	5%	3%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	16.6	0.343	0.646	5.85×10^{-2}	3.85	5.85×10^{-2}	0.154	-9.37×10^{-2}
	76%	2%	3%	0%	18%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	86.9	1.21	8.79	0.159	9.76	0.171	0.166	-5.66×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PERM (MJ, LHV)	6.85	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	86.9	1.21	8.79	0.159	9.76	0.171	0.166	-5.66×10^{-2}
	81%	1%	8%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	959	57.3	33.6	19.3	126	11.8	11.9	-0.703
	79%	5%	3%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	157	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	990	63.0	36.3	21.4	133	13.0	13.1	-0.731
	78%	5%	3%	2%	10%	1%	1%	-
SM (kg)	1.85	6.56×10^{-2}	4.92×10^{-2}	1.40×10^{-2}	0.240	9.66×10^{-3}	9.51×10^{-3}	-1.92×10^{-3}
	83%	3%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.00	8.79×10^{-3}	1.87×10^{-2}	1.41×10^{-3}	0.121	1.23×10^{-3}	1.34×10^{-3}	-4.65×10^{-4}
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.517	9.40×10^{-3}	-5.54×10^{-2}	1.43×10^{-3}	9.61×10^{-2}	1.72×10^{-3}	8.92×10^{-3}	-2.22×10^{-3}
	89%	2%	-10%	0%	17%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.228	6.38×10^{-3}	9.89×10^{-3}	9.73×10^{-4}	5.39×10^{-2}	9.26×10^{-4}	9.33×10^{-4}	-3.92×10^{-4}
	76%	2%	3%	0%	18%	0%	0%	-
MER (kg)	4.51×10^{-4}	3.95×10^{-6}	8.39×10^{-6}	6.34×10^{-7}	5.44×10^{-5}	5.52×10^{-7}	6.04×10^{-7}	-2.09×10^{-7}
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.77	5.44×10^{-2}	4.10×10^{-2}	1.40×10^{-2}	0.226	8.50×10^{-3}	2.49×10^{-2}	-1.42×10^{-3}
	83%	3%	2%	1%	11%	0%	1%	-
HWD (kg)	1.65	0.101	8.11×10^{-2}	2.24×10^{-2}	0.259	1.55×10^{-2}	7.45×10^{-2}	-3.31×10^{-3}
	75%	5%	4%	1%	12%	1%	3%	-
NHWD (kg)	18.2	0.718	36.1	0.161	4.48	0.123	2.06	-1.93×10^{-2}
	29%	1%	58%	0%	7%	0%	3%	-
RWD (kg)	1.89×10^{-3}	1.91×10^{-5}	2.23×10^{-5}	2.37×10^{-6}	1.65×10^{-4}	2.61×10^{-6}	2.54×10^{-6}	-1.21×10^{-6}
	90%	1%	1%	0%	8%	0%	0%	-

Table A12. *Group 4 – 30 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	77.1	6.40	2.18	2.62	11.2	1.38	3.95	-9.19×10^{-2}
	74%	6%	2%	3%	11%	1%	4%	-
GWP – Fossil (kg CO2 eq)	77.8	6.40	2.33	2.62	11.1	1.38	2.26	-9.17×10^{-2}
	75%	6%	2%	3%	11%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-3.59	7.85×10^{-4}	-0.154	-8.28×10^{-4}	-0.116	4.08×10^{-5}	1.69	-1.14×10^{-4}
	170%	0%	7%	0%	5%	0%	-78%	-
GWP-LULUC (kg CO2 eq)	2.91	3.20×10^{-3}	3.35×10^{-3}	1.37×10^{-3}	0.144	5.56×10^{-4}	2.89×10^{-3}	-7.88×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	80.8	6.40	2.34	2.62	11.3	1.38	2.26	-9.18×10^{-2}
	75%	6%	2%	2%	11%	1%	2%	-
ODP (kg CFC11 eq)	1.73×10^{-6}	9.02×10^{-8}	4.80×10^{-8}	3.76×10^{-8}	1.17×10^{-6}	2.06×10^{-8}	2.32×10^{-8}	-7.17×10^{-10}
	55%	3%	2%	1%	38%	1%	1%	-
AP (molc H+ eq)	0.339	5.27×10^{-2}	9.87×10^{-3}	7.70×10^{-2}	5.24×10^{-2}	5.78×10^{-3}	6.48×10^{-3}	-5.63×10^{-4}
	62%	10%	2%	14%	10%	1%	1%	-
EP – fw (kg P eq)	3.96×10^{-2}	6.07×10^{-4}	6.81×10^{-4}	8.29×10^{-5}	3.77×10^{-3}	1.09×10^{-4}	1.94×10^{-4}	-2.76×10^{-5}
	88%	1%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	8.38×10^{-2}	1.69×10^{-2}	3.14×10^{-3}	1.92×10^{-2}	1.16×10^{-2}	2.11×10^{-3}	2.58×10^{-3}	-1.34×10^{-4}
	60%	12%	2%	14%	8%	2%	2%	-
EP – t (molc N eq)	0.683	0.185	3.15×10^{-2}	0.213	0.113	2.30×10^{-2}	2.70×10^{-2}	-1.63×10^{-3}
	54%	15%	3%	17%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.579	5.66×10^{-2}	1.28×10^{-2}	5.76×10^{-2}	5.96×10^{-2}	7.99×10^{-3}	9.19×10^{-3}	-4.50×10^{-4}
	74%	7%	2%	7%	8%	1%	1%	-
ADP – mm (kg Sb-Eq)	4.91×10^{-4}	1.83×10^{-5}	9.75×10^{-6}	2.56×10^{-6}	9.25×10^{-5}	4.58×10^{-6}	3.06×10^{-6}	-5.03×10^{-7}
	79%	3%	2%	0%	15%	1%	0%	-
ADP – ff (MJ, LHV)	1,360	86.7	41.4	32.0	192	19.5	19.6	-1.10
	78%	5%	2%	2%	11%	1%	1%	-
WDP (m3 world eq. deprived)	22.9	0.473	0.677	8.75×10^{-2}	5.66	8.78×10^{-2}	0.232	-0.141
	76%	2%	2%	0%	19%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	120	1.67	8.87	0.237	13.9	0.256	0.249	$-8.49x10^{-2}$
	83%	1%	6%	0%	10%	0%	0%	-
PERM (MJ, LHV)	9.43	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	120	1.67	8.87	0.237	13.9	0.256	0.249	$-8.49x10^{-2}$
	83%	1%	6%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	1,320	79.0	38.2	28.9	183	17.7	17.8	-1.05
	78%	5%	2%	2%	11%	1%	1%	-
PENRM (MJ, LHV)	216	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,360	86.7	41.5	32.0	192	19.5	19.7	-1.10
	78%	5%	2%	2%	11%	1%	1%	-
SM (kg)	2.55	$9.04x10^{-2}$	$5.31x10^{-2}$	$2.10x10^{-2}$	0.348	$1.45x10^{-2}$	$1.43x10^{-2}$	$-2.88x10^{-3}$
	82%	3%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.38	$1.21x10^{-2}$	$1.93x10^{-2}$	$2.11x10^{-3}$	0.175	$1.84x10^{-3}$	$2.02x10^{-3}$	$-6.97x10^{-4}$
	87%	1%	1%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.712	$1.29x10^{-2}$	$-9.02x10^{-2}$	$2.14x10^{-3}$	0.141	$2.58x10^{-3}$	$1.34x10^{-2}$	$-3.33x10^{-3}$
	90%	2%	-11%	0%	18%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.315	$8.79x10^{-3}$	$1.03x10^{-2}$	$1.46x10^{-3}$	$7.93x10^{-2}$	$1.39x10^{-3}$	$1.40x10^{-3}$	$-5.88x10^{-4}$
	75%	2%	3%	0%	19%	0%	0%	-
MER (kg)	$6.21x10^{-4}$	$5.44x10^{-6}$	$8.66x10^{-6}$	$9.49x10^{-7}$	$7.88x10^{-5}$	$8.28x10^{-7}$	$9.06x10^{-7}$	$-3.13x10^{-7}$
	87%	1%	1%	0%	11%	0%	0%	-
MFR (kg)	2.44	$7.49x10^{-2}$	$4.45x10^{-2}$	$2.09x10^{-2}$	0.327	$1.28x10^{-2}$	$3.74x10^{-2}$	$-2.13x10^{-3}$
	82%	3%	2%	1%	11%	0%	1%	-
HWD (kg)	2.27	0.139	$9.59x10^{-2}$	$3.35x10^{-2}$	0.377	$2.33x10^{-2}$	0.112	$-4.96x10^{-3}$
	74%	5%	3%	1%	12%	1%	4%	-
NHWD (kg)	25.0	0.989	51.8	0.242	6.50	0.184	3.11	$-2.89x10^{-2}$
	28%	1%	59%	0%	7%	0%	4%	-
RWD (kg)	$2.60x10^{-3}$	$2.63x10^{-5}$	$2.36x10^{-5}$	$3.55x10^{-6}$	$2.36x10^{-4}$	$3.92x10^{-6}$	$3.82x10^{-6}$	$-1.82x10^{-6}$
	90%	1%	1%	0%	8%	0%	0%	-

Table A13. *Group 5 – 12 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits.* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	34.9	3.12	1.45	1.07	4.79	0.565	1.61	$-3.75x10^{-2}$
	73%	7%	3%	2%	10%	1%	3%	-
GWP – Fossil (kg CO2 eq)	35.2	3.11	1.66	1.07	4.78	0.564	0.922	$-3.75x10^{-2}$
	74%	7%	4%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.59	$1.39x10^{-4}$	-0.221	$-3.39x10^{-4}$	$-5.48x10^{-2}$	$1.66x10^{-5}$	0.688	$-4.67x10^{-5}$
	130%	0%	19%	0%	5%	0%	-58%	-
GWP-LULUC (kg CO2 eq)	1.30	$1.31x10^{-3}$	$2.13x10^{-3}$	$5.62x10^{-4}$	$6.39x10^{-2}$	$2.27x10^{-4}$	$1.18x10^{-3}$	$-3.22x10^{-5}$
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	36.5	3.12	1.67	1.07	4.86	0.565	0.923	$-3.75x10^{-2}$
	75%	6%	3%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	$7.57x10^{-7}$	$4.59x10^{-8}$	$3.59x10^{-8}$	$1.54x10^{-8}$	$4.83x10^{-7}$	$8.40x10^{-9}$	$9.46x10^{-9}$	$-2.93x10^{-10}$
	56%	3%	3%	1%	36%	1%	1%	-
AP (molc H+ eq)	0.145	$1.59x10^{-2}$	$7.07x10^{-3}$	$3.15x10^{-2}$	$2.16x10^{-2}$	$2.36x10^{-3}$	$2.64x10^{-3}$	$-2.30x10^{-4}$
	64%	7%	3%	14%	10%	1%	1%	-
EP – fw (kg P eq)	$1.97x10^{-2}$	$2.53x10^{-4}$	$5.92x10^{-4}$	$3.40x10^{-5}$	$1.72x10^{-3}$	$4.43x10^{-5}$	$7.91x10^{-5}$	$-1.13x10^{-5}$
	88%	1%	3%	0%	8%	0%	0%	-
EP – m (kg N eq)	$3.69x10^{-2}$	$5.51x10^{-3}$	$2.05x10^{-3}$	$7.84x10^{-3}$	$4.84x10^{-3}$	$8.59x10^{-4}$	$1.05x10^{-3}$	$-5.47x10^{-5}$
	62%	9%	4%	13%	8%	2%	2%	-
EP – t (molc N eq)	0.292	$6.02x10^{-2}$	$2.04x10^{-2}$	$8.71x10^{-2}$	$4.64x10^{-2}$	$9.37x10^{-3}$	$1.10x10^{-2}$	$-6.65x10^{-4}$
	56%	11%	4%	17%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.255	$2.01x10^{-2}$	$8.93x10^{-3}$	$2.36x10^{-2}$	$2.53x10^{-2}$	$3.26x10^{-3}$	$3.75x10^{-3}$	$-1.84x10^{-4}$
	75%	6%	3%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	$2.08x10^{-4}$	$1.00x10^{-5}$	$8.05x10^{-6}$	$1.05x10^{-6}$	$3.84x10^{-5}$	$1.87x10^{-6}$	$1.25x10^{-6}$	$-2.06x10^{-7}$
	77%	4%	3%	0%	14%	1%	0%	-
ADP – ff (MJ, LHV)	622	43.6	32.3	13.1	82.7	7.97	8.01	-0.448
	77%	5%	4%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	10.5	0.203	0.623	$3.58x10^{-2}$	2.38	$3.58x10^{-2}$	$9.46x10^{-2}$	$-5.75x10^{-2}$
	76%	2%	5%	0%	17%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	53.8	0.619	8.73	$9.72x10^{-2}$	6.16	0.105	0.102	$-3.47x10^{-2}$
	77%	1%	13%	0%	9%	0%	0%	-
PERM (MJ, LHV)	4.20	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	53.8	0.619	8.73	$9.72x10^{-2}$	6.16	0.105	0.102	$-3.47x10^{-2}$
	77%	1%	13%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	605	39.6	29.9	11.8	78.7	7.23	7.28	-0.431
	78%	5%	4%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	96.4	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	624	43.6	32.3	13.1	82.8	7.97	8.02	-0.448
	77%	5%	4%	2%	10%	1%	1%	-
SM (kg)	1.27	$3.47x10^{-2}$	$4.61x10^{-2}$	$8.59x10^{-3}$	0.154	$5.92x10^{-3}$	$5.82x10^{-3}$	$-1.18x10^{-3}$
	83%	2%	3%	1%	10%	0%	0%	-
RSF (MJ, LHV)	0.694	$4.46x10^{-3}$	$1.82x10^{-2}$	$8.65x10^{-4}$	$7.82x10^{-2}$	$7.52x10^{-4}$	$8.22x10^{-4}$	$-2.85x10^{-4}$
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.321	$5.88x10^{-3}$	$-2.84x10^{-2}$	$8.74x10^{-4}$	$5.94x10^{-2}$	$1.05x10^{-3}$	$5.46x10^{-3}$	$-1.36x10^{-3}$
	88%	2%	-8%	0%	16%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.144	$3.34x10^{-3}$	$9.55x10^{-3}$	$5.96x10^{-4}$	$3.33x10^{-2}$	$5.67x10^{-4}$	$5.71x10^{-4}$	$-2.40x10^{-4}$
	75%	2%	5%	0%	17%	0%	0%	-
MER (kg)	$3.12x10^{-4}$	$2.01x10^{-6}$	$8.18x10^{-6}$	$3.88x10^{-7}$	$3.51x10^{-5}$	$3.38x10^{-7}$	$3.69x10^{-7}$	$-1.28x10^{-7}$
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.22	$3.02x10^{-2}$	$3.83x10^{-2}$	$8.56x10^{-3}$	0.145	$5.21x10^{-3}$	$1.52x10^{-2}$	$-8.72x10^{-4}$
	83%	2%	3%	1%	10%	0%	1%	-
HWD (kg)	1.02	$5.52x10^{-2}$	$6.96x10^{-2}$	$1.37x10^{-2}$	0.160	$9.52x10^{-3}$	$4.57x10^{-2}$	$-2.03x10^{-3}$
	74%	4%	5%	1%	12%	1%	3%	-
NHWD (kg)	10.8	0.426	23.9	$9.89x10^{-2}$	2.82	$7.51x10^{-2}$	1.27	$-1.18x10^{-2}$
	27%	1%	61%	0%	7%	0%	3%	-
RWD (kg)	$1.30x10^{-3}$	$9.54x10^{-6}$	$2.14x10^{-5}$	$1.45x10^{-6}$	$1.08x10^{-4}$	$1.60x10^{-6}$	$1.56x10^{-6}$	$-7.44x10^{-7}$
	90%	1%	2%	0%	8%	0%	0%	-

Table A14. *Group 5 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	48.9	4.37	1.77	1.76	7.40	0.929	2.66	-6.17×10^{-2}
	72%	6%	3%	3%	11%	1%	4%	-
GWP – Fossil (kg CO2 eq)	49.4	4.37	1.96	1.76	7.38	0.929	1.52	-6.16×10^{-2}
	73%	7%	3%	3%	11%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.23	1.95×10^{-4}	-0.191	-5.58×10^{-4}	-7.01×10^{-2}	2.74×10^{-5}	1.13	-7.68×10^{-5}
	160%	0%	14%	0%	5%	0%	-84%	-
GWP-LULUC (kg CO2 eq)	1.82	1.84×10^{-3}	2.67×10^{-3}	9.25×10^{-4}	9.00×10^{-2}	3.74×10^{-4}	1.94×10^{-3}	-5.30×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	51.2	4.37	1.97	1.76	7.49	0.929	1.52	-6.17×10^{-2}
	74%	6%	3%	3%	11%	1%	2%	-
ODP (kg CFC11 eq)	1.06×10^{-6}	6.43×10^{-8}	4.13×10^{-8}	2.53×10^{-8}	7.85×10^{-7}	1.38×10^{-8}	1.56×10^{-8}	-4.82×10^{-10}
	53%	3%	2%	1%	39%	1%	1%	-
AP (molc H+ eq)	0.203	2.22×10^{-2}	8.32×10^{-3}	5.18×10^{-2}	3.36×10^{-2}	3.88×10^{-3}	4.35×10^{-3}	-3.79×10^{-4}
	62%	7%	3%	16%	10%	1%	1%	-
EP – fw (kg P eq)	2.76×10^{-2}	3.55×10^{-4}	6.32×10^{-4}	5.59×10^{-5}	2.59×10^{-3}	7.30×10^{-5}	1.30×10^{-4}	-1.85×10^{-5}
	88%	1%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	5.18×10^{-2}	7.72×10^{-3}	2.53×10^{-3}	1.29×10^{-2}	7.43×10^{-3}	1.41×10^{-3}	1.73×10^{-3}	-9.00×10^{-5}
	61%	9%	3%	15%	9%	2%	2%	-
EP – t (molc N eq)	0.410	8.44×10^{-2}	2.53×10^{-2}	0.143	7.19×10^{-2}	1.54×10^{-2}	1.82×10^{-2}	-1.09×10^{-3}
	53%	11%	3%	19%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.358	2.82×10^{-2}	1.07×10^{-2}	3.88×10^{-2}	3.82×10^{-2}	5.37×10^{-3}	6.18×10^{-3}	-3.02×10^{-4}
	74%	6%	2%	8%	8%	1%	1%	-
ADP – mm (kg Sb-Eq)	2.91×10^{-4}	1.40×10^{-5}	8.81×10^{-6}	1.73×10^{-6}	6.05×10^{-5}	3.08×10^{-6}	2.06×10^{-6}	-3.38×10^{-7}
	76%	4%	2%	0%	16%	1%	1%	-
ADP – ff (MJ, LHV)	873	61.2	36.4	21.6	128	13.1	13.2	-0.737
	76%	5%	3%	2%	11%	1%	1%	-
WDP (m3 world eq. deprived)	14.8	0.285	0.647	5.90×10^{-2}	3.78	5.90×10^{-2}	0.156	-9.45×10^{-2}
	75%	1%	3%	0%	19%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	75.4	0.868	8.79	0.160	9.24	0.172	0.168	-5.71×10^{-2}
	80%	1%	9%	0%	10%	0%	0%	-
PERM (MJ, LHV)	5.89	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	75.4	0.868	8.79	0.160	9.24	0.172	0.168	-5.71×10^{-2}
	80%	1%	9%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	848	55.5	33.6	19.5	121	11.9	12.0	-0.708
	77%	5%	3%	2%	11%	1%	1%	-
PENRM (MJ, LHV)	135	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	875	61.2	36.4	21.6	128	13.1	13.2	-0.737
	76%	5%	3%	2%	11%	1%	1%	-
SM (kg)	1.78	4.87×10^{-2}	4.92×10^{-2}	1.41×10^{-2}	0.237	9.74×10^{-3}	9.59×10^{-3}	-1.94×10^{-3}
	83%	2%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	0.973	6.26×10^{-3}	1.87×10^{-2}	1.42×10^{-3}	0.120	1.24×10^{-3}	1.35×10^{-3}	-4.68×10^{-4}
	87%	1%	2%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.450	8.25×10^{-3}	-5.59×10^{-2}	1.44×10^{-3}	9.35×10^{-2}	1.73×10^{-3}	9.00×10^{-3}	-2.24×10^{-3}
	89%	2%	-11%	0%	18%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.202	4.68×10^{-3}	9.90×10^{-3}	9.81×10^{-4}	5.29×10^{-2}	9.34×10^{-4}	9.40×10^{-4}	-3.95×10^{-4}
	74%	2%	4%	0%	19%	0%	0%	-
MER (kg)	4.37×10^{-4}	2.81×10^{-6}	8.40×10^{-6}	6.39×10^{-7}	5.39×10^{-5}	5.56×10^{-7}	6.08×10^{-7}	-2.10×10^{-7}
	87%	1%	2%	0%	11%	0%	0%	-
MFR (kg)	1.70	4.23×10^{-2}	4.10×10^{-2}	1.41×10^{-2}	0.223	8.57×10^{-3}	2.51×10^{-2}	-1.43×10^{-3}
	83%	2%	2%	1%	11%	0%	1%	-
HWD (kg)	1.43	7.74×10^{-2}	8.13×10^{-2}	2.25×10^{-2}	0.249	1.57×10^{-2}	7.54×10^{-2}	-3.33×10^{-3}
	73%	4%	4%	1%	13%	1%	4%	-
NHWD (kg)	15.2	0.597	36.3	0.163	4.36	0.124	2.09	-1.95×10^{-2}
	26%	1%	62%	0%	7%	0%	4%	-
RWD (kg)	1.83×10^{-3}	1.34×10^{-5}	2.24×10^{-5}	2.39×10^{-6}	1.63×10^{-4}	2.63×10^{-6}	2.56×10^{-6}	-1.22×10^{-6}
	90%	1%	1%	0%	8%	0%	0%	-

Table A15. *Group 5 – 30 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits* Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	66.2	5.91	2.17	2.59	10.5	1.37	3.90	-9.08×10^{-2}
	71%	6%	2%	3%	11%	2%	4%	-
GWP – Fossil (kg CO2 eq)	66.8	5.91	2.32	2.59	10.5	1.37	2.23	-9.06×10^{-2}
	73%	6%	3%	3%	11%	2%	2%	-
GWP – Biogenic (kg CO2 eq)	-3.02	2.64×10^{-4}	-0.156	-8.19×10^{-4}	-8.94×10^{-2}	4.03×10^{-5}	1.67	-1.13×10^{-4}
	190%	0%	10%	0%	6%	0%	-100%	-
GWP-LULUC (kg CO2 eq)	2.47	2.49×10^{-3}	3.33×10^{-3}	1.36×10^{-3}	0.122	5.49×10^{-4}	2.86×10^{-3}	-7.79×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	69.3	5.92	2.33	2.59	10.7	1.37	2.24	-9.08×10^{-2}
	73%	6%	3%	3%	11%	1%	2%	-
ODP (kg CFC11 eq)	1.44×10^{-6}	8.71×10^{-8}	4.78×10^{-8}	3.72×10^{-8}	1.15×10^{-6}	2.03×10^{-8}	2.29×10^{-8}	-7.08×10^{-10}
	51%	3%	2%	1%	41%	1%	1%	-
AP (molc H+ eq)	0.275	3.01×10^{-2}	9.82×10^{-3}	7.61×10^{-2}	4.79×10^{-2}	5.70×10^{-3}	6.40×10^{-3}	-5.57×10^{-4}
	61%	7%	2%	17%	11%	1%	1%	-
EP – fw (kg P eq)	3.73×10^{-2}	4.81×10^{-4}	6.80×10^{-4}	8.21×10^{-5}	3.63×10^{-3}	1.07×10^{-4}	1.92×10^{-4}	-2.73×10^{-5}
	88%	1%	2%	0%	9%	0%	0%	-
EP – m (kg N eq)	7.01×10^{-2}	1.05×10^{-2}	3.11×10^{-3}	1.90×10^{-2}	1.06×10^{-2}	2.08×10^{-3}	2.55×10^{-3}	-1.32×10^{-4}
	59%	9%	3%	16%	9%	2%	2%	-
EP – t (molc N eq)	0.555	0.114	3.13×10^{-2}	0.210	0.103	2.27×10^{-2}	2.67×10^{-2}	-1.61×10^{-3}
	52%	11%	3%	20%	10%	2%	3%	-
POCP (kg NMVOC eq)	0.485	3.82×10^{-2}	1.27×10^{-2}	5.70×10^{-2}	5.39×10^{-2}	7.89×10^{-3}	9.08×10^{-3}	-4.44×10^{-4}
	73%	6%	2%	9%	8%	1%	1%	-
ADP – mm (kg Sb-Eq)	3.94×10^{-4}	1.90×10^{-5}	9.71×10^{-6}	2.53×10^{-6}	8.71×10^{-5}	4.52×10^{-6}	3.03×10^{-6}	-4.97×10^{-7}
	76%	4%	2%	0%	17%	1%	1%	-
ADP – ff (MJ, LHV)	1,180	82.8	41.3	31.7	182	19.3	19.4	-1.08
	76%	5%	3%	2%	12%	1%	1%	-
WDP (m3 world eq. deprived)	20.0	0.386	0.676	8.66×10^{-2}	5.46	8.66×10^{-2}	0.229	-0.139
	74%	1%	3%	0%	20%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	102	1.18	8.86	0.235	13.0	0.253	0.247	-8.39×10^{-2}
	81%	1%	7%	0%	10%	0%	0%	-
PERM (MJ, LHV)	7.97	0.00	8.37×10^{-2}	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PERT (MJ, LHV)	102	1.18	8.86	0.235	13.0	0.253	0.247	-8.39×10^{-2}
	81%	93%	700%	19%	1000%	20%	20%	-
PENRE (MJ, LHV)	1,150	75.2	38.1	28.6	173	17.5	17.6	-1.04
	77%	5%	3%	2%	12%	1%	1%	-
PENRM (MJ, LHV)	183	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	99%	0%	1%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	1,180	82.8	41.3	31.7	182	19.3	19.4	-1.08
	76%	5%	3%	2%	12%	1%	1%	-
SM (kg)	2.40	6.59×10^{-2}	5.30×10^{-2}	2.08×10^{-2}	0.337	1.43×10^{-2}	1.41×10^{-2}	-2.85×10^{-3}
	83%	2%	2%	1%	12%	0%	0%	-
RSF (MJ, LHV)	1.32	8.48×10^{-3}	1.93×10^{-2}	2.09×10^{-3}	0.171	1.82×10^{-3}	1.99×10^{-3}	-6.89×10^{-4}
	87%	1%	1%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.609	1.12×10^{-2}	-8.92×10^{-2}	2.11×10^{-3}	0.135	2.55×10^{-3}	1.32×10^{-2}	-3.30×10^{-3}
	89%	2%	-13%	0%	20%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.274	6.33×10^{-3}	1.03×10^{-2}	1.44×10^{-3}	7.64×10^{-2}	1.37×10^{-3}	1.38×10^{-3}	-5.81×10^{-4}
	74%	2%	3%	0%	21%	0%	0%	-
MER (kg)	5.92×10^{-4}	3.81×10^{-6}	8.65×10^{-6}	9.39×10^{-7}	7.67×10^{-5}	8.18×10^{-7}	8.95×10^{-7}	-3.09×10^{-7}
	87%	1%	1%	0%	11%	0%	0%	-
MFR (kg)	2.31	5.73×10^{-2}	4.44×10^{-2}	2.07×10^{-2}	0.318	1.26×10^{-2}	3.69×10^{-2}	-2.11×10^{-3}
	82%	2%	2%	1%	11%	0%	1%	-
HWD (kg)	1.94	0.105	9.53×10^{-2}	3.31×10^{-2}	0.356	2.30×10^{-2}	0.111	-4.90×10^{-3}
	73%	4%	4%	1%	13%	1%	4%	-
NHWD (kg)	20.6	0.809	51.4	0.239	6.22	0.182	3.07	-2.86×10^{-2}
	25%	1%	62%	0%	8%	0%	4%	-
RWD (kg)	2.48×10^{-3}	1.81×10^{-5}	2.35×10^{-5}	3.51×10^{-6}	2.28×10^{-4}	3.87×10^{-6}	3.77×10^{-6}	-1.80×10^{-6}
	90%	1%	1%	0%	8%	0%	0%	-

Table A16. *Group 6 – 12 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits. Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.*

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	37.2	4.44	1.46	1.10	5.03	0.578	1.65	-3.84×10^{-2}
	72%	9%	3%	2%	10%	1%	3%	-
GWP – Fossil (kg CO2 eq)	37.5	4.44	1.68	1.10	5.02	0.578	0.945	-3.83×10^{-2}
	73%	9%	3%	2%	10%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-1.45	1.45×10^{-4}	-0.220	-3.48×10^{-4}	-4.74×10^{-2}	1.70×10^{-5}	0.705	-4.77×10^{-5}
	140%	0%	22%	0%	5%	0%	-70%	-
GWP-LULUC (kg CO2 eq)	1.21	1.81×10^{-3}	2.15×10^{-3}	5.77×10^{-4}	5.98×10^{-2}	2.33×10^{-4}	1.21×10^{-3}	-3.30×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	38.7	4.44	1.68	1.10	5.10	0.578	0.946	-3.84×10^{-2}
	74%	9%	3%	2%	10%	1%	2%	-
ODP (kg CFC11 eq)	7.90×10^{-7}	6.59×10^{-8}	3.61×10^{-8}	1.58×10^{-8}	4.96×10^{-7}	8.60×10^{-9}	9.69×10^{-9}	-3.00×10^{-10}
	56%	5%	3%	1%	35%	1%	1%	-
AP (molc H+ eq)	0.175	1.99×10^{-2}	7.11×10^{-3}	3.23×10^{-2}	2.36×10^{-2}	2.41×10^{-3}	2.71×10^{-3}	-2.36×10^{-4}
	67%	8%	3%	12%	9%	1%	1%	-
EP – fw (kg P eq)	2.00×10^{-2}	3.52×10^{-4}	5.93×10^{-4}	3.48×10^{-5}	1.76×10^{-3}	4.54×10^{-5}	8.11×10^{-5}	-1.15×10^{-5}
	87%	2%	3%	0%	8%	0%	0%	-
EP – m (kg N eq)	4.11×10^{-2}	7.12×10^{-3}	2.06×10^{-3}	8.04×10^{-3}	5.19×10^{-3}	8.80×10^{-4}	1.08×10^{-3}	-5.60×10^{-5}
	63%	11%	3%	12%	8%	1%	2%	-
EP – t (molc N eq)	0.350	7.77×10^{-2}	2.05×10^{-2}	8.93×10^{-2}	5.07×10^{-2}	9.59×10^{-3}	1.13×10^{-2}	-6.81×10^{-4}
	57%	13%	3%	15%	8%	2%	2%	-
POCP (kg NMVOC eq)	0.260	2.67×10^{-2}	8.99×10^{-3}	2.42×10^{-2}	2.61×10^{-2}	3.34×10^{-3}	3.84×10^{-3}	-1.88×10^{-4}
	74%	8%	3%	7%	7%	1%	1%	-
ADP – mm (kg Sb-Eq)	2.23×10^{-4}	1.46×10^{-5}	8.08×10^{-6}	1.08×10^{-6}	4.00×10^{-5}	1.91×10^{-6}	1.28×10^{-6}	-2.10×10^{-7}
	77%	5%	3%	0%	14%	1%	0%	-
ADP – ff (MJ, LHV)	637	62.6	32.5	13.4	85.6	8.16	8.21	-0.459
	75%	7%	4%	2%	10%	1%	1%	-
WDP (m3 world eq. deprived)	11.0	0.284	0.623	3.67×10^{-2}	2.46	3.67×10^{-2}	9.70×10^{-2}	-5.88×10^{-2}
	76%	2%	4%	0%	17%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	53.1	0.838	8.73	$9.96x10^{-2}$	6.22	0.107	0.104	$-3.55x10^{-2}$
	77%	1%	13%	0%	9%	0%	0%	-
PERM (MJ, LHV)	3.91	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	53.1	0.838	8.73	$9.96x10^{-2}$	6.22	0.107	0.104	$-3.55x10^{-2}$
	77%	1%	13%	0%	9%	0%	0%	-
PENRE (MJ, LHV)	618	56.8	30.1	12.1	81.3	7.41	7.46	-0.441
	76%	7%	4%	2%	10%	1%	1%	-
PENRM (MJ, LHV)	89.8	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	639	62.6	32.5	13.5	85.6	8.16	8.22	-0.459
	75%	7%	4%	2%	10%	1%	1%	-
SM (kg)	1.36	$4.73x10^{-2}$	$4.63x10^{-2}$	$8.81x10^{-3}$	0.161	$6.06x10^{-3}$	$5.96x10^{-3}$	$-1.20x10^{-3}$
	83%	3%	3%	1%	10%	0%	0%	-
RSF (MJ, LHV)	0.745	$6.03x10^{-3}$	$1.82x10^{-2}$	$8.87x10^{-4}$	$8.18x10^{-2}$	$7.70x10^{-4}$	$8.43x10^{-4}$	$-2.91x10^{-4}$
	87%	1%	2%	0%	10%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.329	$8.30x10^{-3}$	$-2.94x10^{-2}$	$8.96x10^{-4}$	$6.09x10^{-2}$	$1.08x10^{-3}$	$5.60x10^{-3}$	$-1.39x10^{-3}$
	87%	2%	-8%	0%	16%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.164	$4.54x10^{-3}$	$9.56x10^{-3}$	$6.11x10^{-4}$	$3.50x10^{-2}$	$5.81x10^{-4}$	$5.85x10^{-4}$	$-2.46x10^{-4}$
	76%	2%	4%	0%	16%	0%	0%	-
MER (kg)	$3.35x10^{-4}$	$2.71x10^{-6}$	$8.19x10^{-6}$	$3.98x10^{-7}$	$3.67x10^{-5}$	$3.46x10^{-7}$	$3.79x10^{-7}$	$-1.31x10^{-7}$
	87%	1%	2%	0%	10%	0%	0%	-
MFR (kg)	1.30	$4.15x10^{-2}$	$3.84x10^{-2}$	$8.78x10^{-3}$	0.152	$5.33x10^{-3}$	$1.56x10^{-2}$	$-8.92x10^{-4}$
	83%	3%	3%	1%	10%	0%	1%	-
HWD (kg)	1.00	$7.59x10^{-2}$	$7.01x10^{-2}$	$1.40x10^{-2}$	0.163	$9.75x10^{-3}$	$4.68x10^{-2}$	$-2.07x10^{-3}$
	73%	6%	5%	1%	12%	1%	3%	-
NHWD (kg)	11.7	0.595	24.3	0.101	2.92	$7.69x10^{-2}$	1.30	$-1.21x10^{-2}$
	29%	1%	59%	0%	7%	0%	3%	-
RWD (kg)	$1.35x10^{-3}$	$1.28x10^{-5}$	$2.14x10^{-5}$	$1.49x10^{-6}$	$1.12x10^{-4}$	$1.64x10^{-6}$	$1.60x10^{-6}$	$-7.61x10^{-7}$
	90%	1%	1%	0%	8%	0%	0%	-

Table A17. *Group 6 – 20 mm LCI and LCIA results per declared unit for all required EN 15804:2012+A2:2019/AC:2021 LCI and LCIA indicators reported by life cycle stage. All values are rounded to three significant digits. Environmental impacts and resource use for B1, B6, B7, C1, and C3 stages are assumed to be zero.*

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
GWP – Total (kg CO2 eq)	52.0	6.20	1.81	1.83	7.82	0.966	2.76	-6.43×10^{-2}
	71%	9%	3%	3%	11%	1%	4%	-
GWP – Fossil (kg CO2 eq)	52.3	6.20	1.99	1.83	7.79	0.966	1.58	-6.41×10^{-2}
	72%	9%	3%	3%	11%	1%	2%	-
GWP – Biogenic (kg CO2 eq)	-2.02	2.02×10^{-4}	-0.188	-5.80×10^{-4}	-5.85×10^{-2}	2.85×10^{-5}	1.18	-7.99×10^{-5}
	190%	0%	17%	0%	5%	0%	-110%	-
GWP-LULUC (kg CO2 eq)	1.69	2.53×10^{-3}	2.73×10^{-3}	9.62×10^{-4}	8.40×10^{-2}	3.89×10^{-4}	2.02×10^{-3}	-5.51×10^{-5}
	95%	0%	0%	0%	5%	0%	0%	-
GWP-GHG (kg CO2)	54.1	6.20	2.00	1.84	7.90	0.966	1.58	-6.43×10^{-2}
	73%	8%	3%	3%	11%	1%	2%	-
ODP (kg CFC11 eq)	1.10×10^{-6}	9.19×10^{-8}	4.19×10^{-8}	2.63×10^{-8}	8.17×10^{-7}	1.44×10^{-8}	1.62×10^{-8}	-5.01×10^{-10}
	52%	4%	2%	1%	39%	1%	1%	-
AP (molc H+ eq)	0.244	2.78×10^{-2}	8.45×10^{-3}	5.39×10^{-2}	3.67×10^{-2}	4.03×10^{-3}	4.54×10^{-3}	-3.94×10^{-4}
	64%	7%	2%	14%	10%	1%	1%	-
EP – fw (kg P eq)	2.79×10^{-2}	4.91×10^{-4}	6.36×10^{-4}	5.81×10^{-5}	2.66×10^{-3}	7.59×10^{-5}	1.36×10^{-4}	-1.93×10^{-5}
	87%	2%	2%	0%	8%	0%	0%	-
EP – m (kg N eq)	5.74×10^{-2}	9.94×10^{-3}	2.58×10^{-3}	1.34×10^{-2}	7.99×10^{-3}	1.47×10^{-3}	1.80×10^{-3}	-9.37×10^{-5}
	61%	11%	3%	14%	8%	2%	2%	-
EP – t (molc N eq)	0.489	0.108	2.59×10^{-2}	0.149	7.87×10^{-2}	1.60×10^{-2}	1.89×10^{-2}	-1.14×10^{-3}
	55%	12%	3%	17%	9%	2%	2%	-
POCP (kg NMVOC eq)	0.362	3.72×10^{-2}	1.09×10^{-2}	4.04×10^{-2}	3.96×10^{-2}	5.58×10^{-3}	6.44×10^{-3}	-3.15×10^{-4}
	72%	7%	2%	8%	8%	1%	1%	-
ADP – mm (kg Sb-Eq)	3.11×10^{-4}	2.03×10^{-5}	8.89×10^{-6}	1.80×10^{-6}	6.36×10^{-5}	3.20×10^{-6}	2.14×10^{-6}	-3.52×10^{-7}
	76%	5%	2%	0%	15%	1%	1%	-
ADP – ff (MJ, LHV)	889	87.3	36.8	22.5	133	13.6	13.8	-0.767
	74%	7%	3%	2%	11%	1%	1%	-
WDP (m3 world eq. deprived)	15.4	0.396	0.649	6.13×10^{-2}	3.94	6.13×10^{-2}	0.162	-9.83×10^{-2}
	75%	2%	3%	0%	19%	0%	1%	-

Impact Category	Material extraction (A1)	Upstream transport (A2)	Production (A3)	Distribution (A4)	Installation (A5)	Transport to disposal (C2)	End of Life (C4)	Recovery (D)
Resources								
PERE (MJ, LHV)	74.1	1.17	8.80	0.166	9.40	0.179	0.175	$-5.94x10^{-2}$
	79%	1%	9%	0%	10%	0%	0%	-
PERM (MJ, LHV)	5.46	0.00	$8.37x10^{-2}$	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PERT (MJ, LHV)	74.1	1.17	8.80	0.166	9.40	0.179	0.175	$-5.94x10^{-2}$
	79%	1%	9%	0%	10%	0%	0%	-
PENRE (MJ, LHV)	862	79.2	34.0	20.2	126	12.4	12.5	-0.737
	75%	7%	3%	2%	11%	1%	1%	-
PENRM (MJ, LHV)	125	0.00	1.92	0.00	0.00	0.00	0.00	0.00
	98%	0%	2%	0%	0%	0%	0%	-
PENRT (MJ, LHV)	891	87.3	36.8	22.5	133	13.6	13.8	-0.767
	74%	7%	3%	2%	11%	1%	1%	-
SM (kg)	1.90	$6.60x10^{-2}$	$4.96x10^{-2}$	$1.47x10^{-2}$	0.249	$1.01x10^{-2}$	$9.99x10^{-3}$	$-2.02x10^{-3}$
	83%	3%	2%	1%	11%	0%	0%	-
RSF (MJ, LHV)	1.04	$8.42x10^{-3}$	$1.87x10^{-2}$	$1.48x10^{-3}$	0.126	$1.29x10^{-3}$	$1.41x10^{-3}$	$-4.88x10^{-4}$
	87%	1%	2%	0%	11%	0%	0%	-
NRSF (MJ, LHV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
FW (m3)	0.459	$1.16x10^{-2}$	$-5.88x10^{-2}$	$1.50x10^{-3}$	$9.69x10^{-2}$	$1.80x10^{-3}$	$9.38x10^{-3}$	$-2.33x10^{-3}$
	88%	2%	-11%	0%	19%	0%	2%	-
Waste								
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	-
EEE (MJ, LHV)	0.230	$6.33x10^{-3}$	$9.93x10^{-3}$	$1.02x10^{-3}$	$5.60x10^{-2}$	$9.71x10^{-4}$	$9.80x10^{-4}$	$-4.11x10^{-4}$
	75%	2%	3%	0%	18%	0%	0%	-
MER (kg)	$4.67x10^{-4}$	$3.78x10^{-6}$	$8.42x10^{-6}$	$6.65x10^{-7}$	$5.67x10^{-5}$	$5.78x10^{-7}$	$6.34x10^{-7}$	$-2.19x10^{-7}$
	87%	1%	2%	0%	11%	0%	0%	-
MFR (kg)	1.82	$5.79x10^{-2}$	$4.13x10^{-2}$	$1.46x10^{-2}$	0.235	$8.91x10^{-3}$	$2.61x10^{-2}$	$-1.49x10^{-3}$
	83%	3%	2%	1%	11%	0%	1%	-
HWD (kg)	1.40	0.106	$8.25x10^{-2}$	$2.34x10^{-2}$	0.255	$1.63x10^{-2}$	$7.83x10^{-2}$	$-3.47x10^{-3}$
	71%	5%	4%	1%	13%	1%	4%	-
NHWD (kg)	16.4	0.830	37.6	0.169	4.57	0.128	2.17	$-2.02x10^{-2}$
	26%	1%	61%	0%	7%	0%	4%	-
RWD (kg)	$1.88x10^{-3}$	$1.79x10^{-5}$	$2.25x10^{-5}$	$2.49x10^{-6}$	$1.68x10^{-4}$	$2.74x10^{-6}$	$2.67x10^{-6}$	$-1.27x10^{-6}$
	90%	1%	1%	0%	8%	0%	0%	-

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