Letastone

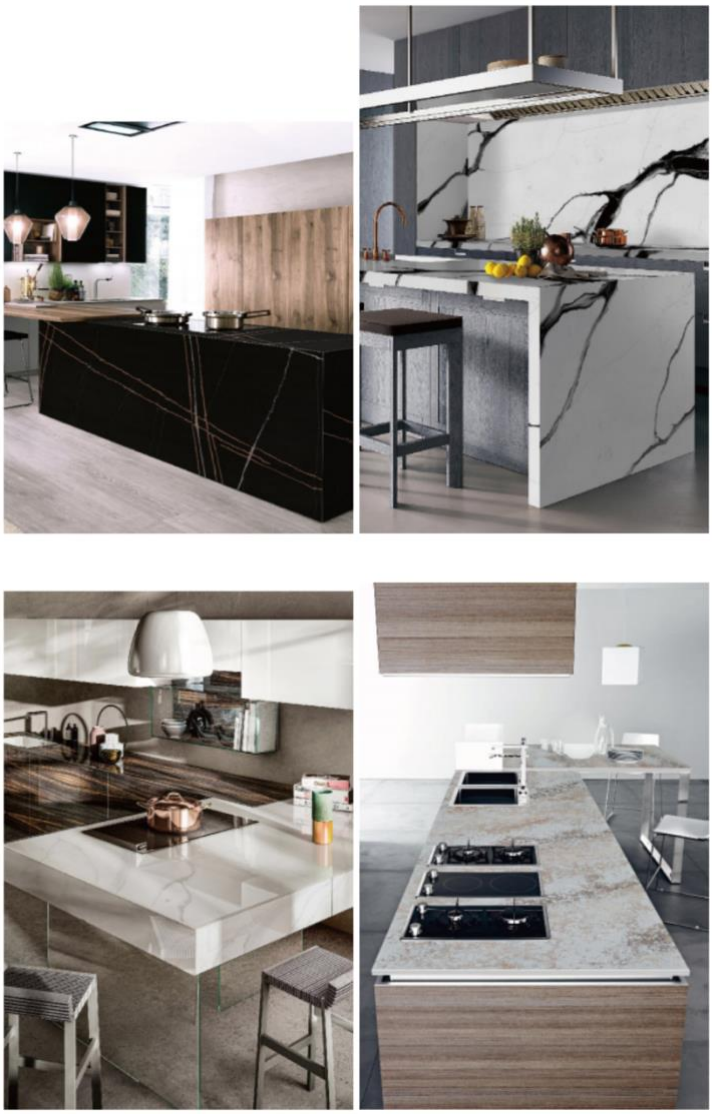
ENVIRONMENTAL PRODUCT DECLARATION

LE SURFACES™ vadara®

According to ISO 14025:2016 and EN 15804:2012+A2:2019 for:

Quartz stone products

From: LETA STONE Co., Ltd.



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Programme Information

EPD Owner	LETA STONE Co., Ltd.
Product Name	Quartz stone products
Registration Number	EPD 720
UN CPC Code	3754 Tiles, flagstones, bricks and similar articles, of cement, concrete or artificial stone
Production Site	228, Moo 8, T. Huawha, A. Srimahaphot, Prachinburi, Thailand
Programme Operator	ASTM International - 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA www.astm.org
Reference PCR	The International EPD® System PCR 2019: 14 PCR Construction products v1.11. (Valid until 2024-12-20)
Declared Product & Declared Unit	1m^2 of quartz stone products, the length and width are 3230mm and 1610mm, the thickness is 20 and 30mm.
Product Application	Residential or commercial indoor surfacing application
Market of Applicability	United States
EPD Scope	Cradle to gate with options, modules C1-C4, module D and optional modules (A1–A3 + A4–A5 + C + D)
LCA Practitioner	Chao WANG from Ecovane
LCA Software (version)	SimaPro 9.5
LCI Dataset (version)	Ecoinvent 3.9.1
Year(s) of Primary Data	01/2023-12/2023
Date of Publication	2024-06-12
Date of Validity	2029-06-11

Verification and Authorization of the Declaration	
This declaration and the rules on which this EPD is based have been examined by an independent external verifier in accordance with ISO 14025 and EN 15804+A2. Tim Brooke, ASTM International	This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by Lindita Bushi, PhD, Athena Sustainable Materials Institute.

ASTM certification of this EPD is not to be construed as representing aesthetics or any other attributes not specifically addressed, nor should it be construed as an ASTM endorsement of the subject of the EPD or a recommendation for its use. There is no warranty by ASTM, express or implied, as to any finding or other matter in the EPD, or as to any product covered by the EPD. The EPD holder is liable for the information and evidence on which the EPD is based.

The EPD owner has the sole ownership, liability and responsibility of the EPD

EPDs of construction products may not be comparable if they do not comply with EN 15804.

1. General Information

1.1 Company information

2 Established in 2020, LETA STONE Co., Ltd. is a wholly foreign-owned company in Thailand. The company is approved by the Thailand Board of Investment, which integrates design, research and development, production and sales services. With the development of few years, LETA STONE has registered trademarks such as LE SURFACES and VADARA. The company covers an area of 275,200 square meters, aims to expand to 50,0000 square meters within 2024. LETA STONE currently equipped with 20 quartz slabs production lines, 4 super jumbo size production lines and 5 quartz slabs polishing lines, as well as a fully automated cut-to-size facility, another 8 super jumbo size production lines and 2 polishing lines will be installed within 2024, the company has more than 2000 staff now. In the high-end quartz board market in the United States, LETA STONE sales rank among the top, also occupies the vast majority of Thailand's quartz board exports.

Figure 1 LETA STONE Co., Ltd

2.1 Scope and type of EPD

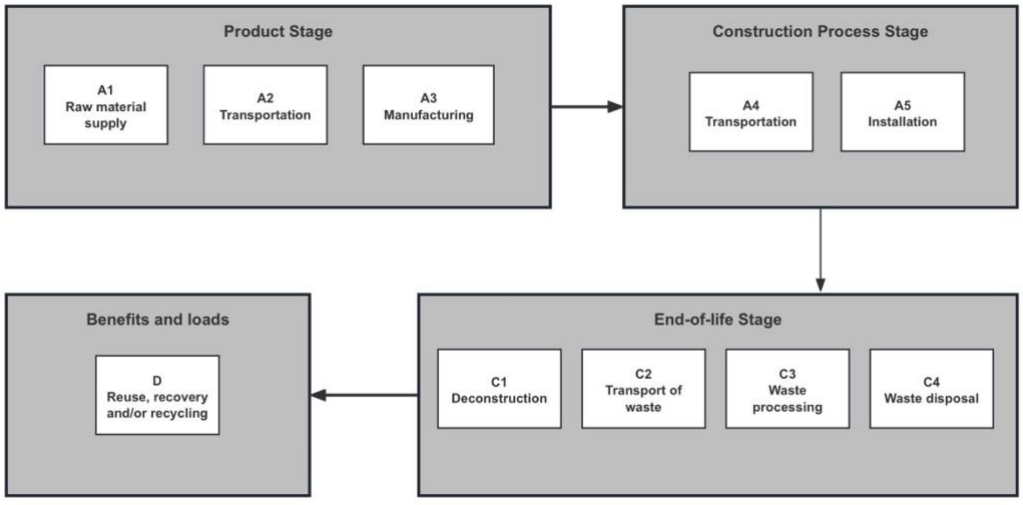

Figure 2 System boundary of quartz stone products

Table 1: Life cycle stages in this LCA study

Included modules in the life cycle assessment	Manufacturing Stage	X	A1 Raw material supply
		X	A2 Transport to the manufacturer
		X	A3 Manufacturing
	Distribution stage	X	A4 Transport to the site
	Installation stage	X	A5 Assembly/Install
	Use & Maintenance stage	MND	B1 Use
		MND	B2 Maintenance
		MND	B3 Repair
		MND	B4 Replacement
		MND	B5 Refurbishment
		MND	B6 Operational energy use
		MND	B7 Operational water use
	De-installation End of Life Stage	X	C1 Deconstruction
		X	C2 Transport to waste processing
		X	C3 Waste processing for reuse, recovery and/or recycling
		X	C4 Disposal;
	Benefits and loads beyond the product system boundary	X	D Reuse, recovery and/or recycling potentials,
Note: X=Declared Module, MND=Module not Declared in this LCA study			

2. Detailed Product Description

Description of the product

LETA STONE's quartz stone products use the first-class ingredients and good quality resin, connecting the particle and micro power together as a compact net structure. It ensures the quartz stone products have a better quality in shock resistance. LETA STONE's quartz stone products are casting under vacuum to ensures its composite material's compactness and imporosity. It has a perfect ability in resisting corrosion of the worktop's acid-base surface. The daily liquor will not infiltrate into interior structure. The surface will not cause corrosion or mildew as liquor on it can be easily cleaned.

Natural quartz crystal is typical fireproofing material, its melting point over 1300℃， resin with high performance ,quartz of high melting point, extremely low coefficient of thermal expansion and frost resisting coefficient of 99% make them highly adaptable to temperature change. With quartz containing over 90% and its Moh's hardness of 7-8, far greater than of knife, shovel etc.

LETA STONE's quartz stone products have been trusted by architects, interior designers, renovators, builders, developers etc. LETA STONE's quartz stone products can be widely applied to any residential or commercial indoor surfacing application, including kitchen benchtops and splash backs, as well as bathroom vanities and public buildings.

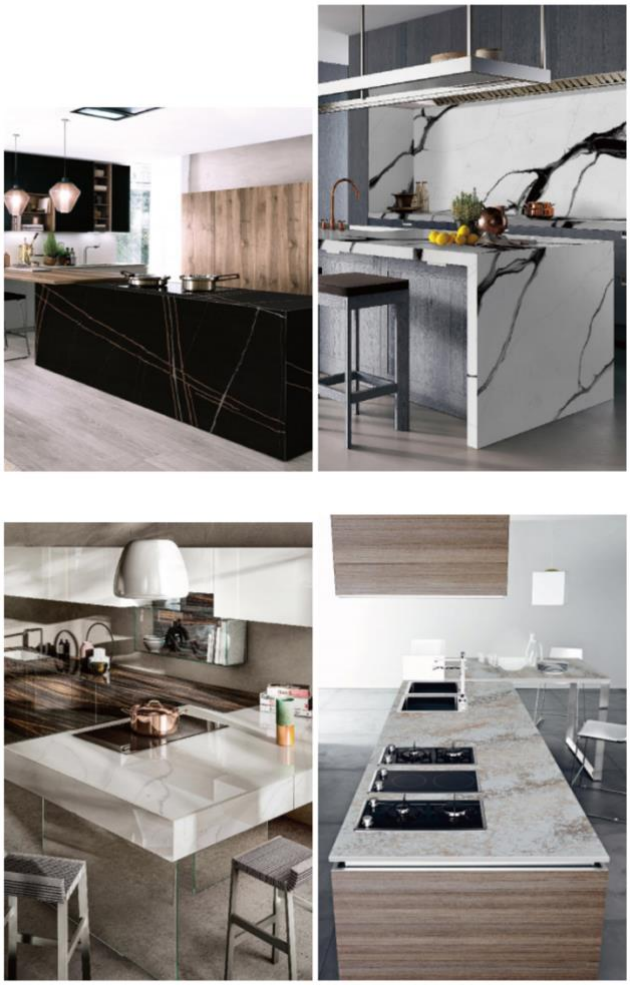

Figure 3 Picture of quartz stone products

LETA STONE cooperates with American's top designers to research and develop the latest style, leading the fashion trend. There are more than 800 types of stone, four major products series, fulfilling the requests of the high-end customers all over the world.

Figure 4 Modern Stylish single-color Grit Series (MS)

Figure 5 Colorful Multi-color Grit Series (CM)

Figure 6 Classic Pure, Fine Particle Series (CP)

Figure 7 Texture Fantasy Veining (TF)

The quartz stone products have the following performances according to LETA STONE:

- Stain Resistant
- Scratch Resistant
- Strength & Durability
- Heat & Scorch Resistant
- Non-porous& Non-absorbent
- Resistant to Bacteria, Mold, Mildew
- Resistant to Household Chemicals
- Colour Consistency & Uniformity
- Maintenance Free
- Warranty products

The quartz stone products that are analysed within this study is manufactured in a factory located in 228 Moo 8 T.Huawha, A.Srimahaphot, Prachinburi, Thailand. The production volume and several technical parameters of each series within 12 months from Jan 1, 2023 to Dec 31, 2023 is listed below.

Table 2 Product information of quartz stone products

Technical parameters	**MS**	**CM**	**CP**	**TF**
Production volume (m2/a)	113694.16	4659.447	88035.88	302860.27
Percentage (%)	37.42	0.67	17.77	44.14
Length (mm)	3230			
Width (mm)	1610			
Thickness (mm)	20/30			
Moh's hardness	8			
Compressive strength (MPa)	151			
Liner thermal expansion coefficient (°C)	$1.0x10^{-5}$			
Gloss	42.8			
Water absorption (%)	0.00			
Abrasion resistance (mm^3)	118			

The only difference of these four series of quartz stone products is the colour. Since the difference of pigment is negligible, the impact of pigments is less than 0.1%.

Description of declared unit

In this study the declared unit is defined as 1m^2 of quartz stone products. The length and width are 3230 and 1610mm, and the thickness is 20 and 30mm. The environmental impact from this study is calculated and reported per declared unit.

Table 3 Declared unit information

Name	Quartz stone products
Declared unit	1m^2
Density (kg/m^3)	2400-2500

Description of the production processes

The quartz stone products are mainly composed of mineral raw materials (quartz sand and quartz powder).

The aesthetic aspect is obtained initially by coloring the mixture with suitable colouring pigments (consisting mainly of complex inorganic oxides) and subsequently before firing through surface decorations with curing and coupling agent.

Auxiliary additives, such as the fluidifying agents necessary to facilitate the grinding process of mineral raw materials, also form part of the product composition.

The packaging materials are polyethylene stretch film and wood pallet. The quantity of packaging materials varies according to the thickness and size of the tiles.

Quartz stone products DO NOT contain substances with a high degree of concern SVHC contemplated in the ECHA Candidate List in concentrations greater than 0.1% by mass.

The weight content of the quartz stone products included in the EPD is shown in the following tables.

Table 4 Main product components and packaging materials per DU.

Product component	Amount-20mm-kg	Amount-30mm-kg	Post-consumer materials-%	Renewable materials-%
Quartz sand	26.40	39.60	0	0
Quartz powder	15.57	23.35	0	0
Colouring pigment	0.13	0.20	0	0
Resin	7.09	10.64	0	0
Curing agent	0.08	0.12	0	0
Coupling agent	0.09	0.14	0	0
Total	49.36	74.05		
Packaging material	**Weight-kg**	**Weight -20mm-%**	**Weight -30mm-%**	
Wood pallet	0.1008	0.20%	0.14%	
Thin film	0.0782	0.16%	0.11%	
Total packaging	0.179			

The weight content of the porcelain stoneware slabs included in the EPD is shown in the following tables. The quartz stone products under study are manufactured following the manufacturing processes as shown in figure below. For simplification purpose, only main stages of manufacturing are presented, raw material, auxiliary processes considered in the LCA but not shown in the flow chart below include:

- Raw and auxiliary material production and transportation
- Recycling of waste materials;
- Waste water and off gas treatment;
- Water recycling and reuse system;
- Supply of natural gas/water/electricity

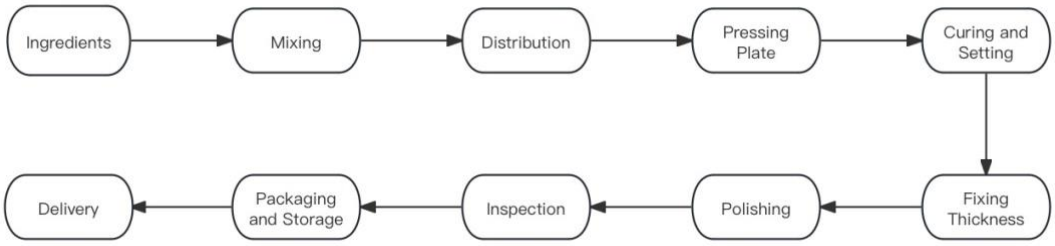

Figure 8 The process diagram of quartz stone products production

3. LCA results

3.1 Environmental Impacts

Based on the LCA model of quartz stone products, the results are calculated and listed in table below. According to the representativeness, 20mm and 30mm of TF quartz stone products results are showed.

Note that impact results were calculated based on one DU of quartz stone products. The results have been demonstrated through different processes according to the PCR.

Table 5 Environmental impacts of TF-20mm

Indicators	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-f	kg CO2 eq.	2.63E+01	3.22E+00	7.40E-03	0.00E+00	2.75E-01	0.00E+00	7.82E-01	0.00E+00
GWP-b	kg CO2 eq.	3.48E+00	-4.45E-04	1.25E-06	0.00E+00	9.59E-05	0.00E+00	1.09E+01	0.00E+00
GWP-l	kg CO2 eq.	3.04E-02	2.39E-03	1.53E-07	0.00E+00	1.43E-04	0.00E+00	3.14E-04	0.00E+00
GWP-t	kg CO2 eq.	2.99E+01	3.23E+00	7.40E-03	0.00E+00	2.75E-01	0.00E+00	1.16E+01	0.00E+00
ODP	Kg CFC11 eq.	1.77E-05	4.91E-08	9.49E-12	0.00E+00	4.35E-09	1.77E-05	4.91E-08	0.00E+00
AP	mol H+ eq	1.42E-01	8.59E-02	2.40E-06	0.00E+00	1.21E-03	1.42E-01	8.59E-02	0.00E+00
EP-freshwater	kg PO43- eq.	8.84E-03	1.27E-04	3.78E-08	0.00E+00	2.23E-05	0.00E+00	2.29E-04	0.00E+00
EP-marine	kg N eq.	2.97E-02	2.17E-02	2.36E-05	0.00E+00	4.43E-04	0.00E+00	2.57E-02	0.00E+00
EP-terrestrial	mol N eq.	2.87E-01	2.39E-01	1.07E-05	0.00E+00	4.73E-03	0.00E+00	7.01E-03	0.00E+00
POFP	kg NMVOC-eq.	1.04E-01	6.52E-02	3.26E-06	0.00E+00	1.63E-03	1.04E-01	6.52E-02	0.00E+00
ADPE	kg Sb eq.	1.08E-04	4.02E-06	5.92E-10	0.00E+00	8.84E-07	1.08E-04	4.02E-06	0.00E+00
ADPF	MJ	3.98E+02	4.03E+01	3.95E-03	0.00E+00	3.89E+00	3.98E+02	4.03E+01	0.00E+00
WDP	m3 H2O eq.	1.11E+01	1.03E-01	4.02E-04	0.00E+00	1.71E-02	1.11E+01	1.03E-01	0.00E+00
GWP-GHG	kg CO2 eq.	2.64E+01	3.23E+00	7.40E-03	0.00E+00	2.75E-01	0.00E+00	7.82E-01	0.00E+00

Table 6 Environmental impacts of TF-30mm

Indicators	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-f	kg CO2 eq.	3.95E+01	4.84E+00	1.11E-02	0.00E+00	4.12E-01	0.00E+00	1.17E+00	0.00E+00
GWP-b	kg CO2 eq.	5.21E+00	-6.67E-04	1.88E-06	0.00E+00	1.44E-04	0.00E+00	1.63E+01	0.00E+00
GWP-l	kg CO2 eq.	4.56E-02	3.58E-03	2.29E-07	0.00E+00	2.15E-04	0.00E+00	4.72E-04	0.00E+00
GWP-t	kg CO2 eq.	4.48E+01	4.84E+00	1.11E-02	0.00E+00	4.12E-01	0.00E+00	1.75E+01	0.00E+00
ODP	Kg CFC11 eq.	2.66E-05	7.36E-08	1.42E-11	0.00E+00	6.52E-09	0.00E+00	7.67E-09	0.00E+00
AP	mol H+ eq	2.12E-01	1.29E-01	3.61E-06	0.00E+00	1.81E-03	0.00E+00	3.71E-03	0.00E+00
EP-freshwater	kg PO43- eq.	1.33E-02	1.90E-04	5.67E-08	0.00E+00	3.35E-05	0.00E+00	3.44E-04	0.00E+00
EP-marine	kg N eq.	4.45E-02	3.25E-02	3.53E-05	0.00E+00	6.64E-04	0.00E+00	3.86E-02	0.00E+00
EP-terrestrial	mol N eq.	4.31E-01	3.59E-01	1.61E-05	0.00E+00	7.10E-03	0.00E+00	1.05E-02	0.00E+00
POFP	kg NMVOC-eq.	1.56E-01	9.78E-02	4.89E-06	0.00E+00	2.44E-03	0.00E+00	7.97E-03	0.00E+00
ADPE	kg Sb eq.	1.62E-04	6.03E-06	8.88E-10	0.00E+00	1.33E-06	0.00E+00	1.35E-06	0.00E+00
ADPF	MJ	5.97E+02	6.04E+01	5.92E-03	0.00E+00	5.83E+00	0.00E+00	7.42E+00	0.00E+00
WDP	m3 H2O eq.	1.66E+01	1.54E-01	6.03E-04	0.00E+00	2.57E-02	0.00E+00	2.59E-01	0.00E+00
GWP-GHG	kg CO2 eq.	3.96E+01	4.84E+00	1.11E-02	0.00E+00	4.12E-01	0.00E+00	1.17E+00	0.00E+00

3.2 Resource use and waste categories

The life cycle inventory analysis results of the primary renewable / nonrenewable energy demand, and waste / hazardous waste as well as water consumption is depicted in tables below. According to the representativeness, 20mm and 30mm of TF quartz stone products results are showed.

Table 7 Life cycle inventory results of TF-20mm

Indicators	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PENRE	MJ	3.98E+02	4.03E+01	3.95E-03	0.00E+00	3.89E+00	0.00E+00	4.94E+00	0.00E+00
PERE	MJ	2.75E+01	3.19E-01	1.06E-04	0.00E+00	4.96E-02	0.00E+00	2.33E-01	0.00E+00
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.98E+02	4.03E+01	3.95E-03	0.00E+00	3.89E+00	0.00E+00	4.94E+00	0.00E+00
PERT	MJ	2.75E+01	3.19E-01	1.06E-04	0.00E+00	4.96E-02	0.00E+00	2.33E-01	0.00E+00
FW	m3	2.87E-01	3.59E-03	1.19E-05	0.00E+00	5.54E-04	0.00E+00	4.47E-03	0.00E+00
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HWD	kg	8.31E-04	2.08E-04	2.06E-08	0.00E+00	2.51E-05	0.00E+00	3.07E-05	0.00E+00
NHWD	kg	7.76E+00	3.62E-01	1.08E-02	0.00E+00	1.89E-01	0.00E+00	1.44E+01	0.00E+00
RWD	kg	2.76E-04	4.94E-06	1.65E-09	0.00E+00	7.85E-07	0.00E+00	4.45E-06	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MRF	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8 Life cycle inventory results of TF-30mm

Indicators	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PENRE	MJ	5.97E+02	6.04E+01	5.92E-03	0.00E+00	5.83E+00	0.00E+00	7.42E+00	0.00E+00
PERE	MJ	4.12E+01	4.78E-01	1.59E-04	0.00E+00	7.44E-02	0.00E+00	3.50E-01	0.00E+00
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	5.97E+02	6.04E+01	5.92E-03	0.00E+00	5.83E+00	0.00E+00	7.42E+00	0.00E+00
PERT	MJ	4.12E+01	4.78E-01	1.59E-04	0.00E+00	7.44E-02	0.00E+00	3.50E-01	0.00E+00
FW	m3	4.31E-01	5.38E-03	1.78E-05	0.00E+00	8.31E-04	0.00E+00	6.71E-03	0.00E+00
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HWD	kg	1.25E-03	3.12E-04	3.09E-08	0.00E+00	3.77E-05	0.00E+00	4.60E-05	0.00E+00
NHWD	kg	1.16E+01	5.44E-01	1.62E-02	0.00E+00	2.83E-01	0.00E+00	2.17E+01	0.00E+00
RWD	kg	4.14E-04	7.40E-06	2.48E-09	0.00E+00	1.18E-06	0.00E+00	6.67E-06	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MRF	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

4. Supplementary information

4.1 Calculation rules

Assumptions:

Assumptions and substitutions were used widely in this LCA study, the main assumption includes:

- For missing background data, the substitution of missing data using a similar background data approach was taken to shorten the gap. A sensitivity analysis is conducted;
- The following materials in manufacturing stage are not available in the database, thus replaced with other substances:
  - Iron oxide is replaced by iron chloride;
  - Curing agent is replaced by ethyl tert-butyl ether;
  - Coupling agent is replaced by Dimethyldichlorosilane.
- During the end-of-life stage, the transportation of the waste quartz stone products to treatment facilities including recycling, landfill, or incineration center was assumed to be 100 km for simplification purposes. A sensitivity analysis is also conducted.

Assumptions about generic data for this study

- Transport model is based on the average regional data
- Energy model are based on average national data, and in case possible, provincial or regional data is used to the best potential
- Raw material uses generic data from database with adaptation of supplier data to the best possible potential

Cut of rules

The following procedure was followed for the exclusion of inputs and outputs:

- All inputs and outputs to a (unit) process will be included in the calculation for which data is available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices will be documented;
- In case of insufficient input data or data gaps for a unit process, according to the PCR requirement, the cut-off criteria chosen is 2% of the total mass and energy of that unit process.
- The total neglected input flows of the life cycle, e.g. per module A1-A3, A4-A5, C1-C4 and D shall be a maximum of 5% of energy usage and mass, in this study, the neglected flow is demonstrated in table below.

Data quality

Steps were taken to ensure that the LCI data were reliable and representative. The type of data that was used is clearly stated in the Inventory analysis, be it measured or calculated from primary sources or whether data are from the LCI databases.

SimaPro is the world's most widely used LCA software and the data in it comes predominantly from Ecoinvent and some other datasets, with the world's most complete and widely used set of data on industrial processes, material production, packaging production, transport and so on.

The data quality requirements for this study were as follows:

- Existing LCI data were, at most, 5 years old. Newly collected LCI data were current or up to 3 years old.
- The LCI data related to the geographical locations in which the processes occurred.
- The technology represented the average technologies at the time of data collection.
- Specific data of the considered system (such materials or energy flows that enter the production system). These data were collected from LETA STONE.

4.2 Scenarios and additional technical information

Raw material acquisition

The slab is mainly composed of mineral raw materials (quartz sand and quartz powder) which come directly from quarries.

The module includes the processes of extraction of mineral raw materials from Chinese quarries, manufacture of the resin, agent and colored pigments, generation of electricity needed for production.

Raw materials transportation

The module includes the transport of raw materials by sea, road, barge and rail to the production sites.

Manufacturing

The module includes the manufacturing activities of the quartz stone products in the production facilities, the production of packaging materials and auxiliary materials and the transport and treatment processes of the waste produced.

Product transportation

The module includes the transport of quartz stone products from production sites to the customer or to the point of installation. The marketing of the products takes place in the US.

Table 9 Transportation of quartz stone products

From	To	Distance (km)	Transport mode	Generic dataset referred
Thailand	the US	146	Lorry	Transport, freight, lorry 16-32 metric ton, EURO4 {RoW}| transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, U
		19321.17	Ocean ship	Transport, freight, sea, container ship {GLO}| market for transport, freight, sea, container ship | Cut-off, U

Installation

Quartz stone products do not use resources nor generate emissions into the environment in installation. At this stage there are no processes that generate environmental impacts. However, packaging material disposal is modelled in this stage.

De-construction

Due to the deconstruction and/or dismantling (C1) process of quartz stone products are done manually, the assumption is zero.

End-of-life

According to LETA STONE, the quartz stone products are consumed in the US. The disposal of the used products will adopt a country and region average disposal mode following literature review and Ecoinvent. End-of-life disposal treatment process (C4) from Ecoinvent will be used in this LCA study. For the waste scenario, 100km of road transportation with (C2) from operation site to waste treatment site was assumed. According to PCR, waste quartz stone products during the disposal stage(C4) is considered 100% landfill.

Benefits and loads

According to the PCR, Module D assesses the impact of the net flows of recovered materials (recycled or reused) from the life cycle stages A to C, the net flow can be described by the difference between M MR in and M MR out, taking the material yield (here designated with Y) into account.

$$Net\ flow = \Sigma\ (MMRout - Y \cdot MMRin)$$

In this LCA study, no secondary material was used in the production stage, so the M MR in is zero. As it is referred above, 100 % of waste quartz stone products is considered landfill. So, for 1DU quartz stone products, none is considered as net flow to assess the impacts.

4.3 Other optional additional environmental information

Electricity power mix

In this LCA, the grid mix data on electricity of for the site in Prachinburi is based on grid mixes of the low voltage level in Thailand. Electricity mix has been modelled from Ecoinvent database 3.9.1 (secondary data). According to the dataset in Ecoinvent, the main part of electricity is produced by natural gas, followed by lignite, hard coal, hydro and wind. The electricity mix used in the manufacturing core process as 0.78 kg CO2 eq./kWh. Thus, the purchased electricity used in the manufacturing process of module A1 accounts for 7.69% (less than 30%) of the GWP-GHG results of modules A1-A3.

Moreover, the electricity consumption of LETA STONE's offices has not been considered in this LCA report.

Contribution Analysis

To analyse the contribution of processes to the environmental impact, a contribution analysis was conducted. The result was allocated by stages, as shown in figure 9 below. From the contribution analysis, it can be concluded that the main environmental impact of the whole life cycle stage is in the stage of raw material (A1).

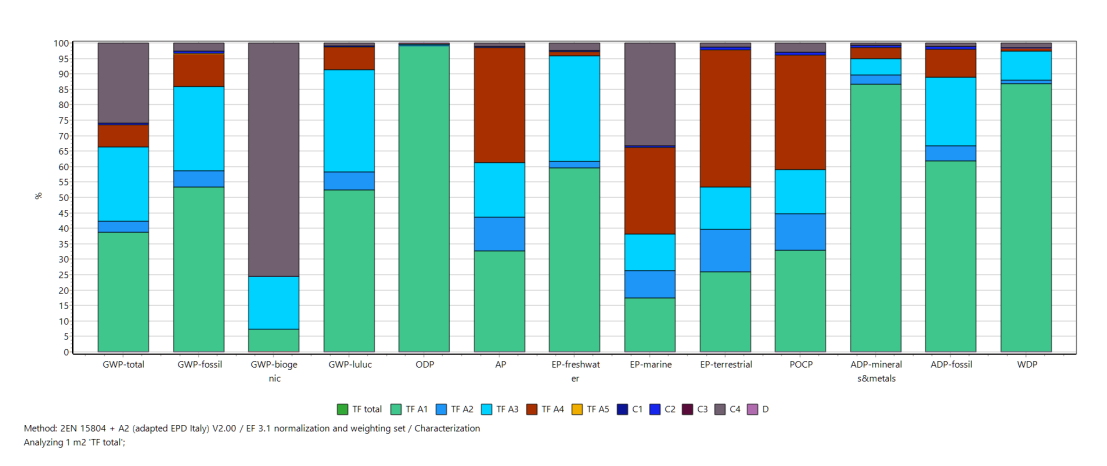

Figure 9 Life cycle contribution analysis of quartz stone products

5. References

- EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
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