EPD

CERTIFICATION

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DIESEL CAMP COLLECTION

ENVIRONMENTAL PRODUCT DECLARATION

Ceramic Tile

DEFINED BY ANSI A137.1
AMERICAN STANDARD SPECIFICATION FOR CERAMIC TILE

STONEPEAK
high tech porcelain

Nestled in the hills of Tennessee's Smoky Mountains, is a company with a uniquely American character that honors the time-proven tradition of fine Italian porcelain ceramics.

The character of this company extends to its operations, as well. We know that how we do business is just as important as what we make, and we pride ourselves on our friendly, no-hassle approach to helping our customers find quality tile. In fact, every product we create, every service we provide, and even the centralized location of our facility is designed around one thing: you.

Marketing
StonePeak Ceramics
314 West Superior
Chicago, Illinois 60654
http://www.stonepeakceramics.com/

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION ULCOM/EPD

UL Environment
2211 Newmarket Parkway
Suite 106
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Environment

UL

ENVIRONMENTAL PRODUCT DECLARATION

STONEPEAK
high tech porcelain

Ceramic tile
Defined by ANSI A137.1 American Standard Specification for Ceramic Tile

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds, e.g., Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Provided
DECLARATION HOLDER	UL Provided
DECLARATION NUMBER	UL Provided
DECLARED PRODUCT	Ceramic Tile
REFERENCE PCR	UL Provided
DATE OF ISSUE	UL Provided
PERIOD OF VALIDITY	UL Provided
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications
The PCR review was conducted by:	UL Provided UL Provided UL Provided
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	UL Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	UL Provided

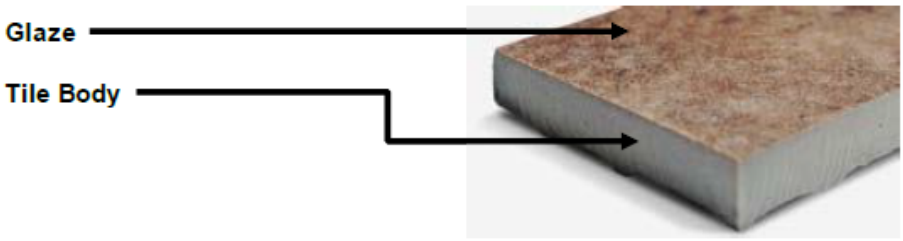
Product Definition

Product Classification and Description

StonePeak ceramic tiles are comprised of natural minerals, including quartz, clay, kaolin, feldspar, silica, and coloring agents fired in a kiln at high temperatures. StonePeak ceramic tile products are manufactured in Crossville, Tennessee. With a hardness rating harder than granite and a low porosity rating, StonePeak ceramic tiles are ideal hard surfacing products. These characteristics, along with a high stain resistance that reduces maintenance requirements, result in a reduction of future materials usage.

Classifications of Ceramic Tile applicable to this EPD - Wear Ratings from the Porcelain Enamel Institute:

- Group I Classification - Tile that is suitable for residential bathrooms with light foot traffic.
- Group II Classification - Tile that can be used in residential areas, but not areas with high foot traffic, such as in kitchens, foyers, laundry rooms, etc.
- Group III Classification - Tile that is recommended for all residential installations with normal foot traffic.
- Group IV Classification - Tile that is suited for light to medium commercial applications, such as offices, sales rooms.
- Group V Classification - Tile used in heavy commercial traffic areas and is suited for exterior areas, shopping centers, airports, hotel lobbies, and public walkways.



Ceramic tiles have a reference service life of (RSL) of 60 years.

Range of Applications

Ceramic tile products are commonly used in commercial, light commercial, institutional, and residential interior and exterior applications. Ceramic tiles can be installed on the floor as well as walls depending on the product specification.

Product Standards

The products considered in this EPD meet or exceed the following Technical Specifications:

- ANSI A137.1 - American National Standard Specifications for Ceramic Tile
- ISO13006 International Organization for Standardization Specifications for Ceramic Tile

Fire Testing:

- Classification: A
- Frame Spread: 0
- Smoke Developed: 0

Facility level certifications are not declared.

Product Characteristics

StonePeak ceramic tiles are characterized in Table 1 in terms of physical description, product categorization, and relevant certifications.

Table 1: Tile Specifications

	Nominal Value	Minimum Value	Maximum Value
Class	P1 (Pressed 1)	N/A	N/A
Tile type	Porcelain	N/A	N/A
Grade	Standard	N/A	N/A
Nominal facial area	Varies	2”	48”
Nominal thickness	8 mm	8.00 mm	9.00 mm
Product weight	22.2 kg per s/m	22.0 kg per s/m	22.4 kg per s/m
Dimensional categories	Calibrated and Rectified	N/A	N/A
Sustainable certification	All products are Green Squared® Certified by SCS	N/A	N/A

Material Content

Table 2: Material content of a production-weighted tile

Component	Material	Mass %	Availability			Origin of raw materials
			Renewable	Non-renewable	Recycled	
Body	Sand	71.3 %		Mineral perpetual	Pre-Consumer	US, Mexico, Europe
	Clay	18.1 %		Mineral perpetual		US, Mexico, Europe
	Lime	0.4 %		Mineral perpetual		US, Mexico, Europe
Surface	Glaze & Stain	10.2%		Mineral perpetual		US, Mexico, Europe

Production of Main Materials

Sand

Sand is a granular material made of fine mineral particles. While sand does not have a defined mineral composition, most commonly it is comprised of silica in the form of quartz. Sand is a common additive in tile production to give the fired tiles size stability.

Clay

Clay is an earthen material comprised of extremely fine particles of minerals, organic matter, and trace amounts of naturally occurring metal oxides. It can be molded when wet and hardened into shape by heating at high temperatures. Clay is mined directly from the earth and can be used in the production of porcelain tiles with minimal processing. While clay is the primary ingredient in any tile, it is often blended with fluxing minerals to achieve the desirable characteristic of the tile product.

Lime

Lime is a calcium-containing mineral used in the production of tile.

Glaze

Glaze is a smooth, protective coating commonly applied to tile products. Color and other aesthetic qualities can be given to the tiles through a glaze coating. Glazing materials are comprised of glass frits, minerals, opacifiers, pigments, and water. It is sprayed, rolled or poured onto the tile, and fired to form an inseparable top coating.

Stain

Stain is a mixed metal oxide colorant or pigment used to change the color of ceramic tile's aesthetic and/or appearance.

Manufacturing Stage

Figure 1 shows a simplified process flow diagram of the manufacturing of StonePeak ceramic tiles.

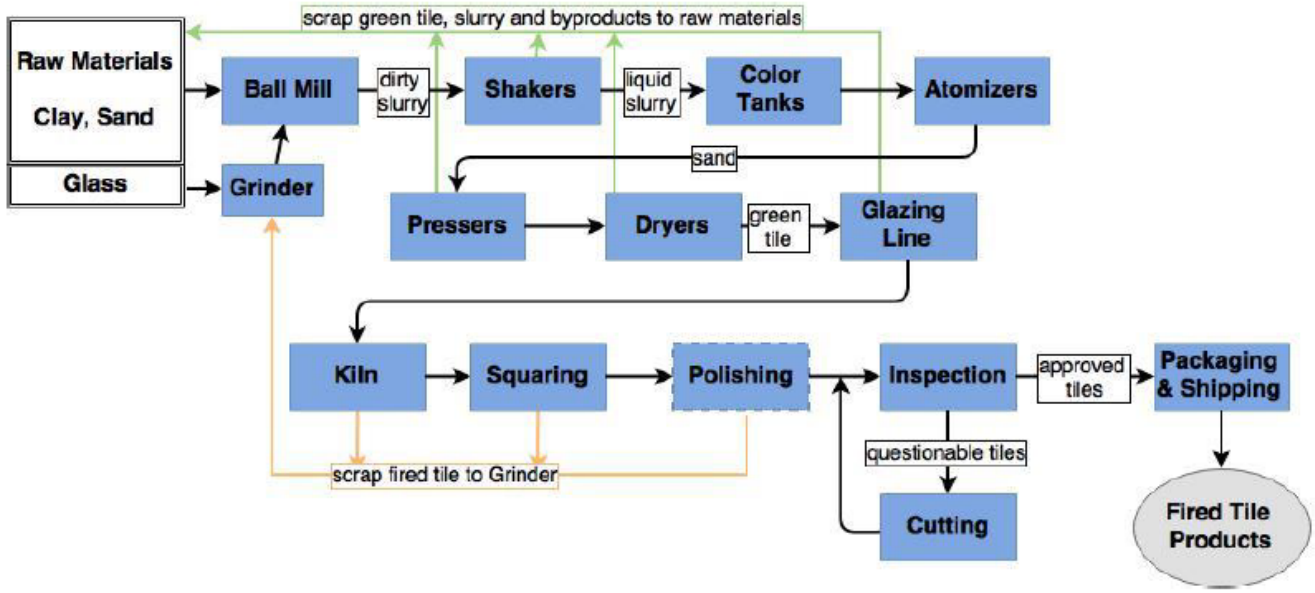


Figure 1: Process flow diagram for tile manufacturing with recycled fired scrap

The primary raw materials for ceramic tiles are glaze, clay and sand. The glass is fed through a grinder and then combined with the clay and sand by weight according to the order recipe. The mixture then enters a ball mill where fresh water is added as it is ground, creating slurry. Once the slurry has been checked, it passes through shakers that separate out large particles, resulting in 100% liquid slurry. This slurry then enters color tanks, where color from natural minerals is injected. Once approved by the lab, the colored slurry is transferred to natural gas-fired atomizers, which dehydrates the slurry back into sand with a moisture content of 4.5% to 6.5%. The rest of the moisture is released as steam. The sand then is pressed into a mold, brushed off, and sent to a dryer where it is baked. The resultant is green tile, which continues to the glazing line to be brushed again and have a paste applied so that the tiles can receive ink from a printer. The tile is printed on by the printers, the top is applied with a glaze and the bottom is applied with Magnesite to prevent sticking to the rollers. At this point, the tile is sent to the kiln and fired, changing its structure from clay to glass. The fired tile is then cut on all edges using grinders and goes through both computer and human inspection, where it is either deemed questionable and goes through a cutting process to remove defects and is re-inspected, or it is approved. The approved tile is packaged and shipped to the customer. Some orders require polishing, in which the fired tile is sprayed with water while polishing stones are used on the surface. The polished tile then goes through computer and human inspection and once approved, goes on to shipping and packaging. Throughout the manufacturing process, byproducts, such as sludge and scrap tile, and water are recycled for future runs.

Production Waste

Most scrap is recycled back into the product, but a small amount of waste is produced (approximately 0.3 kg of waste per m^2 of tile) which is sent offsite to a landfill.

Delivery and Installation

Delivery

For purposes of this study, the average transport distance from manufacturing to construction site was assumed to be 100 miles by truck. LCA impacts associated with installation of the tile products in the building project are included.

Installation

Mortar is required (0.833 lbs / ft^2) for product installation. Sanded grout is also required (0.043 lbs / ft^2). During installation, approximately 4.5% of the total material is lost as waste. Though some of this waste may be recycled, this scrap is modeled as being disposed of in a landfill.

Material safety data sheet (MSDS) and other info needed to protect health, safety, or the environment will be made available upon request

Waste

Based on current best information a small amount of installation waste is incinerated for energy recovery, but for the purposes of this EPD 100% of all such waste is assumed to be disposed of in a landfill.

Packaging

Packaging for StonePeak tiles is dominated by wooden pallets. 100% of the packaging waste is recyclable. However, for this study, no documentation is available to quantify the percentage of packaging which is actually recycled, therefore a cut-off approach is used to model the wooden pallet end-of-life, as per the guiding PCR.

Use stage

The service life of ceramic tile is unique in that it's not dependent on the amount of floor traffic and the type and frequency of maintenance. The level of maintenance is dependent on the actual use and desired appearance of the floor. For the NSF Flooring PCR, the building's Reference Service Life (RSL) is assumed to be 60 years. Since ceramic tile is expected to last at least as long as the building itself, the product will also have an RSL of 60 years.

Since the EPD must present results for both one-year and 60-year time periods, impacts are calculated for both time horizons. In the case of one-year results, the use phase impacts are based on the cleaning and maintenance model for one year. In the case of 60-year results, use phase impacts are scaled to represent maintenance for 60 years.

GREENGUARD Gold certifications support the exclusion of VOC during use stage.

Cleaning and Maintenance

Tile products should be cleaned routinely with tap water. For the purposes of this EPD, average maintenance is presented based on a mix of residential and commercial installations. See Table 3 for a summary of the inputs associated with the cleaning and maintenance phase.

Table 3: Cleaning Processes and material inputs

Maintenance Activity	Maintenance Activity
Mopping with water – 0.783 liter per m² per year	60 times over defined RSL

Prevention of Structural Damage

Interior floor covering should not be installed until any and all structural damage has been adequately repaired and determined to be code compliant. Surfaces must be structurally sound, stable and rigid enough to support the ceramic tile finish.

Health Aspects during Usage

Since tile is fired in kilns at high temperatures, there are no volatile organics in the finished product that can be released into the air. There are also adhesives, grouts, and backer boards available that contain zero, or very low VOCs. Additionally, tile is inhospitable to dust mites, mold, germs, and bacteria and often the preferred floor covering for people with allergies or asthma. Tile grouts and backer boards with built-in mold and mildew protection complement tile's inherent resistance to mold and mildew growth.

End of Life

Because these tile products are comprised primarily of naturally occurring mineral based materials and no hazardous ingredients are added during the manufacturing process, they are basically inert and can be used in multiple applications: e.g., clean fill material in land reclamation/contouring projects, base or substrate material for roadways and/or parking lots, replacement for raw materials used in cement or brick kilns, etc. For purposes of this EPD, StonePeak has taken the most conservative approach and assumed that 100% of all tile removal waste is disposed of in a landfill.

Life Cycle Assessment

A full Life Cycle Assessment has been carried out according to ISO 14025, 14040 and 14044, per the Product Category Rules (PCR) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood, as published by NSF International (2012).

The following life cycle stages are considered:

- Sourcing / Extraction
- Manufacturing
- Delivery & Installation
- Use stage
- End-of-life stage

The main purpose of EPDs is for use in business-to-business communication. As all EPDs are publicly available via the Program Operator and therefore are accessible to the end consumer, they can also be used in business-to-consumer communication.

Functional Unit Description

The declaration refers to the functional unit of 1m² installed floor covering. 1m² is equivalent to 10.76 ft².

Cut-off Criteria

Packaging materials which may accompany procured raw materials are excluded from the study. Additionally, plastic or metal banding that may be used to hold tiles together is excluded as being below the 1% mass cutoff.

Allocation

Co-Product Allocation

Inputs and outputs at manufacturing are allocated by production mass in relation to the total known production volume at the facility.

Reuse, Recycling, and Recovery Allocation

The ceramic tile at the end-of-life is modeled as being disposed in a landfill rather than incinerated or recycled. Plastic and other construction waste is assumed to be inert in landfills so no landfill gas is produced. In the case of landfill gas generated by the decay of bio-based packaging after installation, the cut-off approach is used; no credit is given for energy recovery from landfill gas.

Background Data

For life cycle modeling of the considered products, the GaBi 6 Software System for Life Cycle Engineering, developed by thinkstep AG, has been used to model the product systems considered in this assessment. All relevant background datasets are taken from the GaBi 2014 software database. The datasets from the GaBi database are documented in the online documentation (GaBi 6 2014d). To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.

Data Quality

A variety of tests and checks were performed throughout the project to ensure high quality of the completed LCA. Checks included an extensive review of project-specific LCA models as well as the background data used.

Temporal Coverage

According to the guiding PCR, the information provided regarding the manufacturing process shall be approximate annual values and shall be no more than 5 years of age. Average secondary data shall not be more than 10 years old. Primary data collected from StonePeak is based on 12 month averaged data representing the calendar year of 2012. Background datasets have reference years between 2009 and 2013, with the majority of datasets representing 2012.

Technological Coverage

Data on material composition and manufacturing are primary data from StonePeak. The raw material inputs, energy, waste, and emissions in the calculation for this LCA are based on annual total purchases divided by annual production during the reference year. The primary data collected from StonePeak is considered to be representative of tile manufacturing technology employed at the company.

Geographical Coverage

This background LCA represents StonePeak products produced in the United States at the Crossville, TN facility.

Manufacturing energy was representative for the country, but proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their technological representativeness of the actual materials.

System Boundaries

The scope of the study includes raw material sourcing / extraction, manufacturing, installation, use, and disposal of ceramic tile.

Table 4 summarizes major components being considered for inclusion and exclusion from the study and have been shaped by the need to accurately reflect the environmental burden associated with the functional unit.

Table 4: System Boundaries

Included	Excluded
✓ Raw materials production (chemicals, minerals, etc.) ✓ Use of auxiliary materials, water, and energy during manufacturing, installation, and use ✓ Packaging of finished products ✓ Emissions to air, water, and soil during manufacturing, installation, and use ✓ Transport of raw materials and finished products ✓ Disposal ✓ Overhead (heating, lighting, warehousing) of manufacturing facilities – due to data granularity	× Construction of capital equipment × Maintenance and operation of support equipment × Packaging of raw materials × Human labor and employee commute × Internal transportation (within a manufacturing facility)

Impact Categories

The impact assessment results are calculated using characterization factors published by the University of Leiden's CML 2001 – Apr. 2013.

Abbreviations for the impacts described here are used in the results tables below.

- Environmental Indicators:
  - Primary energy of non-renewable resources [MJ]
  - Primary energy of renewable resources [MJ]
  - Non-renewable material resource [kg]
- Environmental Impact Categories (CML 2001):
  - Abiotic Depletion, Elements (ADP-e) [kg Sb-eq];
  - Abiotic Depletion, Fossil (ADP-f) [MJ];
  - Acidification Potential (AP) [kg SO_2 eq];

- Eutrophication Potential (EP) [kg Phosphate eq];
- Global Warming Potential (GWP) [kg CO_2 eq];
- Ozone Depletion Potential (ODP) [kg R 11 eq];
- Photochemical Oxidant Formation Potential (POCP) [kg Ethene eq];

Results

Results for one square meter installed ceramic tile are presented in the sections below.

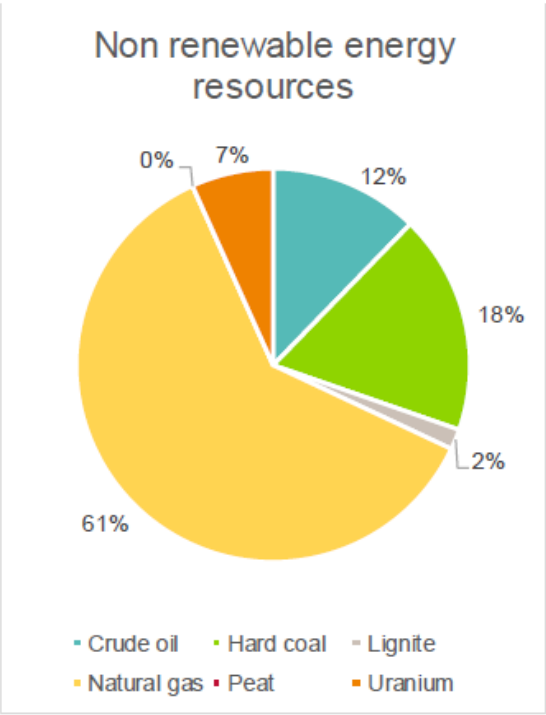
Life Cycle Inventory Analysis

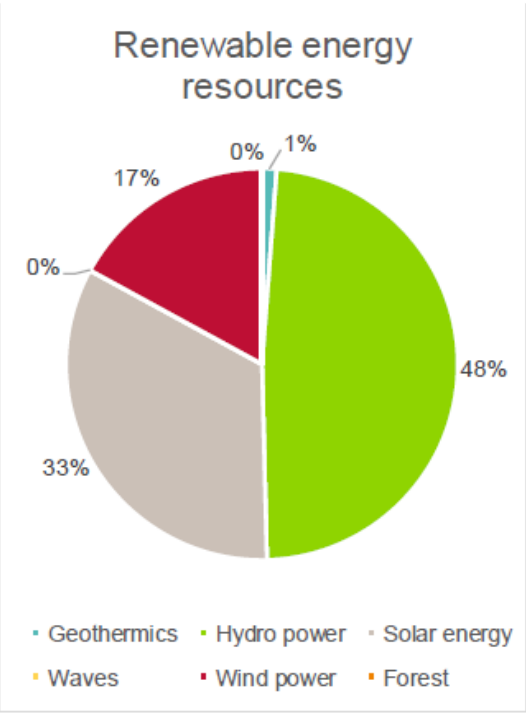
Primary Energy Demand

Primary energy resources, non-renewable and renewable, are presented in Table 5 and **Error! Reference source not found.**. The energy sources are presented in MJ, separated between non-renewable and renewable sources.

Table 5: Primary energy, non-renewable for 1 square meter of ceramic tile for 1 year Use [MJ]

	Total	1. Sourcing / extraction	2. Manufacturing	3. Delivery & Install	4. Use stage	5. End of Life
Non renew able energy resources [kg]	276	48.7	202	6.91	1.80	16.8
Renew able energy resources [kg]	6.05	1.56	3.48	0.278	0.0956	0.646
Non-renew able material sources [kg]	52.51	31.13	10.03	6.86	4.19E-03	4.49





Figures 2: Percent breakdown of life cycle non-renewable and renewable primary energy sources

Life Cycle Impact Assessment

The impact assessment results are calculated using characterization factors published by the University of Leiden's CML 2001 – Apr. 2013 methodology. The impact assessment results for 1 year of use and 60 years of use can be found in Table 6 to Table 8, respectively. They are further depicted in Figure 3 and Figure 4.

Table 6: CML Impact assessment results of cradle to install and end-of-life for 1m² flooring

	Life Cycle Stages				
	Total	1. Sourcing / extraction	2. Manufacturing	3. Delivery & Install	5. End of Life
ADP-e [kg Sb-Equiv.]	9.15E-06	3.35E-06	4.05E-06	1.38E-06	3.65E-07
ADP-f [MJ]	2.56E+02	46.1	187	6.58	16.4
AP [kg SO_2-Equiv.]	5.34E-02	0.0181	0.0286	1.93E-03	4.79E-03
EP [kg PO_4^{3-}-Equiv.]	5.06E-03	1.58E-03	2.43E-03	3.94E-04	6.58E-04
GWP [kg CO_2-Equiv.]	1.81E+01	3.12	13.1	0.745	1.1
ODP [kg R11-Equiv.]	1.98E-09	2.36E-10	1.71E-09	1.07E-11	1.98E-11
POCP [kg C_2H_4-Equiv.]	5.06E-03	1.45E-03	2.95E-03	1.71E-04	4.85E-04

Table 7: Average 1 year use state impacts for 1m² flooring

	Average 1 year Use and Maintenance Impacts
ADP-e [kg Sb-Equiv.]	1.68E-09
ADP-f [MJ]	0.0276
AP [kg SO_2-Equiv.]	7.54E-06
EP [kg PO_4^{3-}-Equiv.]	6.53E-06
GWP [kg CO_2-Equiv.]	2.03E-03
ODP [kg R11-Equiv.]	1.15E-12
POCP [kg C_2H_4-Equiv.]	9.55E-07

Table 8: CML Impact assessment results of 1 square meter for 60 year use

	Life Cycle Stages					
	User Defined Reference Service Life** of product = 60 years Number of Installations over 60 years = 1 time					
	Total	1. Sourcing / extraction	2. Manufacturing	3. Delivery & Install	4. Use stage	5. End of Life
ADP-e [kg Sb-Equiv.]	9.24E-06	3.35E-06	4.05E-06	1.38E-06	1.01E-07	3.65E-07
ADP-f [MJ]	257	46.1	187	6.58	1.65	16.4
AP [kg SO_2-Equiv.]	5.39E-02	1.81E-02	2.86E-02	1.93E-03	4.52E-04	4.79E-03
EP [kg PO_4^{3-}-Equiv.]	5.46E-03	1.58E-03	2.43E-03	3.94E-04	3.92E-04	6.58E-04
GWP [kg CO_2-Equiv.]	18.2	3.12	13.1	0.745	0.122	1.1
ODP [kg R11-Equiv.]	2.04E-09	2.36E-10	1.71E-09	1.07E-11	6.92E-11	1.98E-11
POCP [kg C_2H_4-Equiv.]	5.12E-03	1.45E-03	2.95E-03	1.71E-04	5.73E-05	4.85E-04

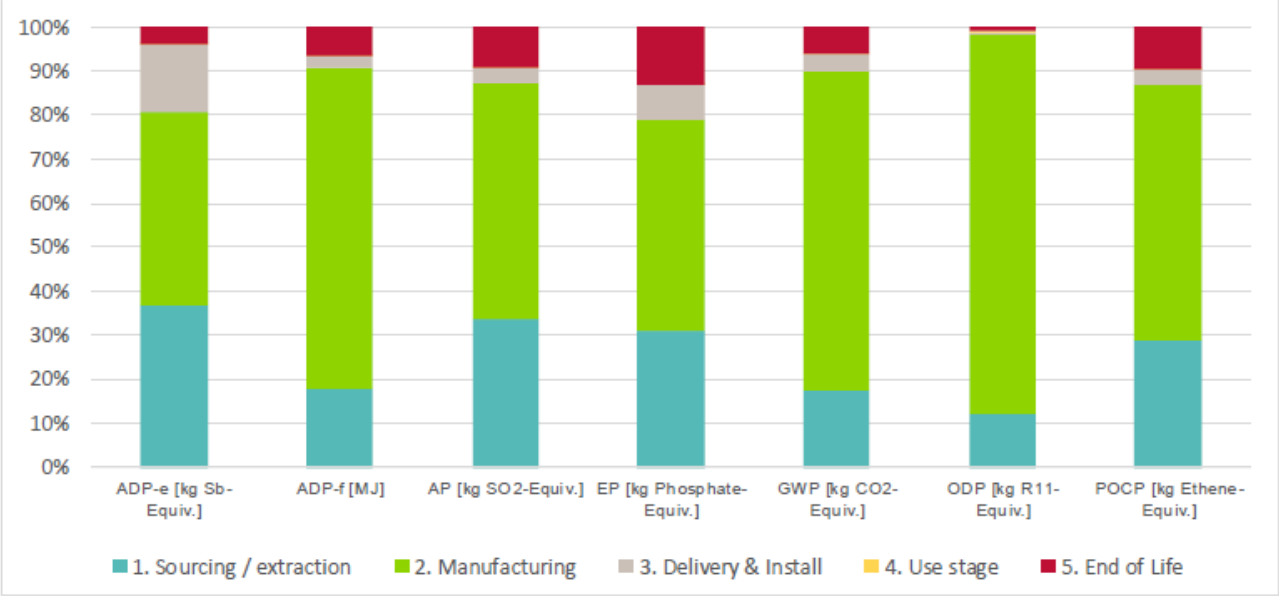


Figure 3: CML Impact assessment results of 1 square meter for 1 year use