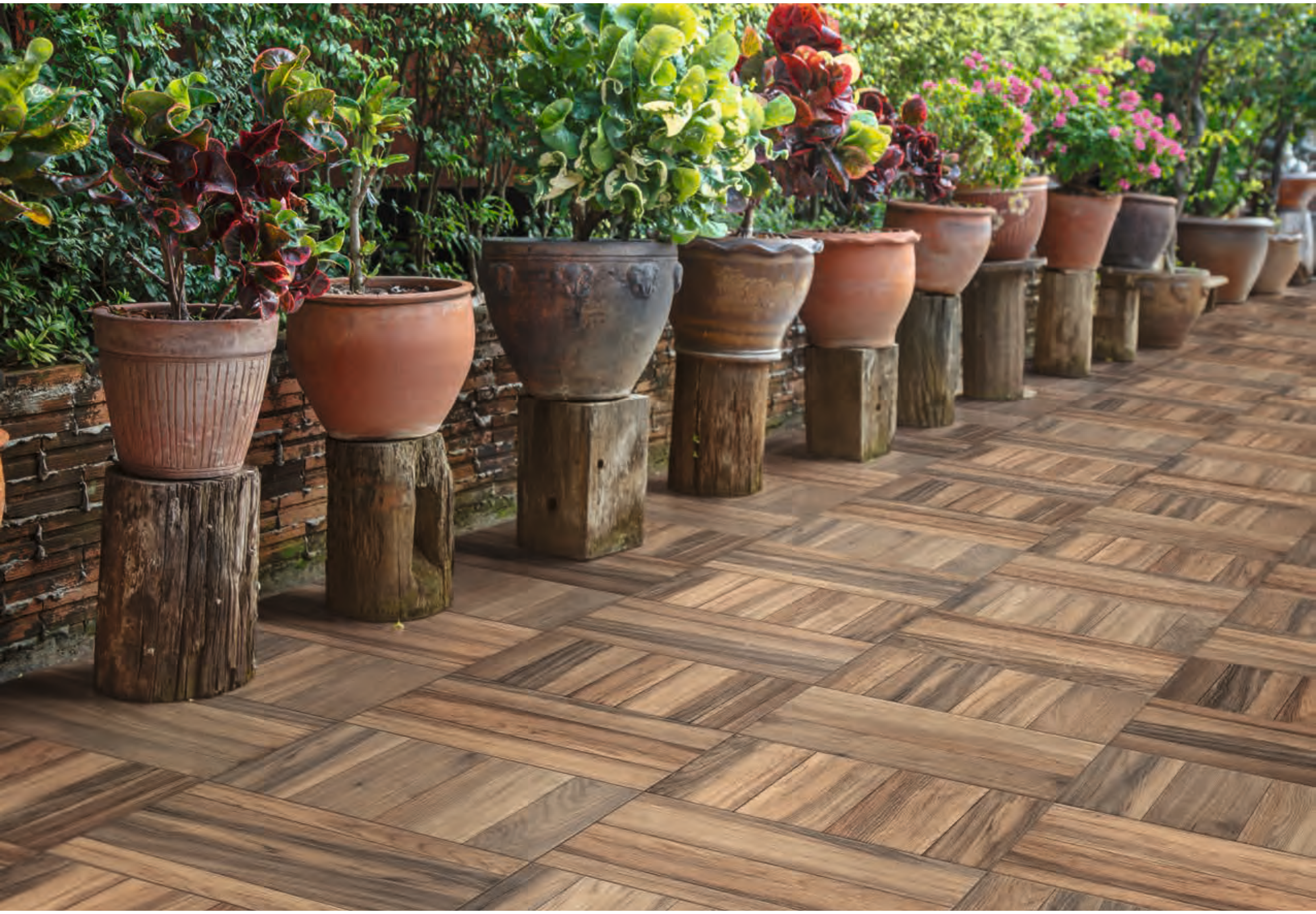
300 International Blvd
Clarksville, TN 37040

Environmental Product Declaration

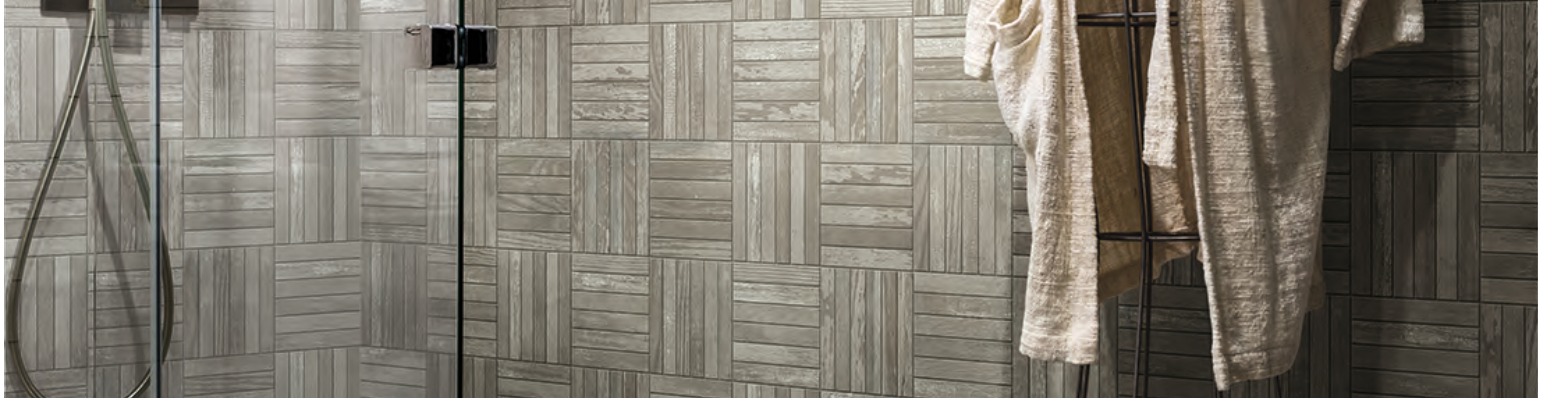


SOLID ROOTS LEAD **TO A BRIGHT FUTURE**

Built upon the solid roots of the Florim Group based in Italy, Florim USA is committed to continued technological innovation and to producing timeless and sustainable porcelain products.

http://www.florimusa.com

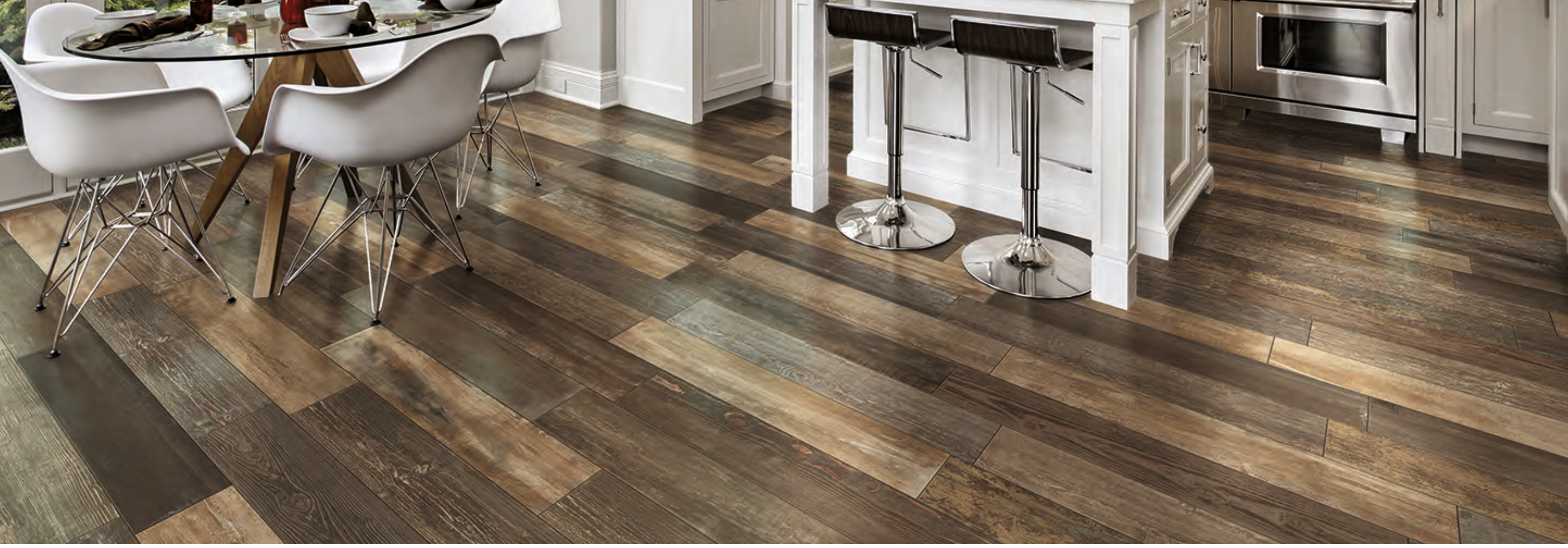
FLORIM USA



EPD Information			
Program Operator		NSF International 789 N. Dixboro Ann Arbor, MI 48105 www.nsf.org	
Declaration Holder		Florim USA	
Product	Date of Issue	Valid Until	Declaration Number
Porcelain Flooring	03/28/2018	03/28/2023	EPD10141
This EPD was independently verified by NSF International in accordance with ISO 14025:			
Internal	External X	Jenny Oorbeck joorbeck@nsf.org	
This life cycle assessment was independently verified by in accordance with ISO 14040-14044 and the reference PCR:		Jack Geibig jgeibig@ecoform.com	

LCA Information	
Basis LCA	Life Cycle Assessment, Florim USA, Porcelain Tiles. March 2018.
LCA Preparer	Brad McAllister brad@wapsustainability.com
This life cycle assessment was critically reviewed in accordance with ISO 14040-14044 by:	Jack Geibig jgeibig@ecoform.com

PCR Information	
Program Operator	NSF International
Reference PCR	Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. Version 2
Date of Issue	June 23, 2014
PCR review was conducted by:	Michael Overcash, Environmental Clarity ncss@nsf.org



COMPANY

Florim USA, located in Clarksville, Tennessee, continually builds upon the roots of its parent company, the Italy-based Florim Group. Florim USA is committed to continued technological innovation, producing timeless, sustainable porcelain products and commits itself to the environment by observing environmental regulations through certified quality management systems and ecological processes.

We select raw materials that allow some of our products to contain up to 40% recycled content. Florim has adopted a well-aimed and functional approach in preventing environmental risks, preserving natural resources, ensuring the safety of its employees, and in supporting the welfare of the global community.

PRODUCT

The products being studied for the life-cycle assessment are Florim USA's porcelain flooring products. This LCA was conducted for a representative ceramic tile derived from Florim's line of products. The product was created based on the line of twenty products offered by Florim USA. An average product was derived from twenty products as a majority of the raw materials are the same. The only difference between the various products is amount of and type of stain and glaze used which is why the look and feel are unique to each type of tile. Porcelain tiles are primarily made up of sand, clays and other additives and then molded into shape followed by kiln firing. Porcelain tiles can be glazed or unglazed, the former being the popular choice today. There are several advantages to porcelain tiles. They are impervious to moisture, resistant to tread wear, have permanence of color and are easy to clean.

APPLICATIONS

Products are designed to be used in commercial and residential applications. These tiles can be used for indoor or outdoor purposes. Florim USA can be used on floors and walls.

TECHNICAL INFORMATION

Name	Test Method	Value	Unit
Product Thickness	-	10-20	mm
Scratch Hardness	MOHS	≥7	-
Breaking Strength	ASTM-C648	≥400	-
Coefficient of Friction	ANSI-137.1	≥0.5	-

DELIVERY STATUS

Tiles are packaged in corrugated cardboard boxes, palletized and shipped to the customer. For the purposes of the LCA study, transportation distances were calculated as an average of all delivery distances in 2016.

INSTALLATION

Detailed installation instructions are provided online through the Tile Council of North America. It has been determined that 4.07 kg of mortar and 0.212 kg of grout is required per m^2 of tile. For the installation of the tile with mortar, 0.017 kg of acrylate and 0.15 kg of water is required and for grout, 0.026 kg of acrylate and 0.22 kg of water. Accessory materials, such as trowels, are required, though not included in the study as these are multi-use tools and the impacts per functional unit is considered negligible. 4.5% of the mortar and grout used during installation is assumed to be waste that is disposed at a landfill.

BASE MATERIALS

Base materials for Florim USA porcelain tiles include:

MANUFACTURE

This stage includes an aggregation of raw material extraction, supplier processing, delivery, manufacturing and packaging by Florim USA. In general, the mixing of materials, firing tiles in the kiln, and packaging of the final products are performed at the Florim USA facility in Clarksville, Tennessee.

Componet	Material	Mass %	Availability			Origin of raw materials
			Renewable	Non-renewable	Recycled	
Body	Feldspar	26.8%		Mineral perpetual		US, Mexico, Europe
	Clay	42.3%		Mineral perpetual		US, Mexico, Europe
	Sand	20.6%		Mineral perpetual		US, Mexico, Europe
	Scrap	7.7%			Pre-consumer	US
	Fluicer	0.4%		Mineral perpetual		US, Mexico, Europe
	Water	0.5%	Abundant			US
	Additives	0.04%		Mineral perpetual		US, Mexico, Europe
Surface	Glaze	1.1%		Mineral perpetual		US, Mexico, Europe
	Stain	0.6%		Mineral perpetual		US, Mexico, Europe
	Ink	0.03%		Mineral perpetual		US, Mexico, Europe
Total		100.0%				

* The modeled product used in the LCA contains <10% recycled content. This is considered a conservative estimate. Some Florim products contain as much as 40% recycled content.

Energy resources used in the manufacturing process include electricity, natural gas, and steam. Included in stage are:

- Extraction and processing of raw materials
- Processing of recycled raw material from previous product system
- Generation of energy and water inputs
- Waste creation and processing, including packaging waste
- Processing of secondary materials
- Energy Recovery (not applicable)
- Transportation up to factory gate
- Manufacturing of products and co-products
- Manufacturing and use of packaging
- Production of ancillary materials (not applicable)

The main raw materials for ceramic tile are:

Clay: A sedimentary materials that is plastic when moist but hard when fired and is composed mainly of hydrous aluminum silicate and is used for brick, tile and pottery.

Feldspar: A group of crystalline minerals that consist of aluminum silicates with either potassium, sodium, calcium, or barium and that are an essential constituent of nearly all crystalline rocks.

Sand: Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt.

Fluicer: Material used as a dispersant and deflocculant.

Stain: Mixed metal oxide pigment used to change the color of ceramic tiles to enhance aesthetic appeal.

The production space consists of six operations: body preparation, glaze preparation, press, glazing, kiln, and selection. The process is considered “closed-loop”, because all waste generated throughout the six operations is recycled back through the system to be used in subsequent products.

The manufacturing process begins with the mining of raw materials for the tile body. The body consists of a mixture of clay and other non-metallic minerals. These raw materials are listed in Table 4. The clay and mineral mixture is blended and wet-milled to form a pump able slurry. This slurry is then pumped into a large dryer to form a coarse powder with little moisture content. Next, this powder is pressed into a tile shape. After that, the tiles are dried to remove most of their moisture. Simultaneously, the tile glaze is produced using a glass derivative called frits and other colored dyes or stains.

This glaze is applied to the wear surface of the tile using a variety of techniques to achieve the desired result while passing on a conveyor belt. The tiles are next fired at extremely high temperatures to vitrify the tile and glaze into a single amorphous mass.

No materials contained in the product are listed by RCRA subtitle 3. No materials contained in the product or used in its manufacture are required to be reported by state or federal agencies.

ENVIRONMENT AND HEALTH (MANUFACTURING)

Florim USA complies with all required Environmental Health regulations. Florim USA manufacturing facilities are:

- ISO 9001 certified for quality management

PACKAGING

The porcelain tiles are packaged using corrugated cardboard and then transported to a distributor. The distributor then sells the tile to an installer. Packaging could be disposed of by either the distributor or the installer. For all cases in the LCA, packaging is assumed to be landfilled.

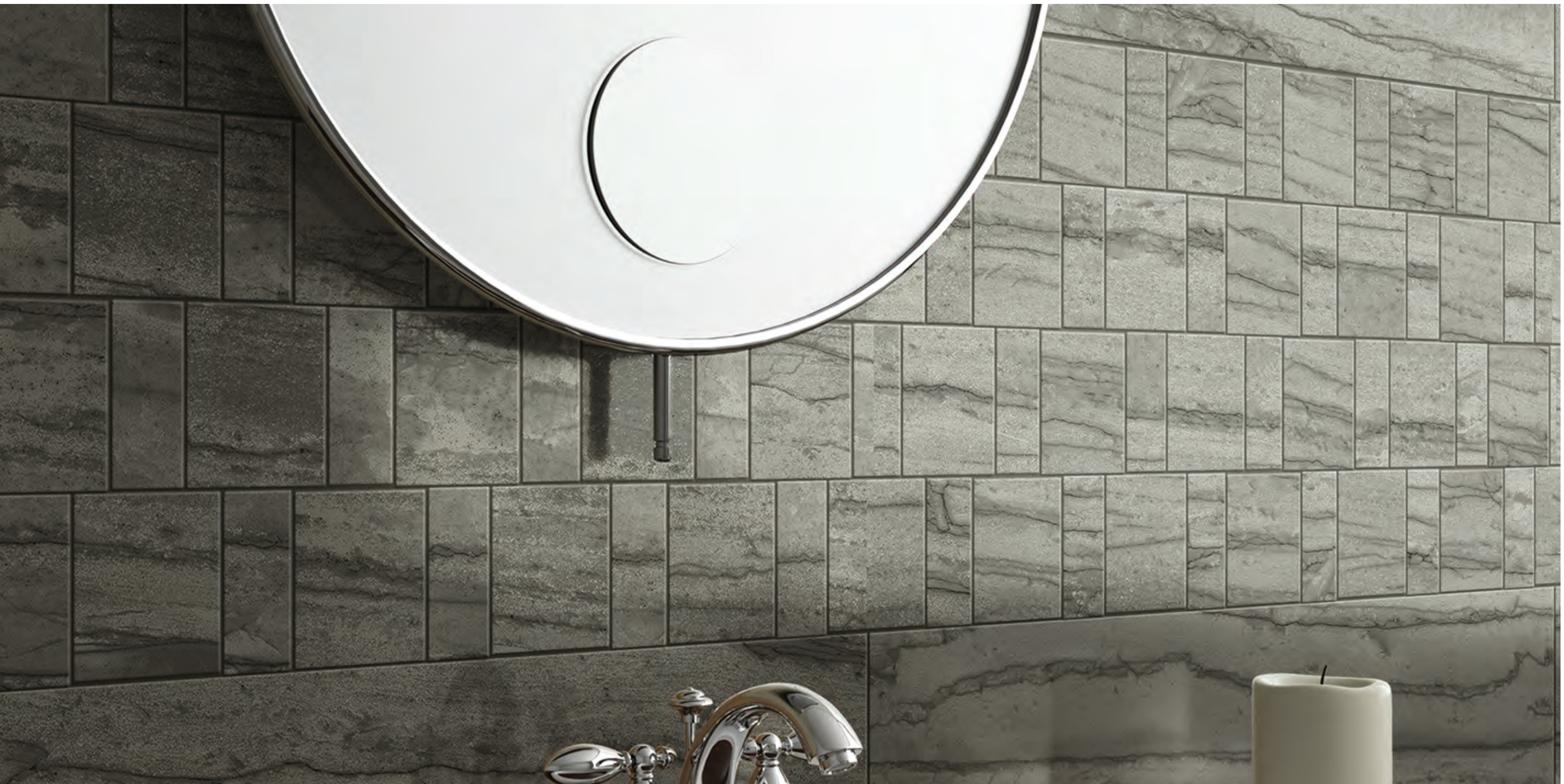
CONDITIONS OF USE

Full installation instructions can be found online at:

https://www.tcnatile.com/faqs/47-installing-tile.html

The porcelain tiles are regularly cleaned with a dust mop and damp mop with tap water:

Input	Amount	Unit
Dust mop	365	times/ year
Damp mop (residential)	4	times/ year
Damp mop (commercial)	36	times/ year
	Total material usage	
Tap Water	0.783	L/m²/yr



ENVIRONMENT AND HEALTH (INSTALLATION)

Inherently cement grout and mortar used during installation do not emit VOCs. Other information regarding environment and health impacts of cement and grout can be found on the Tile Council of North America (TCNA) website under the “Health Aspects during Usage” section of the EPD. EPDs for both cement mortar and grout have been published through the TCNA.

ENVIRONMENT AND HEALTH (USE)

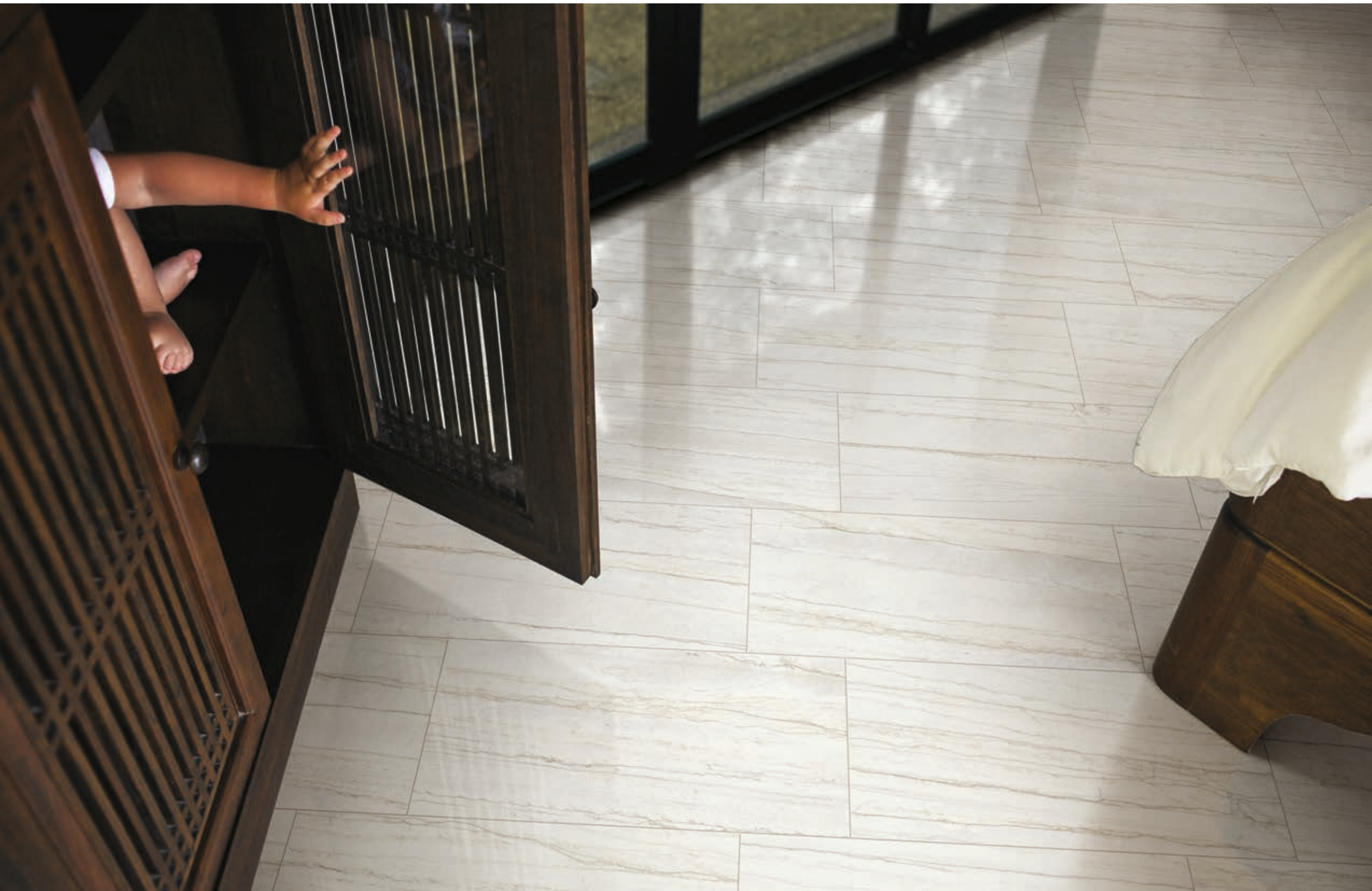
There are no known environmental or health risk considerations while using this product according to manufacturer recommendations. Since the tiles are fired at high temperatures, there are no volatile organic compounds (VOCs) that are released from the finished product. Porcelain tiles are also impervious to water and do not promote the growth of molds.

REFERENCE SERVICE LIFE

It is assumed the flooring systems will last for 60 years, depending on the use and care of the floor. The reference service life of the product is considered to be the same as that of a building. A building life of 60 years is per the NSF International (NSF) product category rules and is the value used for the industry average Life Cycle Assessment (LCA) conducted by the Tile Council of North America.

DISPOSAL

As this product cannot be repaired in place, there are no impacts during this stage. As the functional unit of the study looks at one service life of the product, there are no impacts during replacement and refurbishment. As the product is



adhered to the floor, it is assumed the ceramic flooring products will be disposed of with the underlying floor in a construction landfill.

FUNCTIONAL UNIT

The functional unit according to the Product Category Rules (PCR) is 1 m^2 of finished flooring for the reference service life of 60 years.

Name	Value	Unit
Functional Unit	1	m^2
Conversion factor to 1 kg	21.42	-

SYSTEM BOUNDARY

This particular LCA is a cradle-to-grave. A summary of the life cycle stages included in this LCA is presented in the following table.

Module Name	Analysis Period	Summary of Included Elements
Sourcing and Extraction	2016	Raw Material sourcing and processing as defined by secondary data. Packaging materials are included as well. Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and estimated distance.
Manufacturing	2016	Energy, water and material inputs required for manufacturing products from raw materials.
Delivery and Installation	2016	Shipping from manufacturing site to project site. Fuel use requirements estimated based on product weights and mapped distance. Installation and packaging material waste included in this stage.
Use Stage	2016	Cleaning energy, water, and materials, including refinishing the product.
End of Life	2016	Shipping from project site to landfill. Fuel use requirements estimated based on product weight and mapped distance. Assumes all products are sent to landfill. Landfill impacts modeled based on secondary data.

System Boundary Summary

ESTIMATES AND ASSUMPTIONS

Landfilling at End of Life – All products were considered to be landfilled at end of life.

Installation Tools – Accessory materials, such as trowels, are required, though not included in the study as these are multi-use tools and the impacts per functional unit is considered negligible.

CUT-OFF CRITERIA

All inputs in which data was available were included.

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

The excluded materials include:

- Ink (0.03% of final product)
- Composto M/GL (0.35% of final product)
- Stain Body (0.47% of final product)

Some material and energy inputs may have been excluded within the GaBi datasets used for this project. All GaBi datasets have been critically reviewed and conform to the exclusion requirement of the PCR.

BACKGROUND DATA

All background data was sourced from GaBi databases. GaBi version 8 was used to complete the assessment.

DATA QUALITY

Geographical Coverage

The geographical scope of the manufacturing portion of the life cycle is the Florim USA facility in Clarksville, Tennessee. All primary data were collected from this location. The geographic coverage of primary data is considered excellent.

The geographical scope of the raw material acquisition is USA, Mexico and Italy, while the scope of customer distribution, site installation and use portions of the life cycle is global. Locations and shipping distance values were determined through analyzing customer sales details provided by Florim USA. This data is considered very good.

Disposal and end-of-life geographic coverage (i.e. site of disposal location) was assumed to be 100 miles from the de-construction site.

Time Coverage

Primary data were provided by Florim USA associates and represent all information from Florim USA's facilities for calendar year 2016. Using 2016 data meets the PCR requirements. Time coverage of this data is considered very good.

Data necessary to model cradle-to-gate unit processes was sourced from thinkstep LCI datasets. Time coverage of the GaBi datasets varies from approximately 2010 to present. All datasets rely on at least one 1-year average data. Overall time coverage of the datasets is considered good and meets the requirement of the PCR that all data be updated within a 10-year period.

Technological Coverage

Primary data provided by Florim USA is specific to the technology that the company uses in manufacturing their product. It is site specific and considered of good quality. It is worth noting that the energy and water used in manufacturing the product includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality.

Data necessary to model cradle-to-gate unit processes was sourced from GaBi LCI datasets. Technological coverage of the datasets is considered good relative to the actual supply chain of Florim USA. While improved life cycle data from suppliers would improve technological coverage, the use of lower quality generic datasets does meet the goal of this LCA.

ALLOCATION

General principles of allocation were based on ISO14044. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis.

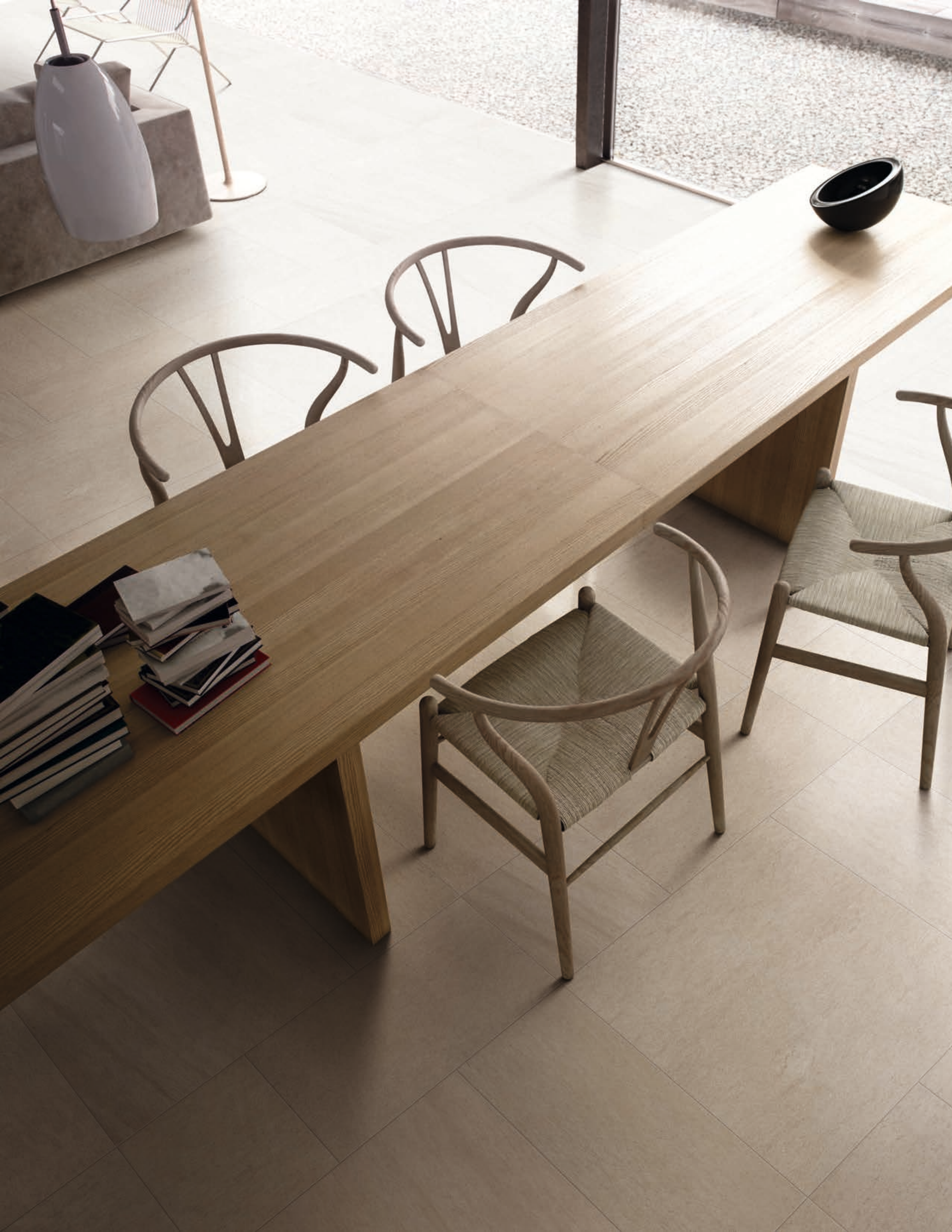
COMPARABILITY

The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the uncertainty of the final results and make comparisons misleading. Without understanding the specific variability, the user is therefore, not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results.

LCA SCENARIOS

The following technical information is a basis for the declared modules and can be used for developing specific scenarios in the context of a building assessment. All indicated values refer to the functional unit.

Input	Amount	Unit
Raw Material Supplier to Manufacturing Facility	1,531.69	Miles
Shipping to Customer – US Truck	562	Miles
Installation Waste to Landfill	100	Miles
Shipping to EOL (landfill)	100	Miles
Tap Water For Cleaning	0.783	L/m2/yr



LCA RESULTS, NSF FLOORING PCR V2

Results of the LCA - Environmental Impact, TRACI 2.1						
Parameter	Life Cycle Stages					
	Unit	Total	1. Sourcing/ Extraction	2. Manufacturing	3. Delivery & Install	5. End of Life
Global Warming Potential	[kg CO2-Equiv.]	2.22E+01	6.04E+00	1.06E+01	3.96E+00	1.57E+00
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.29E-09	4.70E-10	1.43E-09	3.67E-10	2.16E-11
Acidification Potential	[kg SO2-Equiv.]	5.37E-02	1.82E-02	1.67E-02	1.16E-02	7.20E-03
Eutrophication Potential	[kg N eq.]	3.30E-03	1.02E-03	8.47E-04	1.01E-03	4.26E-04
Smog Air	[kg O3 eq.]	9.55E-01	2.59E-01	2.49E-01	2.8E-01	1.67E-01
Resources, Fossil fuels	[MJ surplus energy]	3.56E+01	8.73E+00	1.92E+01	4.54E+00	3.10E+00

Parameter	Life Cycle Stages	
	Unit	Average 1 year use and Maintenance Impacts
Global Warming Potential	[kg CO2-Equiv.]	3.28E-04
Ozone Layer Depletion Potential	[kg R11-Equiv.]	4.07E-16
Acidification Potential	[kg SO2-Equiv.]	4.79E-07
Eutrophication Potential	[kg N eq.]	2.77E-07
Smog Air	[kg O3 eq.]	8.25E-06
Resources, Fossil fuels	[MJ surplus energy]	2.06E-04
List of use and maintenance activities can be found in the section Conditions of Use.		

Results of the LCA - Environmental Impact, TRACI 2.1, 60 year							
Parameter	User Defined Reference Service Life of product = 60 years, 1 installation over 60 years						
	Life Cycle Stages						
	Unit	Total	1. Sourcing/ Extraction	2. Manufacturing	3. Delivery & Install	4. Use Stage	5. End of Life
Global Warming Potential	[kg CO2-Equiv.]	2.22E+01	6.04E+00	1.06E+01	3.96E+00	1.97E-02	1.57E+00
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.29E-09	4.70E-10	1.43E-09	3.67E-10	2.44E-14	2.16E-11
Acidification Potential	[kg SO2-Equiv.]	5.37E-02	1.82E-02	1.67E-02	1.16E-02	2.87E-05	7.20E-03
Eutrophication Potential	[kg Phosphate-Equiv.]	3.31E-03	1.02E-03	8.47E-04	1.01E-03	1.66E-05	4.26E-04
Smog Air	[kg O3 eq.]	9.55E-01	2.59E-01	2.49E-01	2.8E-01	4.95E-04	1.67E-01
Resources, Fossil fuels	[MJ surplus energy]	3.56E+01	8.73E+00	1.92E+01	4.54E+00	1.24E-02	3.10E+00

Results of the LCA - Environmental Impact, CML 2001 - Jan 2016, 1 year						
Parameter	Life Cycle Stages					
	Unit	Total	1. Sourcing/ Extraction	2. Manufacturing	3. Delivery & Install	5. End of Life
Global Warming Potential	[kg CO2-Equiv.]	2.23E+01	6.07E+00	1.07E+01	3.97E+00	1.57E+00
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.10E-09	4.42E-10	1.35E-09	2.90E-10	2.03E-11
Acidification Potential	[kg SO2-Equiv.]	5.01E-02	1.77E-02	1.65E-02	9.62E-03	6.32E-03
Eutrophication Potential	[kg Phosphate-Equiv.]	6.29E-03	1.87E-03	1.52E-03	1.89E-03	1.00E-03
Photochem. Ozone Creation Potential	[kg Ethene-Equiv.]	4.46E-03	1.18E-03	1.41E-03	1.30E-03	5.67E-04
Abiotic Depletion	[kg Sb-Equiv.]	1.66E-05	6.41E-06	4.10E-06	5.52E-06	5.49E-07
Abiotic Depletion for fossil resources	[MJ surplus energy]	2.91E+02	7.13E+01	1.59E+02	3.73E+01	2.39E+01
Primary energy from non renewable resources	[MJ]	3.10E+02	7.58E+01	1.72E+02	3.83E+01	2.44E+01
Primary energy from renewable resources	[MJ]	1.30E+01	6.51E+00	2.53E+00	2.60E+00	1.41E+00

Parameter	Life Cycle Stages	
	Unit	Average 1 year use and Maintenance Impacts
Global Warming Potential	[kg CO2-Equiv.]	3.29E-04
Ozone Layer Depletion Potential	[kg R11-Equiv.]	3.85E-16
Acidification Potential	[kg SO2-Equiv.]	3.61E-07
Eutrophication Potential	[kg Phosphate-Equiv.]	1.63E-07
Photochem. Ozone Creation Potential	[kg Ethene-Equiv.]	3.07E-08
Abiotic Depletion	[kg Sb-Equiv.]	5.03E-11
Abiotic Depletion for fossil resources	[MJ surplus energy]	1.92E-03
Primary energy from non renewable resources	[MJ]	2.01E-03
Primary energy from renewable resources	[MJ]	1.35E-04

Results of the LCA - Environmental Impact, CML 2001 - Jan 2016, 60 year							
Parameter	User Defined Reference Service Life of product = 60 years, 1 installation over 60 years						
	Life Cycle Stages						
	Unit	Total	1. Sourcing/ Extraction	2. Manufacturing	3. Delivery & Install	4. Use Stage	5. End of Life
Global Warming Potential	[kg CO2-Equiv.]	2.23E+01	6.07E+00	1.07E+01	3.97E+00	1.97E-02	1.57E+00
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.10E-09	4.42E-10	1.35E-09	2.90E-10	2.31E-14	2.03E-11
Acidification Potential	[kg SO2-Equiv.]	5.02E-02	1.77E-02	1.65E-02	9.62E-03	2.17E-05	6.32E-03
Eutrophication Potential	[kg Phosphate-Equiv.]	6.30E-03	1.87E-03	1.52E-03	1.89E-03	9.78E-06	1.00E-03
Photochem. Ozone Creation Potential	[kg Ethene-Equiv.]	4.46E-03	1.18E-03	1.41E-03	1.30E-03	1.84E-06	5.67E-04
Abiotic Depletion	[kg Sb-Equiv.]	1.66E-05	6.41E-06	4.10E-06	5.52E-06	3.02E-09	5.49E-07
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Primary energy from non renewable resources	[MJ]	3.11E+02	7.58E+01	1.72E+02	3.83E+01	1.21E-01	2.44E+01
Primary energy from renewable resources	[MJ]	1.31E+01	6.51E+00	2.53E+00	2.60E+00	8.10E-03	1.41E+00