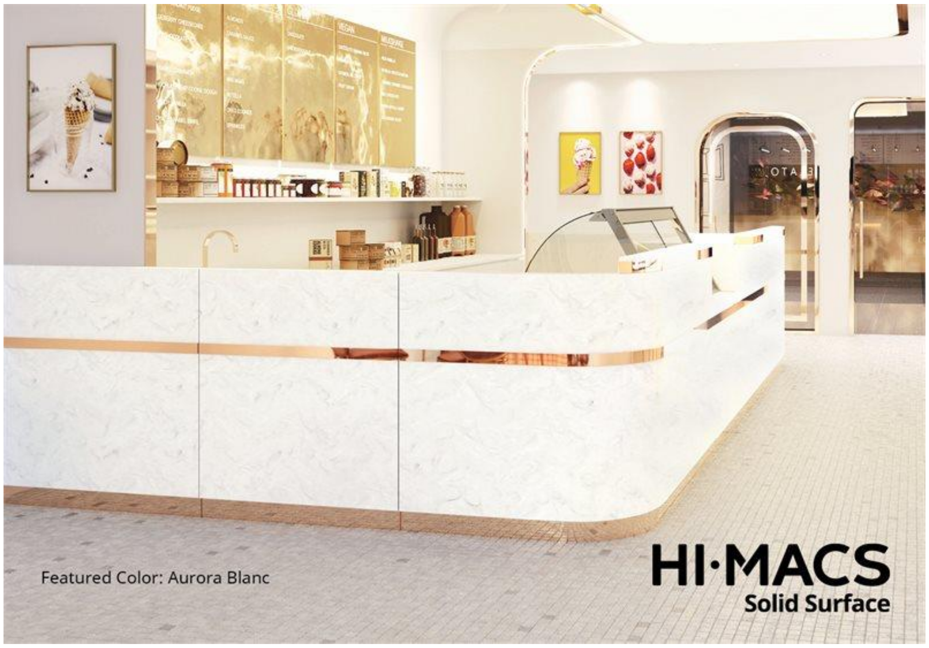
HIMACS and Viatera by LX Hausys | Countertops

ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION



LX Hausys America Inc. is a part of Korean-based LX Hausys Ltd., one of the world's leading providers of building and decorative materials. Headquartered in Atlanta, GA., LX Hausys America uses the industry's most advanced technology to design beautiful and functional spaces with sustainable products. LX Hausys America's business lines include surface materials, flooring, and automotive components.

LX Hausys Ltd. has established its own environmental, safety, and health policy to grow and develop together with society. LX Hausys Ltd. strives to secure society's trust through zero-accident and eco-friendly management in recognition of the fact that environment, safety, and health management is an important factor in ensuring the company's sustainable development based on the principle of "Respecting Human Dignity". In addition, LX Hausys Ltd. has introduced management regulations covering water and air quality, chemicals, and waste management at each manufacturing facility to create harmony between the entrepreneurial activities and the environment.

NSF Certified Environmental Product Declaration www.nsf.org

EPD Program Operator
NSF International
789 N. Dixboro Rd.
Ann Arbor, MI 48105 USA
www.nsf.org

Date of Issue: June 2, 2022
Period of Validity: 5 years
Declaration#: EPD10096

ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION

EPD Information			
Program Operator		NSF International	
Declaration Holder		LX Hausys America, Inc. 900 Circle 75 Parkway, Suite 1500 Atlanta, GA 30339	
Product: HIMACS and Viatera Functional Unit: 1m^2 of product over ten year service life	Date of Issue June 2, 2022	Period of Validity 5 Years	Declaration Number EPD10096
This EPD was independently verified by NSF International in accordance with ISO 14025: ☐ Internal ☒ External		Tony Favilla afavilla@nsf.org	
This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR:		Jack Geibig, EcoForm, LLC jgeibig@ecoform.com	

LCA Information	
Basis LCA	LX Hausys Countertop LCA April 2022
LCA Preparer	Sustainable Solutions Corporation
This life cycle assessment was critically reviewed in accordance with ISO 14044 and ISO 21930:2017 by:	Jack Geibig- EcoForm, LLC jgeibig@ecoform.com

PCR Information	
Program Operator	NSF International
Reference PCR	NSF PCR for Residential Countertops
Date of Issue	September 17, 2013 Extended 12 months per PCRext2021-109 valid through September 30, 2022
PCR review was conducted by:	NSF International ncss@nsf.org

Product Description

For both HIMACS and Viatera product lines, the results contained within this declaration represent the general minimum and maximum case scenarios in terms of life cycle impacts. Specific variations and product thicknesses within each product line have been analyzed, and life cycle impact assessment results for any given variation of either the HIMACS or Viatera products fall within the range of results presented in this declaration.

HIMACS

HIMACS surfaces are laminate acrylic countertop surfaces. Laminate acrylic is a non-porous surface that requires no sealing. Additionally, the HIMACS products can be thermoformed to produce an unlimited variety of shapes, allowing them to be used for vertical and other applications beyond countertops. Within the HIMACS product line, there are several variations, each of which has a slightly different pattern which are available in a number of color options. The maximum available thickness of HIMACS is 12mm, however, thinner profiles are available. With durability similar to that of natural stone, HIMACS stands up to everyday scratches and endures its everyday wear and tear with higher resistance to stains, chemical, and heat. This Environmental Product Declaration covers all product lines in the HIMACS collection.

Product Classification: 06 61 16 Solid Surfacing Fabrications

Viatera

Viatera surfaces are engineered stone quartz countertop surfaces. Silica is combined with polyester resin and pigment to create a non-porous surface that requires no sealing. Each variation of the Viatera product contains different ratios of various silica sizes, used to create a unique pattern. Similar to HIMACS, each available pattern has a variety of color options achieved through the use of different colored pigments. The maximum available thickness of the Viatera product is 30mm, however, thinner profiles are available. This Environmental Product Declaration covers all product lines in the Viatera collection.

Product Classification: 12 36 61.19 Quartz Agglomerate Countertops

Manufacturing Location

HIMACS surfaces are manufactured in both Adairsville, GA, USA and Cheongju, South Korea. Viatera surfaces are manufactured in Adairsville, GA. Data were collected from both facilities, and the results presented here are representative of the production processes in both locations.

Recycled Content

Within the HIMACS product line, the Eden Collection offers surfaces that contain pre-consumer recycled content. The exact amount of pre-consumer recycled content ranges from 6% to 35% depending on product color: For more information on the recycled content of the HIMACS Eden Collection, please view the following certification documents:

https://cdn.scscertified.com/products/cert_pdfs/LXHausys_US_2022_SCS-MC-01491_s.pdf

https://cdn.scscertified.com/products/cert_pdfs/LXHausys_US_2022_SCS-MC-02322_s.pdf

https://cdn.scscertified.com/products/cert_pdfs/LXHausys_US_2022_SCS-MC-02807_s.pdf

Viatera products contain no recycled content.

Product Characteristics

The specific product characteristics / technical data for the HIMACS and Viatera products are presented below in Tables 1 and 2, respectively.

Table 1 – HIMACS Technical Data

Property	Typical Result	Test
Thickness	12 mm (0.47 in)	-
Density	1.69 g/cm^3 (0.061 lb/in^3)	-
Substrate Type	Laminate	-
Tensile Strength	6,000 psi (41.4 MPa)	ASTM D 638
Tensile Modulus	1.5 x 10^6 psi (1.0 x 10^4 MPa)	ASTM D 638
Tensile Elongation	0.5%	ASTM D 638
Flexural Strength	8,407 psi (60.0 MPa)	ASTM D 638
Tensile Modulus	1.34 x 10^6 psi (9.24 x 10^3 MPa)	ASTM D 638
Hardness	90 Pass (Rockwell) 65 (Barcol)	ASTM D 2583
Thermal Expansion	1.65 x 10^{-5} mm / mm / degrees C	ASTM D 696
Deflection Temperature (under load)	90 degrees C (194 degrees F)	ASTM D 648
Light Resistance	Pass	NEMA LD 3.3 ISFA SST 7.1
Wear and Cleanability	Pass	ANSI Z-124.3 ANSI Z-124.6
Cleanability and Stain Resistance	Pass	NEMA LD 3.4 ISFA SST 3.1
Food Contact	Pass (Indoor)	NSF 51
Fungus Resistance	Pass	ASTM G21
Boiling Water Resistance	Pass	NEMA LD 3.5 ISFA SST 8.1
High Temperature Resistance	Pass	NEMA LD 3.6 ISFA SST 9.1
Radiant Heat Resistance	Pass	NEMA LD 3.1
Scratch Resistance	Pass	ISFA SST 6.1 NEMA LC 3.7
Ball Impact Resistance	8 oz @ 144" - Pass	NEMA LD 3.8 ISFA SST 6.1
Water Absorption	0.04%	ISO 4586-2 / ASTM D570
Toxicity	66.9 grams (2.36 oz)	Pittsburgh Protocol
Flammability - Flame Spread Index - USA	<25	ASTM E-84/UL 723: Class A
Flammability - Smoke Development Index - USA	<25	ASTM E-84/UL 723: Class A
Flammability - Flame Spread Index - Canada	30	ANSI/UL 723CAN/ULC-S102-10
Flammability - Smoke Development Index - Canada	10	ANSI/UL 723CAN/ULC-S102.2
Flammability - Europe	Class B-s1, d0	EN-13501

Table 2 – Viatera Technical Data

Property	Typical Result	Test
Thickness	30 mm (1.18 in)	-
Density	2.31 g/cm^3 (0.083 lb/in^3)	-
Substrate Type	Engineered Stone	-
Tensile Strength	1,043 psi (7.19 MPa)	ASTM D 638
Tensile Modulus	1.35 x 10^6 psi (9.31 x 10^3 MPa)	ASTM D 638
Tensile Elongation	0.5%	ASTM D 638
Flexural Strength	4,114 psi (28.4 MPa)	ASTM D 638
Tensile Modulus	5.5 x 10^6 psi (3.8 x 10^4 MPa)	ASTM D 638
Hardness	94/100 (Barcol)	ASTM D 2583
Thermal Expansion	1.55<1.83 x 10^{-5} mm / mm / degrees C	ASTM E 228
Deflection Temperature (under load)	279 degrees C (534 degrees F)	ASTM D 648
Wear and Cleanability	Pass	ANSI Z-124.3 ANSI Z-124.6
Cleanability and Stain Resistance	Pass	NEMA LD 3.4 ISFA SST 3.1
Food Contact	Pass (All Types)	NSF 51 ANSI 61
Fungus Resistance	Pass	ASTM G21
Boiling Water Resistance	Pass (20 min)	NEMA LD 3.5 ISFA SST 8.1
High Temperature Resistance	Pass (20 min)	NEMA LD 3.6 ISFA SST 9.1
Radiant Heat Resistance	Pass	NEMA LD 3.1
Scratch Resistance	Pass	ISFA SST 6.1 NEMA LC 3.7
Ball Impact Resistance	8 oz @ 144" - Pass	NEMA LD 3.8 ISFA SST 6.1
Water Absorption	0.04%	ISO 4586-2 / ASTM D570
Flammability - Flame Spread Index - USA	<25	ASTM E-84/UL 723: Class A
Flammability - Smoke Development Index - USA	<25	ASTM E-84/UL 723: Class A
Flammability - Flame Spread Index - Canada	5	ANSI/UL 723CAN/ULC-S102-10
Flammability - Smoke Development Index - Canada	90	ANSI/UL 723CAN/ULC-S102.2

Functional Unit

The functional unit for this study is one square meter of countertop surface area with a service life of ten years, including end-of-life disposition. Table 3 below summarizes the functional unit for the HIMACS and Viatera products and provides a scaling factor to one kilogram.

Table 3 – HIMACS and Viatera Functional Unit

Parameter	HIMACS	Viatera
Functional Unit (m^2)	1	1
Service Life (years)	10	10
Weight per Functional Unit (kg)	20.0	69.3
Ratio to 1 kg	0.050	0.014

System Boundaries

The system boundary of the LX Hausys Countertop LCA is presented below in Figure 1.

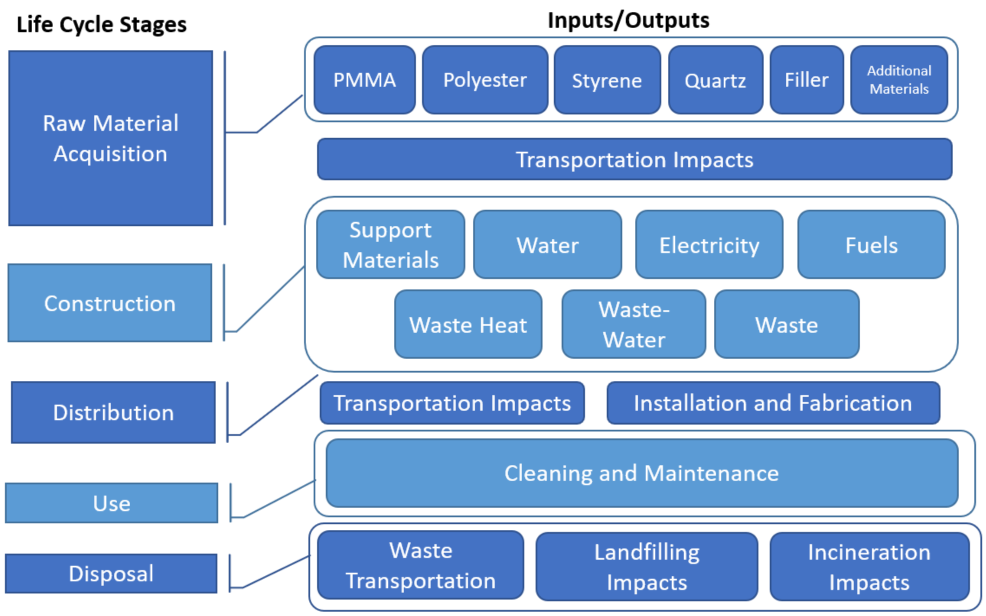


Figure 1 – HIMACS and Viatera System Boundary

Waste Management

The treatment of waste throughout this study follows the most current version of the US Environmental Protection Agency's (EPA) Waste Reduction Model (WARM). According to this model, the average municipal solid waste disposition is 80% landfill and 20% incineration. This assumption is followed throughout this study in the absence of primary disposal data, with the exception of the construction stage where primary data were available.

Allocation Rules

The manufacturing facility in Adairsville, GA produces both HIMACS and Viatera countertops for LX Hausys. In addition, HIMACS surfaces are also produced in a facility located in Cheongju, South Korea. Both the Adairsville, GA and Cheongju, South Korea facilities produce surfaces of variable thickness, so allocation was conducted on a mass basis to capture variations in product size. In the Adairsville facility, the HIMACS and Viatera production lines are metered separately; therefore, no allocation was required to separate the production of the two product types.

For recycled materials, the recycled content methodology was applied.

Calculation Rules and Data Quality Requirements

SimaPro v9.2 Software System for Life Cycle Engineering, an internationally recognized LCA modeling software program, was used for life cycle impact assessment modeling. In the absence of primary data, representative secondary datasets were utilized. The two datasets used in this study were the ecoinvent Version 3 database and the USLCI database. The data used in this study meet all data quality requirements as outlined in the PCR. Secondary data were evaluated with regards to precision, completeness, consistency, reproducibility, representativeness and uncertainty. Based on these criteria, the data quality used throughout this study is considered high.

Cut-off rules were followed as defined by ISO 14044. Processes whose total contribution to the final result, with respect to their mass and in relation to all considered impact categories, is less than 1% can be neglected. The sum of the neglected processes may not exceed 5% by mass of the considered impact categories. All hazardous and toxic materials and substances were included in the life cycle inventory. This EPD is in compliance with the cut-off criteria. Capital items for the production processes (machine, buildings, etc.) were not taken into consideration.

Life Cycle Assessment Stages

The following life cycle assessment stages were considered in this study:

- Raw Material Acquisition & Pre-processing
- Construction
- Installation
- Use
- End-of-Life (Disposal)

The following sections provide a more detailed description of each considered life cycle stage.

Raw Material Acquisition Stage

The raw material acquisition stage considers the upstream production and sourcing of raw materials used in the countertops. This stage begins when the material is extracted from the environment and ends when the material reaches the gate of the countertop construction facility. The material content of the HIMACS and Viatera products are presented below, using generalized names and percent ranges to protect proprietary information.

Table 4 – HIMACS Material Composition

HIMACS Raw Material	Percent Composition by Weight
Methyl Methacrylate (MMA)	20% - 30%
Methacrylic Polymer (PMMA)	5% - 10%
Aluminum Hydroxide	35% - 60%
Initiators, Pigments, and Other Additives	0% - 20%

Table 5 – Viatera Material Composition

Viatera Raw Material	Percent Composition by Weight
Crystalline Silica (Quartz)	80% - 95%
Polyester Resin Solution	5% - 15%
Initiators, Pigments, and Other Additives	0% - 5%

No hazardous substances were identified within these products.

In addition to the upstream production of these materials, this life cycle stage also considers the transportation of the raw materials to the LX Hausys facilities. Proprietary supplier data were collected to facilitate these freight calculations which come from a variety of suppliers utilizing transport by both truck and ship.

Construction Stage

Both HIMACS and Viatera surfaces are manufactured using processes such as mixing of raw ingredients, heat curing, cutting of the surface to shape, and sanding and polishing of the surface. Primary data were used from the 2020 calendar year to determine the inputs and outputs to the manufacturing process. All transport of support materials to the manufacturing facility and transport of waste to its disposal site is considered in the construction stage. Disposal impacts from manufacturing waste are also considered in the construction stage.

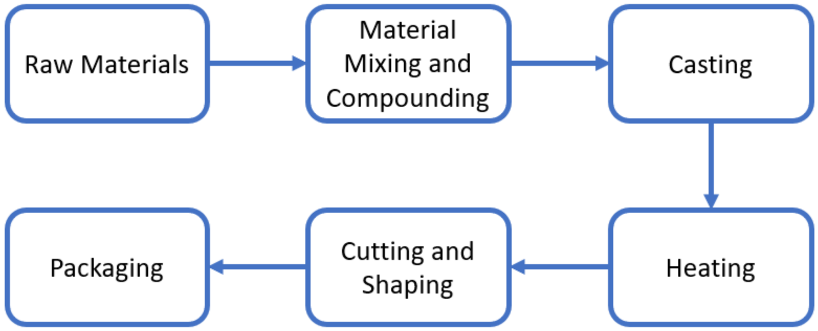


Figure 2 – Manufacturing Process Flow

Installation Stage

The installation stage starts with the product leaving the production facility and ends when the product reaches the consumer. Included in this stage are the distribution and warehousing, along with the installation of the product. Primary data were provided regarding product warehousing and distribution, and these data are proprietary and undisclosed in this EPD. All transport of the product between the manufacturing site, warehousing locations, and final installation site are considered in this stage, along with the scrap created during the installation process. Products produced at the Adairsville facility are transported to a warehouse for storage before distribution. The warehouse is located around 15 km from the manufacturing site and products are transported by truck. Products produced in the United States are distributed across North America with an average transportation distance of around 1466 km by truck and 129 km by ship. Products produced in South Korea are distributed across Europe and Asia with an average transportation distance of around 1775 km by truck and 9918 km by ship.

In addition to the warehousing and distribution, this stage also considers the installation of the countertop product. Installation involves cutting, sanding, and securing the surface in place with adhesive and caulk, along with the disposal of any scrap created during installation. A 10% scrap rate was chosen based on data from and conversations with LX Hausys personnel. Based on these assumptions, the following installation inventories were used for HIMACS and Viatera products, respectively:

Table 6 – HIMACS Installation Inventory

Input	Quantity	Unit (per m^2)
Silicone Adhesive	0.10	kg
Silicone Caulk	0.25	kg
Electricity	0.05	kWh
Install Scrap Disposal	2.0	kg

Table 7 – Viatera Installation Inventory

Input	Quantity	Unit (per m^2)
Silicone Adhesive	0.10	kg
Silicone Caulk	0.25	kg
Electricity	0.05	kWh
Install Scrap Disposal	6.9	kg

Use Stage

Considered in the use stage is the daily maintenance of the countertop across the ten year service life. Identical maintenance assumptions are used for HIMACS and Viatera products. Table 8 below details the assumed maintenance inventory for one square meter of installed countertop over a period of ten years.

Table 8 – HIMACS and Viatera Maintenance Inventory

Input	Quantity	Unit (per m^2)
Water	110	kg
Detergent	2.74	kg

Disposal Stage

HIMACS and Viatera surfaces are not typically recycled or reused at the end of life. As such, disposal was modeled as 80% landfill and 20% incineration, according to the most current version of the US EPA WARM. The transportation distance at end of life is assumed to be 100 kilometers. These assumptions are used for both the Adairsville, GA and the Cheongju, South Korea sites.

Life Cycle Assessment (LCA)

This section presents the life cycle impact assessment (LCIA) results for both HIMACS and Viatera surfaces across the full cradle to grave life cycle of these products. All results presented in this section are impacts per functional unit: one square meter of countertop over a period of ten years.

HIMACS TRACI 2.1

Tables 9 and 10 below represent the cradle to grave life cycle impact assessment results for the HIMACS products with the respective highest and lowest results according to the TRACI 2.1 impact assessment methodology. The highest and lowest impact products were chosen based off of overall trends in results.

Table 9 – HIMACS Maximum Case Scenario TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	7.84E+01	1.40E+01	6.35E+00	4.42E+01	2.41E+00	**1.45E+02**
Acidification	kg SO_2 eq	4.47E-01	1.16E-01	2.00E-02	1.50E-01	5.09E-03	**7.39E-01**
Smog	kg O_3 eq	6.45E+00	7.37E-01	2.84E-01	1.88E+00	1.32E-01	**9.48E+00**
Eutrophication	kg N eq	1.30E-01	5.81E-03	2.47E-02	2.47E+00	3.11E-03	**2.63E+00**
Ozone Depletion	kg CFC_{-11} eq	1.59E-06	1.65E-07	1.43E-06	2.71E-06	5.09E-08	**5.96E-06**
Fossil Fuel Depletion*	MJ surplus	1.64E+02	1.75E+01	9.07E+00	1.19E+01	9.39E-01	**2.04E+02**

Table 10 – HIMACS Minimum Case Scenario TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	5.51E+01	4.54E+00	8.61E+00	4.42E+01	2.41E+00	**1.15E+02**
Acidification	kg SO_2 eq	2.92E-01	2.76E-02	6.66E-02	1.50E-01	5.09E-03	**5.42E-01**
Smog	kg O_3 eq	3.11E+00	2.28E-01	9.93E-01	1.88E+00	1.32E-01	**6.34E+00**
Eutrophication	kg N eq	9.23E-02	2.69E-02	2.50E-02	2.47E+00	3.11E-03	**2.62E+00**
Ozone Depletion	kg CFC_{-11} eq	1.41E-06	1.61E-07	1.96E-06	2.71E-06	5.09E-08	**6.29E-06**
Fossil Fuel Depletion*	MJ surplus	1.14E+02	4.04E+00	1.36E+01	1.19E+01	9.39E-01	**1.44E+02**

* TRACI 2.1 methodology does not currently contain a comprehensive Abiotic Depletion Potential category. Instead, impacts are reported using the Fossil Fuel Depletion impact category, which assesses the use of non-renewable fuel resources throughout the product life cycle.

HIMACS Interpretation

The TRACI 2.1 results presented above were analyzed to understand the trends across the full cradle to grave life cycle of the HIMACS products. Figures 3 and 4 below show the contribution of each HIMACS life cycle stage to the overall impacts in each of the considered TRACI 2.1 impact categories.

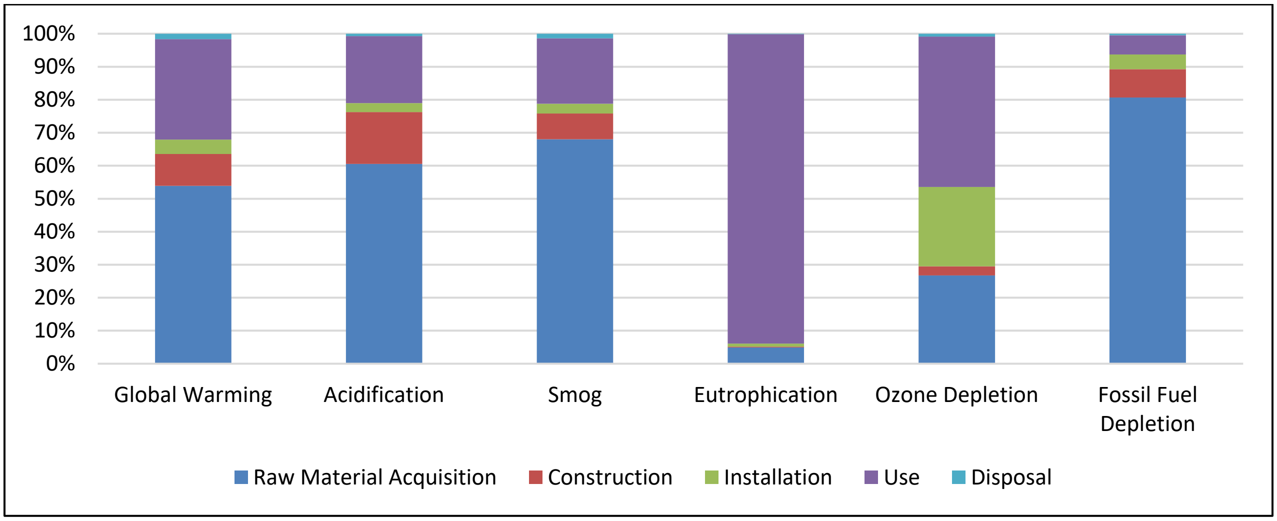


Figure 3 – HIMACS Maximum Case Scenario TRACI 2.1 Impact Analysis

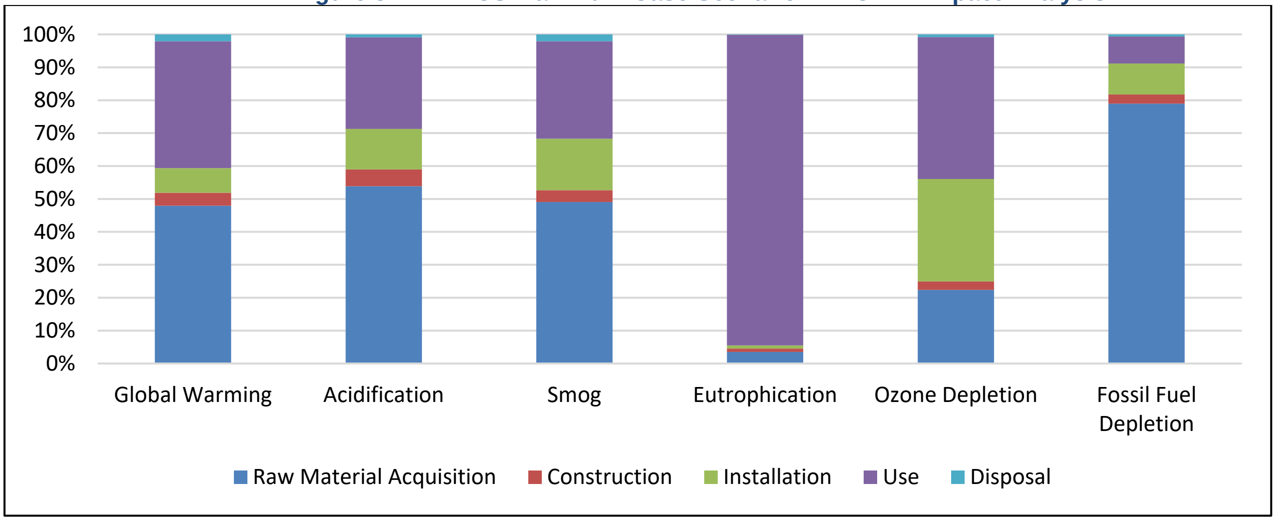


Figure 4 - HIMACS Minimum Case Scenario TRACI 2.1 Impact Analysis

For this HIMACS product, raw material acquisition is the primary driver of environmental impacts in all considered impact categories with two exceptions. In the eutrophication and ozone depletion impact categories, product use is the dominant contributor. Raw material impacts are driven by methyl methacrylate and aluminum hydroxide used in the product recipe, the ingredients that contribute most to the product's mass. The impact from the use stage comes from the use of soap for daily product maintenance over the course of ten years.

The use stage is the secondary driver of impacts in the global warming, acidification, and smog categories. The installation stage is the secondary driver of impacts in the ozone depletion category. The construction stage is the secondary driver of fossil fuel depletion in the maximum case scenario and installation is the secondary driver of fossil fuel depletion in the minimum case scenario.

Viatera TRACI 2.1

Tables 11 and 12 below represents the cradle to grave life cycle impacts assessment results for the Viatera products with the respective highest and lowest results according to the TRACI 2.1 impact assessment methodology. The highest and lowest impact products were chosen based off of overall trends in results.

Table 11 – Viatera Maximum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	1.10E+02	2.88E+01	1.91E+01	4.41E+01	8.32E+00	**2.11E+02**
Acidification	kg SO_2 eq	6.11E-01	2.26E-01	5.64E-02	1.50E-01	1.76E-02	**1.06E+00**
Smog	kg O_3 eq	1.27E+01	1.64E+00	8.09E-01	1.88E+00	4.57E-01	**1.74E+01**
Eutrophication	kg N eq	2.50E-01	2.14E-02	7.77E-02	2.47E+00	1.07E-02	**2.83E+00**
Ozone Depletion	kg CFC_{-11} eq	9.77E-06	8.17E-07	3.26E-06	2.71E-06	1.76E-07	**1.67E-05**
Fossil Fuel Depletion*	MJ surplus	2.04E+02	3.99E+01	2.68E+01	1.19E+01	3.25E+00	**2.86E+02**

Table 12 - Viatera Minimum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	7.99E+01	2.88E+01	1.93E+01	4.42E+01	8.33E+00	**1.81E+02**
Acidification	kg SO_2 eq	5.17E-01	2.26E-01	5.65E-02	1.50E-01	1.76E-02	**9.68E-01**
Smog	kg O_3 eq	1.17E+01	1.64E+00	8.12E-01	1.88E+00	4.57E-01	**1.65E+01**
Eutrophication	kg N eq	1.68E-01	2.15E-02	7.94E-02	2.47E+00	1.07E-02	**2.75E+00**
Ozone Depletion	kg CFC_{-11} eq	6.27E-06	8.17E-07	3.26E-06	2.71E-06	1.76E-07	**1.32E-05**
Fossil Fuel Depletion*	MJ surplus	1.46E+02	3.99E+01	2.68E+01	1.19E+01	3.25E+00	**2.28E+02**

* TRACI 2.1 methodology does not currently contain a comprehensive Abiotic Depletion Potential category. Instead, impacts are reported using the Fossil Fuel Depletion impact category, which assesses the use of non-renewable fuel resources throughout the product life cycle.

Viatera Interpretation

The TRACI 2.1 results presented above were analyzed to understand the trends across the full cradle to grave life cycle of the Viatera products. Figures 5 and 6 below shows the contribution of each Viatera life cycle stage to the overall impacts in each of the considered TRACI 2.1 impact categories.

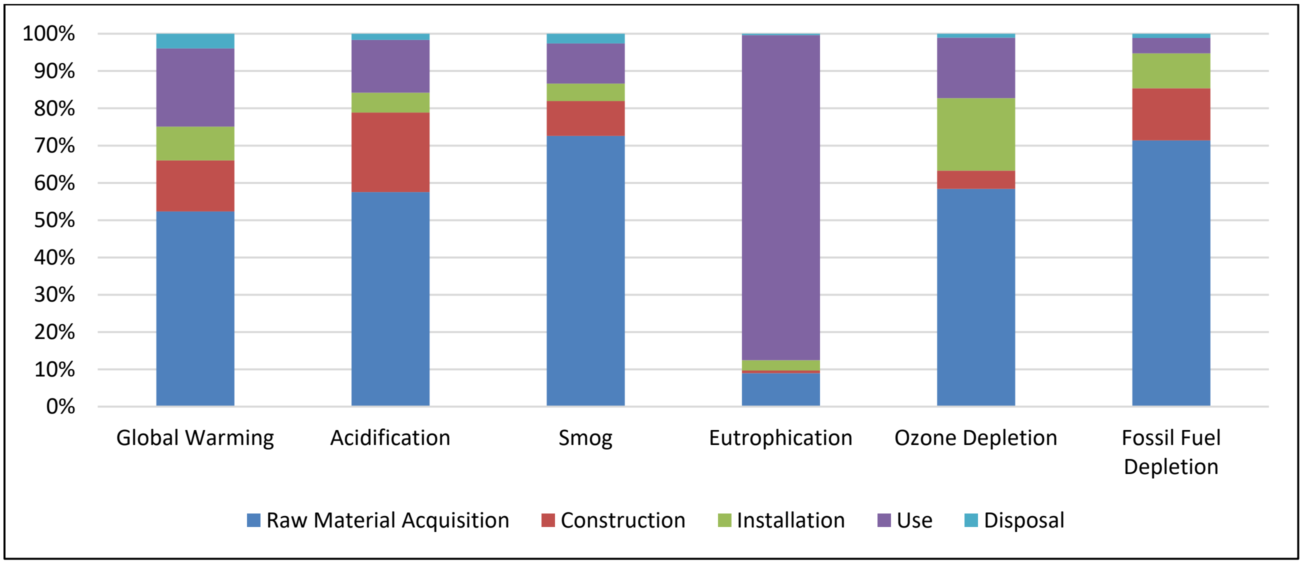


Figure 5 – Viatera Maximum TRACI 2.1 Impact Analysis

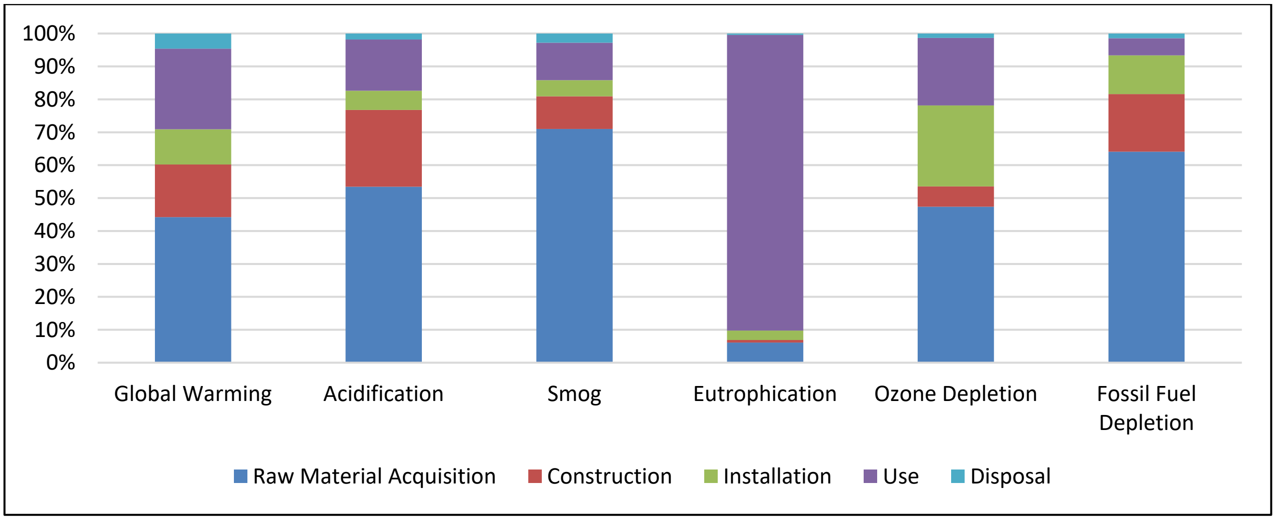


Figure 6 - Viatera Minimum TRACI 2.1 Impact Analysis

For the Viatera product, raw material acquisition is the primary driver of environmental impact in all considered impact categories with one exception. In the eutrophication impact category, product use is the dominant contributor. Raw material impacts are driven by the polyester resin solution used in the product recipe. Although silica is the largest contributor to the product's mass, silica has a lower environmental impact; thus, the polyester resin is the largest driver of raw material impacts. The impact from the use stage comes from the use of soap for daily product maintenance over the course of ten years.

The use stage is the secondary driver of impacts in the global warming and smog categories, while the installation stage is the secondary contributor in the ozone depletion category, and the construction stage is the secondary contributor in the acidification and fossil fuel depletion categories.

CML

In addition to the LCIA results reported above using the TRACI 2.1 methodology, LCIA results were also calculated using the CML v3.06 impact assessment methodology. Tables 13 through 16 below represent the cradle to grave life cycle impact assessment results for the HIMACS and Viatera products according to the CML impact assessment methodology.

Table 13 – HIMACS Maximum CML Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	7.97E+01	1.42E+01	6.70E+00	4.47E+01	2.40E+00	**1.48E+02**
Acidification	kg SO_2 eq	4.45E-01	1.27E-01	1.94E-02	1.34E-01	3.97E-03	**7.29E-01**
Photochemical Ozone Creation	kg C_2H_4 eq	3.07E-02	5.64E-03	1.23E-03	2.67E-02	-4.71E-04	**6.38E-02**
Eutrophication	kg PO_4 eq	7.78E-02	5.53E-03	1.07E-02	1.06E+00	1.90E-03	**1.16E+00**
Ozone Depletion	kg CFC_{-11} eq	1.37E-06	1.32E-07	1.23E-06	2.47E-06	3.93E-08	**5.24E-06**
Abiotic Depletion (elements)	kg Sb eq	1.56E-04	1.08E-05	1.67E-05	3.46E-04	5.67E-07	**5.30E-04**
Abiotic Depletion (fossil fuel)	MJ	1.22E+03	2.07E+02	7.36E+01	1.40E+02	7.00E+00	**1.65E+03**

Table 14 – HIMACS Minimum CML Cradle to Grave LCIA

Impact Category	Unit (per m^2)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	5.60E+01	4.59E+00	8.86E+00	4.47E+01	2.40E+00	**1.17E+02**
Acidification	kg SO_2 eq	3.05E-01	2.95E-02	6.09E-02	1.34E-01	3.97E-03	**5.33E-01**
Photochemical Ozone Creation	kg C_2H_4 eq	2.81E-02	1.67E-03	2.42E-03	2.67E-02	-4.71E-04	**5.84E-02**
Eutrophication	kg PO_4 eq	4.99E-02	1.22E-02	1.54E-02	1.06E+00	1.90E-03	**1.14E+00**
Ozone Depletion	kg CFC_{-11} eq	1.19E-06	1.30E-07	1.63E-06	2.47E-06	3.93E-08	**5.46E-06**
Abiotic Depletion (elements)	kg Sb eq	1.05E-04	2.12E-05	1.91E-05	3.46E-04	5.67E-07	**4.91E-04**
Abiotic Depletion (fossil fuel)	MJ	8.53E+02	5.63E+01	1.00E+02	1.40E+02	7.00E+00	**1.16E+03**

Table 15 – Viatera Maximum CML Cradle to Grave LCIA

Impact Category	Unit (per m²)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	1.09E+02	2.91E+01	2.03E+01	4.47E+01	8.31E+00	**2.12E+02**
Acidification	kg SO_2 eq	5.50E-01	2.44E-01	5.48E-02	1.34E-01	1.37E-02	**9.96E-01**
Photochemical Ozone Creation	kg C_2H_4 eq	4.37E-02	1.19E-02	3.49E-03	2.67E-02	-1.63E-03	**8.42E-02**
Eutrophication	kg PO_4 eq	1.62E-01	1.54E-02	3.30E-02	1.06E+00	6.55E-03	**1.28E+00**
Ozone Depletion	kg CFC_{-11} eq	8.88E-06	7.17E-07	2.60E-06	2.47E-06	1.36E-07	**1.48E-05**
Abiotic depletion (elements)	kg Sb eq	8.03E-04	3.71E-05	3.45E-05	3.46E-04	1.96E-06	**1.22E-03**
Abiotic Depletion (fossil fuel)	MJ	1.67E+03	4.39E+02	2.13E+02	1.40E+02	2.42E+01	**2.49E+03**

Table 16 - Viatera Minimum CML Cradle to Grave LCIA

Impact Category	Unit (per m²)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
Global Warming	kg CO_2 eq	7.93E+01	2.91E+01	2.04E+01	4.47E+01	8.31E+00	**1.82E+02**
Acidification	kg SO_2 eq	4.54E-01	2.44E-01	5.49E-02	1.34E-01	1.37E-02	**9.01E-01**
Photochemical Ozone Creation	kg C_2H_4 eq	3.32E-02	1.19E-02	3.51E-03	2.67E-02	-1.63E-03	**7.36E-02**
Eutrophication	kg PO_4 eq	1.22E-01	1.54E-02	3.36E-02	1.06E+00	6.55E-03	**1.24E+00**
Ozone Depletion	kg CFC_{-11} eq	5.66E-06	7.17E-07	2.60E-06	2.47E-06	1.36E-07	**1.16E-05**
Abiotic depletion (elements)	kg Sb eq	4.97E-04	3.71E-05	3.45E-05	3.46E-04	1.96E-06	**9.17E-04**
Abiotic Depletion (fossil fuel)	MJ	1.18E+03	4.39E+02	2.13E+02	1.40E+02	2.42E+01	**2.00E+03**

Material Resources

This section presents the material resource use for both HIMACS and Viatera surfaces across the full cradle to grave life cycle of these products. All resource use results are presented in this section per functional unit: one square meter of countertop over a period of ten years. These numbers are representative of the most impactful product variation in each product line.

Table 17 – HIMACS Material Resource Use

Material Resource Category	Raw Material Acquisition	Construction	Install	Use	Disposal	Total
Virgin Renewable Resources (kg)	0.00E+00	6.08E-02	0.00E+00	0.00E+00	0.00E+00	**6.08E-02**
Recycled Resources (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Virgin Non-renewable Resources (kg)	2.48E+01	1.28E-02	3.50E-01	2.91E+00	0.00E+00	**2.81E+01**

Table 18 – Viatera Material Resource Use

Material Resource Category	Raw Material Acquisition	Construction	Install	Use	Disposal	Total
Virgin Renewable Resources (kg)	0.00E+00	4.72E-02	0.00E+00	0.00E+00	0.00E+00	**4.72E-02**
Recycled Resources (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Virgin Non-renewable Resources (kg)	9.36E+01	1.62E-02	3.50E-01	2.91E+00	0.00E+00	**9.68E+01**

Parameters to be Declared in the EPD

The following life cycle inventory (LCI) data are included, highlighting the material and energy flows throughout the product life cycle of both the HIMACS and Viatera products. These numbers are representative of the most and least impactful product variation in each product line.

Table 19 – HIMACS Maximum LCI Parameters

Inventory Assessment Category Emissions to Air (kg)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
SO_X	2.64E-01	9.34E-02	1.13E-02	3.95E-02	7.66E-04	**4.09E-01**
NO_X	3.13E-01	3.13E-02	1.15E-02	7.15E-02	5.36E-03	**4.33E-01**
CO_2	6.79E+01	1.33E+01	5.75E+00	1.27E+02	5.35E+00	**2.19E+02**
CH_4	4.27E-01	4.33E-02	6.70E-02	1.92E-01	6.47E-04	**7.29E-01**
N_2O	1.12E-02	3.64E-04	2.17E-04	1.52E-04	1.04E-02	**2.23E-02**
CO	1.45E-01	1.15E-02	1.01E-02	1.79E-01	2.42E-03	**3.48E-01**
Water Usage and Emissions to Water (kg)						
Phosphates	2.43E-02	1.25E-03	1.82E-03	7.47E-01	5.00E-04	**7.75E-01**
Nitrates	7.05E-03	5.34E-04	8.40E-03	8.11E-01	6.70E-04	**8.28E-01**
Dioxin	1.47E-17	4.60E-18	2.13E-17	7.34E-17	2.77E-19	**1.14E-16**
Arsenic	3.68E-04	5.18E-06	7.91E-06	6.73E-05	6.23E-06	**4.55E-04**
Lead	3.08E-04	2.65E-05	1.60E-03	8.50E-04	1.14E-03	**3.93E-03**
Water Usage and Emissions to Water (kg)						
Mercury	2.29E-06	1.27E-07	4.14E-06	2.54E-06	2.00E-07	**9.30E-06**
Cadmium	9.86E-06	1.21E-06	3.38E-05	4.06E-05	2.83E-06	**8.83E-05**
Chromium	2.33E-03	2.25E-05	3.55E-05	3.72E-04	1.92E-05	**2.78E-03**
Water Consumption	1.52E+04	1.01E+03	1.80E+03	1.00E+05	2.56E+02	**1.19E+05**
Energy Type and Usages (MJ)						
Primary Energy Demand	1.40E+03	3.00E+02	8.31E+01	3.23E+02	7.57E+00	**2.11E+03**
Fossil Fuel Based Energy	1.32E+03	2.24E+02	7.87E+01	1.51E+02	7.45E+00	**1.78E+03**
Nuclear Energy	6.57E+01	1.48E+00	2.27E+00	1.96E+01	5.95E-02	**8.92E+01**

Energy Type and Usages (MJ)						
Solar Energy	2.56E-03	4.29E-04	3.15E-03	2.03E-01	9.69E-05	**2.09E-01**
Wind Energy	7.48E-01	1.45E-01	2.14E-01	2.20E+00	6.46E-03	**3.31E+00**
Hydro Energy	6.43E+00	6.25E-01	1.09E+00	8.80E+00	3.17E-02	**1.70E+01**
Biomass Energy	6.78E+00	7.39E+01	8.52E-01	1.41E+02	1.96E-02	**2.23E+02**
Waste Management (kg)						
Incineration Without Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Incineration With Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E+00	**0.00E+00**
Landfill (non-hazardous)	4.81E+00	8.69E+00	2.00E+00	0.00E+00	1.60E+01	**3.15E+01**
Hazardous Waste	0.00E+00	2.47E-02	0.00E+00	0.00E+00	0.00E+00	**2.47E-02**
Landfill Avoidance (recycling)	0.00E+00	7.01E-02	0.00E+00	0.00E+00	0.00E+00	**7.01E-02**

Table 20 - HIMACS Minimum LCI Parameters

Inventory Assessment Category Emissions to Air (kg)	Raw Material Acquisition	Construction	Install	Use	Disposal	Total
SO_x	2.04E-01	2.07E-02	3.42E-02	3.93E-02	7.63E-04	**2.99E-01**
NO_x	1.22E-01	8.94E-03	3.85E-02	7.01E-02	5.23E-03	**2.45E-01**
CO_2	1.00E-01	2.54E-02	4.46E-01	7.23E-02	7.59E-04	**6.44E-01**
CH_4	3.28E-01	9.98E-03	6.87E-02	1.92E-01	6.47E-04	**5.99E-01**
N_2O	1.13E-03	9.06E-05	2.79E-04	1.05E-02	1.97E-04	**1.22E-02**
CO	9.43E-02	3.71E-03	1.22E-02	1.79E-01	2.42E-03	**2.92E-01**
Water Usage and Emissions to Water (kg)						
Phosphates	1.76E-02	1.05E-02	2.67E-03	7.47E-01	5.00E-04	**7.79E-01**
Nitrates	6.88E-03	3.55E-03	8.83E-03	8.11E-01	6.70E-04	**8.31E-01**
Dioxin	9.74E-18	1.05E-17	2.20E-17	7.34E-17	2.77E-19	**1.16E-16**
Arsenic	2.45E-04	1.79E-05	9.81E-06	6.71E-05	6.15E-06	**3.46E-04**
Lead	2.14E-04	4.94E-05	1.63E-03	8.45E-04	1.14E-03	**3.88E-03**
Mercury	1.76E-03	9.01E-04	4.29E-03	2.54E-03	2.00E-04	**9.69E-03**
Cadmium	7.09E-06	3.21E-06	3.46E-05	4.06E-05	2.83E-06	**8.84E-05**
Chromium	1.18E-03	3.12E-05	4.07E-05	2.83E-04	1.49E-05	**1.55E-03**
Water Consumption	1.17E+04	1.41E+03	1.91E+03	1.00E+05	2.56E+02	**1.16E+05**
Energy Type and Usages (MJ)						
Primary Energy Demand	9.97E+02	1.12E+02	1.14E+02	3.23E+02	7.57E+00	**1.55E+03**
Fossil Fuel Based Energy	9.31E+02	6.12E+01	1.07E+02	1.51E+02	7.45E+00	**1.26E+03**
Nuclear Energy	5.30E+01	2.95E+01	3.61E+00	1.96E+01	5.95E-02	**1.06E+02**

Energy Type and Usages (MJ)						
Solar Energy	3.41E-03	5.03E-01	5.19E-03	2.87E-01	1.38E-04	**7.98E-01**
Wind Energy	6.29E-01	5.34E-01	3.83E-01	2.31E+00	6.77E-03	**3.86E+00**
Hydro Energy	5.16E+00	2.52E+00	1.57E+00	8.80E+00	3.17E-02	**1.81E+01**
Biomass Energy	7.46E+00	1.74E+01	9.93E-01	1.41E+02	1.96E-02	**1.67E+02**
Waste Management (kg)						
Incineration Without Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Incineration With Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E+00	**0.00E+00**
Landfill (non-hazardous)	4.81E+00	8.69E+00	2.00E+00	0.00E+00	1.60E+01	**3.15E+01**
Hazardous Waste	0.00E+00	2.47E-02	0.00E+00	0.00E+00	0.00E+00	**2.47E-02**
Landfill Avoidance (recycling)	0.00E+00	7.01E-02	0.00E+00	0.00E+00	0.00E+00	**7.01E-02**

Table 21 – Viatera Maximum LCI Parameters

Inventory Assessment Category Emissions to Air (kg)	Raw Material Acquisition	Construction	Installation	Use	Disposal	Total
SO_X	2.47E-01	1.76E-01	3.17E-02	3.95E-02	2.65E-03	**4.97E-01**
NO_X	4.96E-01	6.42E-02	3.25E-02	7.01E-02	1.85E-02	**6.81E-01**
CO_2	8.65E+01	2.76E+01	1.71E+01	1.27E+02	1.85E+01	**2.76E+02**
CH_4	3.28E-01	8.86E-02	2.18E-01	1.92E-01	2.24E-03	**8.29E-01**
N_2O	6.33E-02	2.48E-04	6.39E-04	1.05E-02	6.82E-04	**7.54E-02**
CO	3.14E-01	2.92E-02	2.96E-02	1.79E-01	8.37E-03	**5.60E-01**
Water Usage and Emissions to Water (kg)						
Phosphates	5.57E-02	4.84E-03	4.06E-03	7.47E-01	1.73E-03	**8.14E-01**
Nitrates	2.19E-02	3.13E-03	2.79E-02	8.11E-01	2.32E-03	**8.67E-01**
Dioxin	1.29E-13	3.43E-14	2.56E-14	7.34E-14	9.56E-16	**2.63E-13**
Arsenic	2.00E-04	1.68E-05	2.07E-05	6.73E-05	2.15E-05	**3.26E-04**
Water Usage and Emissions to Water (kg)						
Lead	1.76E-03	1.00E-04	5.39E-03	8.50E-04	3.95E-03	**1.21E-02**
Mercury	7.24E-06	5.11E-07	1.39E-05	2.71E-06	7.07E-07	**2.51E-05**
Cadmium	5.25E-05	4.58E-06	1.13E-04	4.08E-05	9.83E-06	**2.21E-04**
Chromium	6.39E-01	7.58E-02	1.07E-01	3.72E-01	6.65E-02	**1.26E+00**
Water Consumption	5.23E+04	3.54E+03	2.37E+03	1.00E+05	8.85E+02	**1.60E+05**

Energy Type and Usages (MJ)						
Primary Energy Demand	1.93E+03	6.84E+02	2.34E+02	3.23E+02	3.17E+03	**1.93E+03**
Fossil Fuel Based Energy	1.80E+03	4.74E+02	2.27E+02	1.51E+02	2.65E+03	**1.80E+03**
Nuclear Energy	7.16E+01	6.34E+00	3.99E+00	1.96E+01	1.02E+02	**7.16E+01**
Solar Energy	1.80E-01	1.25E-02	5.53E-03	3.61E-03	2.02E-01	**1.80E-01**
Wind Energy	2.03E+01	1.27E+01	1.68E+00	5.36E-01	3.52E+01	**2.03E+01**
Hydro Energy	2.94E+01	2.34E+00	1.89E+00	8.80E+00	4.24E+01	**2.94E+01**
Biomass Energy	2.81E+01	2.01E+02	1.20E+00	1.41E+02	3.72E+02	**2.81E+01**
Waste Management (kg)						
Incineration Without Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Incineration With Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E+01	**1.39E+01**
Landfill (non-hazardous)	2.43E+01	1.56E+01	6.93E+00	0.00E+00	5.54E+01	**1.02E+02**
Hazardous Waste	0.00E+00	1.66E-01	0.00E+00	0.00E+00	0.00E+00	**1.66E-01**
Landfill Avoidance (recycling)	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	**1.04E-01**

Table 22 - Viatera Minimum LCI Parameters

Inventory Assessment Category Emissions to Air (kg)	Raw Material Acquisition	Construction	Install	Use	Disposal	Total
SO_X	2.47E-01	1.76E-01	3.17E-02	3.95E-02	2.65E-03	**4.97E-01**
NO_X	4.96E-01	6.42E-02	3.25E-02	7.01E-02	1.85E-02	**6.81E-01**
CO_2	8.65E+01	2.76E+01	1.71E+01	1.27E+02	1.85E+01	**2.76E+02**
CH_4	3.28E-01	8.86E-02	2.18E-01	1.92E-01	2.24E-03	**8.29E-01**
N_2O	6.33E-02	2.48E-04	6.39E-04	1.05E-02	6.82E-04	**7.54E-02**
CO	3.14E-01	2.92E-02	2.96E-02	1.79E-01	8.37E-03	**5.60E-01**
Water Usage and Emissions to Water (kg)						
Phosphates	5.57E-02	4.84E-03	4.06E-03	7.47E-01	1.73E-03	**8.14E-01**
Nitrates	2.19E-02	3.13E-03	2.79E-02	8.11E-01	2.32E-03	**8.67E-01**
Dioxin	1.29E-13	3.43E-14	2.56E-14	7.34E-14	9.56E-16	**2.63E-13**
Arsenic	2.00E-04	1.68E-05	2.07E-05	6.73E-05	2.15E-05	**3.26E-04**
Lead	1.76E-03	1.00E-04	5.39E-03	8.50E-04	3.95E-03	**1.21E-02**
Mercury	7.24E-06	5.11E-07	1.39E-05	2.71E-06	7.07E-07	**2.51E-05**
Cadmium	5.25E-05	4.58E-06	1.13E-04	4.08E-05	9.83E-06	**2.21E-04**
Chromium	6.39E-01	7.58E-02	1.07E-01	3.72E-01	6.65E-02	**1.26E+00**
Water Consumption	5.23E+04	3.54E+03	2.37E+03	1.00E+05	8.85E+02	**1.60E+05**

Energy Type and Usages (MJ)						
Primary Energy Demand	1.93E+03	6.84E+02	2.34E+02	3.23E+02	3.17E+03	**1.93E+03**
Fossil Fuel Based Energy	1.80E+03	4.74E+02	2.27E+02	1.51E+02	2.65E+03	**1.80E+03**
Nuclear Energy	7.16E+01	6.34E+00	3.99E+00	1.96E+01	1.02E+02	**7.16E+01**
Solar Energy	1.80E-01	1.25E-02	5.53E-03	3.61E-03	2.02E-01	**1.80E-01**
Wind Energy	2.03E+01	1.27E+01	1.68E+00	5.36E-01	3.52E+01	**2.03E+01**
Hydro Energy	2.94E+01	2.34E+00	1.89E+00	8.80E+00	4.24E+01	**2.94E+01**
Biomass Energy	2.81E+01	2.01E+02	1.20E+00	1.41E+02	3.72E+02	**2.81E+01**
Waste Management (kg)						
Incineration Without Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Incineration With Energy Recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E+01	**1.39E+01**
Landfill (non-hazardous)	2.43E+01	1.56E+01	6.93E+00	0.00E+00	5.54E+01	**1.02E+02**
Hazardous Waste	0.00E+00	1.66E-01	0.00E+00	0.00E+00	0.00E+00	**1.66E-01**
Landfill Avoidance (recycling)	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	**1.04E-01**

Other Environmental Information

Material Ingredient Reporting

In addition to the environmental impact data contained within the declaration, LX Hausys has also published Health Product Declarations (HPDs) for both the HIMACS and Viatera surfaces. The declarations can be accessed via the HPD Public Repository.

Disclaimer

Comparability of EPDs is limited to those applying a functional unit. EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. This EPD was not written to support comparative assertions. Even for similar products, differences in functional unit, use and end-of-life stage assumptions, and data quality may produce incomparable results. It is not recommended to compare EPDs with another organization as there may be differences in methodology, assumptions, allocation methods, data quality such as variability in datasets, and results of variability in assessment software tools used. This declaration represents an average performance based on production values for a calendar year.

Contact Information

For additional information, please visit https://www.lxhausys.com. To contact LX Hausys, please visit https://www.lxhausys.com/us/contactUs/pro.

References

The following references were used in the publication of this EPD:

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- ISO 14044:2006-10, Environmental management — Life cycle assessment — Requirements and guidelines
- ISO 9001 Quality Management System
- ISO 14001 Environmental Management System
- ISO 21930:2017, Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 4586-2:2004, High-Pressure Decorative Laminates – Sheets Made from Thermosetting Resins – Part 2: Determination Of Properties
- Product Category Rule for Environmental Product Declaration – PCR for Residential Countertops. NSF International. Valid through September 17, 2021
- ASTM D570 – Standard Test Method for Water Absorption of Plastics
- ASTM D638 – Standard Test Method for Tensile Properties of Plastics
- ASTM D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- ASTM D696 – Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer
- ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
- NEMA LD 3 – High-Pressure Decorative Laminates (HPDL)
- ANSI/UL 723CAN/ULC-S102-10 – Surface Burning Characteristics of Building Materials
- ANSI/NSF Standard 51 (National Sanitation Foundation – Food Equipment Materials)
- ANSI Z124.3 – Plastic Lavatories
- ANSI Z124.6 – Plastic Sinks
- ISFA SST 3.1 – Cleanability/Stain Resistance
- ISFA SST 6.1 – Impact Resistance 226.8g (1/2lb.) Ball
- ISFA SST 7.1 – Light Resistance
- ISFA SST 8.1 – Boiling Water Resistance
- ISFA SST 9.1 – High Temperature Resistance
- Pittsburgh Protocol
- EN-13501 – Fire Classification of Construction Products and Building Elements
- Product Life Cycle Accounting and Reporting Standard, Greenhouse Gas Protocol, World Business Council

for Sustainable Development and World Resources Institute

- Countertop Life Cycle Assessment. LX Hausys / Sustainable Solutions Corporation. April 2022
- US EPA’s Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks page 111

Appendix: ISO 21930 Analysis

In order to meet ISO 21930 criteria, this EPD includes supplemental information in addition to the scope of the NSF Countertop PCR as presented in this section. Below are the life cycle assessment scenarios required by ISO 21930.

Table 23-Transport to Building Site (A4)

Name	HIMACS Georgia		HIMACS South Korea		Viatera		Unit
Fuel type	Diesel	Heavy fuel oil	Diesel	Heavy fuel oil	Diesel	Heavy fuel oil	-
Liters of fuel	3.80E+01	2.21E+04	3.80E+01	2.21E+04	3.80E+01	2.21E+04	l/100km
Vehicle type	Truck	Ship	Truck	Ship	Truck	Ship	-
Transport distance	1.47E+03	1.29E+02	1.77E+03	9.92E+03	1.47E+03	1.29E+02	km
Capacity utilization (including empty runs, mass or volume based)	9.00E+01	9.00E+01	9.00E+01	9.00E+01	9.00E+01	9.00E+01	%
Gross density of products transported	2.00E+01	2.00E+01	2.00E+01	2.00E+01	6.93E+01	6.93E+01	kg/m^3

Table 24 – Installation into the Building (A5)

Name	HIMACS	Viatera	Unit
Silicone Adhesive	1.00E-01	1.00E-01	kg
Silicone Caulk	2.50E-01	2.50E-01	kg
Net freshwater consumption	0.00E+00	0.00E+00	m^3
Other resources	0.00E+00	0.00E+00	kg
Electricity consumption	5.00E-02	5.00E-02	kWh
Other energy carriers	0.00E+00	0.00E+00	MJ
Product loss per functional unit	2.00E+00	6.93E+00	kg
Waste materials at the construction site	0.00E+00	0.00E+00	kg
Output materials resulting from on-site waste processing	0.00E+00	0.00E+00	kg
Packaging waste, wood	6.04E-02	4.72E-02	kg
Packaging waste, cardboard	4.48E-04	0.00E+00	kg
Packaging waste, protective film	3.90E-03	8.51E-03	kg
Biogenic carbon contained in packaging	3.03E-02	2.36E-02	kg CO_2
Direct emissions to ambient air, soil, and water	0.00E+00	0.00E+00	kg
VOC emissions	-	-	$\mu g/m^3$

Table 25 – Reference Service Life

Name	HIMACS and Viatera	Unit
RSL	10	years
Indoor environment	Normal building operating conditions	-
Use conditions	Normal building operating conditions	-

Table 26 – Maintenance (B2)

Name	HIMACS	Viatera	Unit
Daily Cleaning	3.65E+03	3.65E+03	Cycles/RSL
Daily Cleaning	3.65E+03	3.65E+03	Cycles/ESL
Net freshwater consumption specified by water source and fate	0.11, tap water, evaporated	0.11, tap water, evaporated	m^3
Detergent	2.91E+00	2.91E+00	kg
Other resources	0.00E+00	0.00E+00	kg
Energy input, specified by activity, type and amount	0.00E+00	0.00E+00	kWh
Other energy carriers specified by type	0.00E+00	0.00E+00	kWh
Power output of equipment	0.00E+00	0.00E+00	kW
Waste materials from maintenance	0.00E+00	0.00E+00	kg
Direct emissions to ambient air, soil and water	0.00E+00	0.00E+00	kg
Further assumptions for scenario development	Countertops cleaned with soap and water daily over a 10 year period.		

Table 27 – End of Life (C1 – C4)

Name		HIMACS	Viatera	Unit
Assumptions for scenario development	This disposal was modeled according to the average US municipal waste disposition (80% landfill, 20% incineration) according to US EPA data. Waste is transported via diesel powered refuse truck.			
Collection process	Collected separately	2.00E+01	6.93E+01	kg
	Collected with mixed construction waste	0.00E+00	0.00E+00	kg
Recovery	Reuse	0.00E+00	0.00E+00	kg
	Recycling	0.00E+00	0.00E+00	kg
	Landfill	1.60E+01	5.54E+01	kg
	Incineration	4.01E+00	1.39E+01	kg
	Incineration with energy recovery	0.00E+00	0.00E+00	kg
	Energy conversion	-	-	-
Disposal	Product or material for final deposition	2.00E+01	6.93E+01	kg
Removals of biogenic carbon		0.00E+00	0.00E+00	kg CO_2

The system boundary and life cycle stages mandated by ISO 21930 closely follow the system boundary presented above with one difference: ISO 21930 groups the Raw Material Acquisition and Construction Stages together under the Production Stage. The PCR does not account for replacement included in module B4. All other life cycle stages are consistent between the two standards. Table 28 below shows how the life cycle stages compare between ISO 21930 and the NSF Countertop PCR.

Table 28 – System Boundary Comparison

System Boundary																	
ISO 21930 Life Cycle Stage	Production stage			Construction stage		Use stage							End-of-Life stage				Benefits and Loads Beyond the System Boundary
Modules	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Inclusion	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND
Countertop PCR Life Cycle Stage	Raw Material Acquisition		Construction	Install		Use							Disposal				Not included
Included in System Boundary	Yes		Yes	Yes		Yes							Yes				No

All assumptions and included flows and processes remain identical between the two system boundaries. All results are presented including the distinction between the Raw Material Acquisition and Construction Stage to show greater transparency and to meet the requirements of both standards. All modules were considered in this study, however, reported results below are only shown for modules that include non-zero values.

ISO 21930 also requires additional inventory data to be reported. Tables 29 through 32 show the use of resources and renewable primary energy across the life cycle of the HIMACS and Viatera products, respectively. All figures presented in this section are representative of the most impactful product variation in each product line per functional unit.

Table 29 – HIMACS Maximum Use of Primary and Secondary Resources

Primary and Secondary Resource Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
RPRE	Renewable primary energy as energy carrier	MJ	7.34E+00	0.00E+00	8.01E-01	3.80E-01	9.68E-01
RPRM	Renewable primary energy resources as material utilization	MJ	6.78E+00	0.00E+00	7.39E+01	1.33E-01	7.19E-01
NRPRE	Nonrenewable primary energy as energy carrier	MJ	1.27E+03	1.20E+02	2.21E+02	5.90E+01	2.17E+01
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Primary and Secondary Resource Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	3.67E-01	0.00E+00	2.44E-02	5.19E-03	4.27E-02

Primary and Secondary Resource Categories		Unit	Use B2	Use B4	Disposal C2	Disposal C4	Total
RPRE	Renewable primary energy as energy carrier	MJ	1.17E+01	1.49E+02	0.00E+00	3.94E-02	**1.70E+02**
RPRM	Renewable primary energy resources as material utilization	MJ	1.41E+02	1.56E+03	0.00E+00	1.96E-02	**1.78E+03**
NRPRE	Nonrenewable primary energy as energy carrier	MJ	2.00E+02	1.33E+04	3.70E+00	3.81E+00	**1.52E+04**
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
FW	Use of net fresh water	m^3	2.66E+00	2.17E+01	0.00E+00	7.06E-03	**2.48E+01**

Table 30 - HIMACS Minimum Use of Primary and Secondary Resources

Primary and Secondary Resource Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
RPRE	Renewable primary energy as energy carrier	MJ	5.89E+00	0.00E+00	3.57E+00	1.03E+00	9.69E-01
RPRM	Renewable primary energy resources as material utilization	MJ	7.46E+00	0.00E+00	1.74E+01	2.74E-01	7.19E-01
NRPRE	Nonrenewable primary energy as energy carrier	MJ	9.69E+02	1.49E+01	9.02E+01	8.89E+01	2.18E+01
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	2.82E-01	0.00E+00	8.89E-02	9.04E-03	4.27E-02

Primary and Secondary Resource Categories		Unit	Use B2	Use B4	Disposal C2	Disposal C4	Total
RPRE	Renewable primary energy as energy carrier	MJ	1.17E+01	1.62E+02	0.00E+00	0.00E+00	**1.85E+02**
RPRM	Renewable primary energy resources as material utilization	MJ	1.41E+02	1.17E+03	0.00E+00	0.00E+00	**1.34E+03**
NRPRE	Nonrenewable primary energy as energy carrier	MJ	2.00E+02	9.74E+03	3.70E+00	3.81E+00	**1.11E+04**
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

	Primary and Secondary Resource Categories	Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
FW	Use of net fresh water	m^3	2.66E+00	2.16E+01	0.00E+00	0.00E+00	**2.46E+01**

Table 31 – Viatera Maximum Use of Primary and Secondary Resources

	Primary and Secondary Resource Categories	Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
RPRE	Renewable primary energy as energy carrier	MJ	3.62E+01	0.00E+00	3.03E+00	1.31E+00	1.06E+00
RPRM	Renewable primary energy resources as material utilization	MJ	2.81E+01	0.00E+00	2.01E+02	4.59E-01	7.42E-01
NRPRE	Nonrenewable primary energy as energy carrier	MJ	1.54E+03	3.25E+02	4.72E+02	2.04E+02	2.61E+01
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	1.29E+00	0.00E+00	8.66E-02	1.80E-02	4.65E-02

	Primary and Secondary Resource Categories	Unit	Use		Disposal		Total
			B2	B4	C2	C4	
RPRE	Renewable primary energy as energy carrier	MJ	1.17E+01	3.74E+02	0.00E+00	1.36E-01	**4.27E+02**
RPRM	Renewable primary energy resources as material utilization	MJ	1.41E+02	2.60E+03	0.00E+00	6.78E-02	**2.97E+03**
NRPRE	Nonrenewable primary energy as energy carrier	MJ	2.00E+02	1.96E+04	1.28E+01	1.32E+01	**2.24E+04**
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
FW	Use of net fresh water	m^3	2.66E+00	2.89E+01	0.00E+00	2.44E-02	**3.30E+01**

Table 32 - Viatera Minimum Use of Primary and Secondary Resources

Primary and Secondary Resource Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
RPRE	Renewable primary energy as energy carrier	MJ	2.25E+01	0.00E+00	3.03E+00	1.31E+00	1.06E+00
RPRM	Renewable primary energy resources as material utilization	MJ	1.92E+01	0.00E+00	2.01E+02	4.59E-01	7.43E-01
NRPRE	Nonrenewable primary energy as energy carrier	MJ	9.72E+02	3.40E+02	4.72E+02	2.04E+02	2.63E+01
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m^3	8.07E-01	0.00E+00	8.66E-02	1.80E-02	4.66E-02

Primary and Secondary Resource Categories		Unit	Use		Disposal		Total
			B2	B4	C2	C4	
RPRE	Renewable primary energy as energy carrier	MJ	1.17E+01	2.78E+02	0.00E+00	1.36E-01	**3.18E+02**
RPRM	Renewable primary energy resources as material utilization	MJ	1.41E+02	2.54E+03	0.00E+00	6.78E-02	**2.90E+03**
NRPRE	Nonrenewable primary energy as energy carrier	MJ	2.00E+02	1.56E+04	2.85E-01	1.32E+01	**1.78E+04**
NRPRM	Nonrenewable primary energy as material utilization	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
SM	Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RSF	Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
NRSF	Use of nonrenewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RE	Energy recovered from disposed waste	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
FW	Use of net fresh water	m^3	2.66E+00	2.55E+01	0.00E+00	2.44E-02	**2.91E+01**

Additionally, the resource use for all stages of the life cycle of the HIMACS and Viatera products were differentiated by resources type, as shown below in Tables 33 through 36.

Table 33 – HIMACS Maximum Emissions and Removals of CO_2

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	0.00E+00	3.03E-02	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.03E-02

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Emissions and Removals of CO2 Categories		Unit	Use		Disposal		Total
			B2	B4	C2	C4	
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	2.12E-01	0.00E+00	0.00E+00	**2.42E-01**
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	2.12E-01	0.00E+00	0.00E+00	**2.42E-01**
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 34 – HIMACS Minimum Emissions and Removals of CO_2

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	0.00E+00	6.74E-03	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.74E-03
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Emissions and Removals of CO2 Categories		Unit	Use B2	Use B4	Disposal C2	Disposal C4	Total
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	4.72E-02	0.00E+00	0.00E+00	**5.39E-02**
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	4.72E-02	0.00E+00	0.00E+00	**5.39E-02**
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 35 – Viatera Maximum Emissions and Removals of CO_2

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	0.00E+00	2.36E-02	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-02
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Emissions and Removals of CO2 Categories		Unit	Use B2	Use B4	Disposal C2	Disposal C4	Total
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	1.65E-01	0.00E+00	0.00E+00	**1.89E-01**
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	1.65E-01	0.00E+00	0.00E+00	**1.89E-01**
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 36 - Viatera Minimum Emissions and Removals of CO_2

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	0.00E+00	2.36E-02	0.00E+00	0.00E+00
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-02
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Emissions and Removals of CO2 Categories		Unit	Use		Disposal		Total
			B2	B4	C2	C4	
BCRP	Biogenic Carbon Removal from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCEP	Biogenic Carbon Emissions from Product	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2	0.00E+00	1.65E-01	0.00E+00	0.00E+00	**1.89E-01**
BCEK	Biogenic Carbon Emissions from Packaging	kg CO_2	0.00E+00	1.65E-01	0.00E+00	0.00E+00	**1.89E-01**
BCEW	Biogenic Carbon Emissions from Combustion of Waste from Renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Emissions and Removals of CO2 Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
CCE	Calcination Carbon Emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCR	Carbonation Carbon Removal	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CWNR	Carbon Emissions from Combustion of Waste from Non-renewable Sources Used in Production Process	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

The disposal of waste throughout the product life cycle is classified as either hazardous or non-hazardous waste. This inventory data for both the HIMACS and Viatera product lines is included in Tables 37 through 40 below. These data are expressed in mass per functional unit.

Table 37 – HIMACS Maximum Waste to Disposal

Waste Categories		Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
HWD	Hazardous waste disposed	kg	1.53E-04	0.00E+00	2.34E-05	1.13E-04	1.41E-05
NHWD	Non-hazardous waste disposed	kg	1.28E+01	0.00E+00	8.55E+00	3.99E+00	3.02E+00
HLRW	High-level radioactive waste	kg	3.20E-04	0.00E+00	6.09E-05	3.10E-04	3.64E-05
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E-02
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-03
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories		Unit	Use		Disposal		Total
			B2	B4	C2	C4	
HWD	Hazardous waste disposed	kg	3.33E-02	2.35E-01	0.00E+00	7.32E-06	**2.68E-01**
NHWD	Non-hazardous waste disposed	kg	1.31E+01	4.02E+02	0.00E+00	1.60E+01	**4.59E+02**
HLRW	High-level radioactive waste	kg	5.96E-04	9.40E-03	0.00E+00	1.92E-05	**1.07E-02**
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
MR	Materials for recycling	kg	0.00E+00	3.19E-01	0.00E+00	0.00E+00	**3.65E-01**
MER	Materials for energy recovery	kg	0.00E+00	2.81E+01	0.00E+00	4.01E+00	**3.21E+01**
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 38 - HIMACS Minimum Waste to Disposal

Waste Categories		Unit	Raw Material Acquisition A1	Raw Material Acquisition A2	Construction A3	Install A4	Install A5
HWD	Hazardous waste disposed	kg	1.21E-04	0.00E+00	3.03E-05	1.53E-04	1.42E-05
NHWD	Non-hazardous waste disposed	kg	9.27E+00	0.00E+00	1.38E+00	4.79E+00	3.06E+00
HLRW	High-level radioactive waste	kg	3.74E-04	0.00E+00	4.17E-04	5.46E-04	3.65E-05
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E-02
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-03
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories		Unit	Use B2	Use B4	Disposal C2	Disposal C4	Total
HWD	Hazardous waste disposed	kg	3.33E-02	2.35E-01	0.00E+00	7.32E-06	**2.69E-01**
NHWD	Non-hazardous waste disposed	kg	1.31E+01	3.33E+02	0.00E+00	1.60E+01	**5.85E+01**
HLRW	High-level radioactive waste	kg	5.96E-04	1.39E-02	0.00E+00	1.92E-05	**1.59E-02**
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
MR	Materials for recycling	kg	0.00E+00	3.19E-01	0.00E+00	0.00E+00	**3.65E-01**
MER	Materials for energy recovery	kg	0.00E+00	2.81E+01	0.00E+00	4.01E+00	**3.21E+01**
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 39 – Viatera Maximum Waste to Disposal

	Waste Categories	Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
HWD	Hazardous waste disposed	kg	7.15E-04	0.00E+00	7.98E-05	3.91E-04	2.30E-05
NHWD	Non-hazardous waste disposed	kg	7.58E+00	0.00E+00	4.81E+01	1.38E+01	1.00E+01
HLRW	High-level radioactive waste	kg	1.77E-03	0.00E+00	2.12E-04	1.07E-03	4.94E-05
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.54E-02
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.81E-03
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste Categories	**Unit**	**Use**		**Disposal**		**Total**
			B2	**B4**	**C2**	**C4**	
HWD	Hazardous waste disposed	kg	3.33E-02	2.41E-01	0.00E+00	2.53E-05	**2.76E-01**
NHWD	Non-hazardous waste disposed	kg	1.31E+01	1.06E+03	0.00E+00	5.92E+01	**1.21E+03**
HLRW	High-level radioactive waste	kg	5.96E-04	2.64E-02	0.00E+00	6.65E-05	**3.01E-02**
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
MR	Materials for recycling	kg	0.00E+00	2.48E-01	0.00E+00	0.00E+00	**2.83E-01**
MER	Materials for energy recovery	kg	0.00E+00	9.70E+01	0.00E+00	1.39E+01	**1.11E+02**
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 40 - Viatera Minimum Waste to Disposal

	Waste Categories	Unit	Raw Material Acquisition		Construction	Install	
			A1	A2	A3	A4	A5
HWD	Hazardous waste disposed	kg	4.75E-04	0.00E+00	7.98E-05	3.91E-04	2.34E-05
NHWD	Non-hazardous waste disposed	kg	5.24E+00	0.00E+00	4.81E+01	1.38E+01	1.03E+01
HLRW	High-level radioactive waste	kg	1.21E-03	0.00E+00	2.12E-04	1.07E-03	4.99E-05
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.54E-02
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.81E-03
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories		Unit	Use		Disposal		Total
			B2	B4	C2	C4	
HWD	Hazardous waste disposed	kg	3.33E-02	2.40E-01	0.00E+00	2.53E-05	**2.74E-01**
NHWD	Non-hazardous waste disposed	kg	1.31E+01	1.05E+03	0.00E+00	5.92E+01	**1.20E+03**
HLRW	High-level radioactive waste	kg	5.96E-04	2.24E-02	0.00E+00	6.65E-05	**2.56E-02**
ILLRW	Intermediate- and low-level radioactive waste	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
MR	Materials for recycling	kg	0.00E+00	2.48E-01	0.00E+00	0.00E+00	**2.83E-01**
MER	Materials for energy recovery	kg	0.00E+00	9.70E+01	0.00E+00	1.39E+01	**1.11E+02**
EE	Recovered energy exported from product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Lastly, ISO 21930 requires life cycle impact assessment data to be presented. LCIA data using both TRACI 2.1 and CML methodologies are presented below.

TRACI 2.1

Tables 41 through 44 below represent the cradle to grave life cycle impact assessment results for the HIMACS and Viatera products according to the TRACI 2.1 impact assessment methodology.

Table 41 – HIMACS Maximum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Constr-uction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	6.96E+01	8.82E+00	1.40E+01	3.45E+00	2.90E+00	4.42E+01	1.02E+03	2.43E-01	2.16E+00	**1.16E+03**
Acidification	kg SO_2 eq	3.49E-01	9.83E-02	1.16E-01	1.36E-02	6.42E-03	1.50E-01	5.17E+00	3.21E-03	1.88E-03	**5.91E+00**
Smog	kg O_3 eq	3.63E+00	2.81E+00	7.37E-01	1.88E-01	9.60E-02	1.88E+00	6.63E+01	8.23E-02	4.99E-02	**7.58E+01**
Eutroph-ication	kg N eq	1.25E-01	5.37E-03	5.81E-03	3.07E-03	2.16E-02	2.47E+00	1.84E+01	1.94E-04	2.91E-03	**2.11E+01**
Ozone Depletion	kg CFC-11 eq	1.59E-06	3.35E-10	1.65E-07	7.29E-07	7.04E-07	2.71E-06	4.17E-05	1.03E-11	5.09E-08	**4.77E-05**
Fossil Fuel Depletion	MJ surplus	1.48E+02	1.58E+01	1.75E+01	7.00E+00	2.07E+00	1.19E+01	1.42E+03	4.85E-01	4.54E-01	**1.63E+03**

Table 42 - HIMACS Minimum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Constr-uction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	5.40E+01	1.03E+00	4.54E+00	5.52E+00	2.55E+00	4.42E+01	8.00E+02	2.43E-01	2.16E+00	**9.14E+02**
Acidification	kg SO_2 eq	2.81E-01	1.05E-02	2.76E-02	5.55E-02	6.17E-03	1.50E-01	3.75E+00	3.21E-03	1.88E-03	**4.29E+00**
Smog	kg O_3 eq	2.83E+00	2.82E-01	2.28E-01	8.57E-01	9.06E-02	1.88E+00	4.41E+01	8.23E-02	4.99E-02	**5.04E+01**
Eutroph-ication	kg N eq	9.15E-02	7.37E-04	2.69E-02	7.07E-03	1.78E-02	2.47E+00	1.83E+01	1.94E-04	2.91E-03	**2.09E+01**
Ozone Depletion	kg CFC-11 eq	1.35E-06	5.73E-08	1.61E-07	1.26E-06	7.02E-07	2.71E-06	4.40E-05	1.03E-11	5.09E-08	**5.03E-05**
Fossil Fuel Depletion	MJ surplus	1.12E+02	1.92E+00	4.04E+00	1.07E+01	2.03E+00	1.19E+01	1.01E+03	4.85E-01	4.54E-01	**1.15E+03**

Table 43 – Viatera Maximum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Constr-uction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	8.64E+01	2.40E+01	2.88E+01	1.19E+01	7.16E+00	4.41E+01	1.47E+03	8.40E-01	7.48E+00	**1.69E+03**
Acidification	kg SO_2 eq	3.16E-01	2.94E-01	2.26E-01	4.70E-02	9.35E-03	1.50E-01	7.31E+00	3.55E-11	1.76E-07	**8.35E+00**
Smog	kg O_3 eq	4.19E+00	8.46E+00	1.64E+00	6.49E-01	1.60E-01	1.88E+00	1.19E+02	1.11E-02	6.51E-03	**1.36E+02**
Eutroph-ication	kg N eq	2.34E-01	1.61E-02	2.14E-02	1.06E-02	6.71E-02	2.47E+00	1.98E+01	6.69E-04	1.01E-02	**2.26E+01**
Ozone Depletion	kg CFC-11 eq	9.77E-06	9.10E-10	8.17E-07	2.52E-06	7.35E-07	2.71E-06	3.20E+00	2.85E-01	1.73E-01	**3.66E+00**
Fossil Fuel Depletion	MJ surplus	1.61E+02	4.30E+01	3.99E+01	2.42E+01	2.57E+00	1.19E+01	2.00E+03	1.68E+00	1.57E+00	**2.29E+03**

Table 44 – Viatera Minimum TRACI 2.1 Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Constr-uction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	5.49E+01	2.50E+01	2.88E+01	1.19E+01	7.32E+00	4.42E+01	1.26E+03	8.40E-01	7.48E+00	**1.44E+03**
Acidification	kg SO_2 eq	2.08E-01	3.10E-01	2.26E-01	4.70E-02	9.46E-03	1.50E-01	6.78E+00	1.11E-02	6.51E-03	**7.74E+00**
Smog	kg O_3 eq	2.79E+00	8.91E+00	1.64E+00	6.49E-01	1.63E-01	1.88E+00	1.15E+02	2.85E-01	1.73E-01	**1.32E+02**
Eutroph-ication	kg N eq	1.51E-01	1.69E-02	2.15E-02	1.06E-02	6.88E-02	2.47E+00	1.92E+01	6.69E-04	1.01E-02	**2.20E+01**
Ozone Depletion	kg CFC-11 eq	6.27E-06	9.50E-10	8.17E-07	2.52E-06	7.36E-07	2.71E-06	9.27E-05	3.55E-11	1.76E-07	**1.06E-04**
Fossil Fuel Depletion	MJ surplus	1.01E+02	4.49E+01	3.99E+01	2.42E+01	2.58E+00	1.19E+01	1.60E+03	1.68E+00	1.57E+00	**1.82E+03**

CML

In addition to the LCIA results reported above using the TRACI 2.1 methodology, LCIA results were also calculated using the CML impact assessment methodology. Tables 45 through 48 below represent the cradle to grave life cycle impact assessment results for the HIMACS and Viatera products according to the CML impact assessment methodology.

Table 45 – HIMACS Maximum CML Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Construc-tion	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	7.08E+01	8.84E+00	1.42E+01	3.46E+00	3.24E+00	4.47E+01	1.03E+03	2.44E-01	2.16E+00	**1.18E+03**
Acidification	kg SO_2 eq	3.65E-01	7.95E-02	1.27E-01	1.34E-02	6.00E-03	1.34E-01	5.10E+00	2.46E-03	1.52E-03	**5.83E+00**
Photochemical Ozone Creation	kg C_2H_4 eq	2.83E-02	2.42E-03	5.64E-03	6.41E-04	5.90E-04	2.67E-02	4.46E-01	-5.24E-04	5.29E-05	**5.10E-01**
Eutrophication	kg PO_4 eq	6.30E-02	1.49E-02	5.53E-03	1.99E-03	8.66E-03	1.06E+00	8.11E+00	5.37E-04	1.36E-03	**9.27E+00**
Ozone Depletion	kg CFC-11 eq	1.37E-06	3.32E-10	1.32E-07	5.47E-07	6.86E-07	2.47E-06	3.67E-05	1.02E-11	3.93E-08	**4.19E-05**

Impact Category	Unit	Raw Material Acquisition		Construc-tion	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Abiotic Depletion (elements)	kg Sb eq	1.56E-04	0.00E+00	1.08E-05	6.98E-06	9.77E-06	3.46E-04	3.71E-03	0.00E+00	5.67E-07	**4.24E-03**
Abiotic Depletion (fossil fuel)	MJ	1.11E+03	1.13E+02	2.07E+02	5.50E+01	1.86E+01	1.40E+02	1.15E+04	3.49E+00	3.51E+00	**1.32E+04**

Table 46 - HIMACS Minimum CML Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Construc-tion	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	5.50E+01	1.05E+00	4.59E+00	5.58E+00	3.28E+00	4.47E+01	8.16E+02	2.44E-01	2.16E+00	**9.33E+02**
Acidification	kg SO_2 eq	2.96E-01	8.83E-03	2.95E-02	5.49E-02	6.01E-03	1.34E-01	3.73E+00	2.46E-03	1.52E-03	**4.26E+00**
Photochemical Ozone Creation	kg C_2H_4 eq	2.78E-02	2.73E-04	1.67E-03	1.82E-03	5.95E-04	2.67E-02	4.09E-01	-5.24E-04	5.29E-05	**4.67E-01**
Eutrophication	kg PO_4 eq	4.83E-02	1.58E-03	1.22E-02	6.65E-03	8.78E-03	1.06E+00	8.00E+00	5.37E-04	1.36E-03	**9.14E+00**
Ozone Depletion	kg CFC-11 eq	1.15E-06	4.29E-08	1.30E-07	9.43E-07	6.86E-07	2.47E-06	3.82E-05	1.02E-11	3.93E-08	**4.37E-05**
Abiotic Depletion (elements)	kg Sb eq	1.04E-04	5.19E-07	2.12E-05	9.28E-06	9.77E-06	3.46E-04	3.44E-03	0.00E+00	5.67E-07	**3.93E-03**
Abiotic Depletion (fossil fuel)	MJ	8.39E+02	1.39E+01	5.63E+01	8.18E+01	1.86E+01	1.40E+02	8.10E+03	3.49E+00	3.51E+00	**9.25E+03**

Table 47 – Viatera Maximum CML Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Construction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	8.52E+01	2.40E+01	2.91E+01	1.20E+01	8.30E+00	4.47E+01	1.48E+03	7.47E+00	8.44E-01	**1.69E+03**
Acidification	kg SO_2 eq	3.12E-01	2.38E-01	2.44E-01	4.65E-02	8.29E-03	1.34E-01	6.97E+00	5.25E-03	8.49E-03	**7.97E+00**
Photochemical Ozone Creation	kg C_2H_4 eq	3.69E-02	6.83E-03	1.19E-02	2.22E-03	1.27E-03	2.67E-02	5.89E-01	1.83E-04	-1.81E-03	**6.73E-01**
Eutrophication	kg PO_4 eq	1.18E-01	4.46E-02	1.54E-02	6.90E-03	2.61E-02	1.06E+00	8.96E+00	4.70E-03	1.86E-03	**1.02E+01**
Ozone Depletion	kg CFC-11 eq	8.88E-06	9.01E-10	7.17E-07	1.89E-06	7.09E-07	2.47E-06	1.04E-04	1.36E-07	3.51E-11	**1.18E-04**
Abiotic Depletion (elements)	kg Sb eq	8.03E-04	0.00E+00	3.71E-05	2.41E-05	1.04E-05	3.46E-04	8.56E-03	1.96E-06	0.00E+00	**9.78E-03**
Abiotic Depletion (fossil fuel)	MJ	1.37E+03	3.07E+02	4.39E+02	1.90E+02	2.26E+01	1.40E+02	1.74E+04	1.21E+01	1.21E+01	**1.99E+04**

Table 48 - Viatera Minimum CML Cradle to Grave LCIA

Impact Category	Unit	Raw Material Acquisition		Construction	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Global Warming	kg CO_2 eq	5.42E+01	2.51E+01	2.91E+01	1.20E+01	8.48E+00	4.47E+01	1.27E+03	8.44E-01	7.47E+00	**1.45E+03**
Acidification	kg SO_2 eq	2.04E-01	2.50E-01	2.44E-01	4.65E-02	8.37E-03	1.34E-01	6.30E+00	8.49E-03	5.25E-03	**7.20E+00**
Photochemical Ozone Creation	kg C_2H_4 eq	2.60E-02	7.15E-03	1.19E-02	2.22E-03	1.30E-03	2.67E-02	5.15E-01	-1.81E-03	1.83E-04	**5.89E-01**
Eutrophication	kg PO_4 eq	7.50E-02	4.70E-02	1.54E-02	6.90E-03	2.67E-02	1.06E+00	8.68E+00	1.86E-03	4.70E-03	**9.92E+00**

Impact Category	Unit	Raw Material Acquisition		Construc-tion	Install		Use		Disposal		Total
		A1	A2	A3	A4	A5	B2	B4	C2	C4	
Ozone Depletion	kg CFC-11 eq	5.66E-06	9.41E-10	7.17E-07	1.89E-06	7.10E-07	2.47E-06	8.11E-05	3.51E-11	1.36E-07	**9.26E-05**
Abiotic Depletion (elements)	kg Sb eq	4.97E-04	0.00E+00	3.71E-05	2.41E-05	1.04E-05	3.46E-04	6.42E-03	0.00E+00	1.96E-06	**7.33E-03**
Abiotic Depletion (fossil fuel)	MJ	8.61E+02	3.20E+02	4.39E+02	1.90E+02	2.27E+01	1.40E+02	1.40E+04	1.21E+01	1.21E+01	**1.60E+04**

For additional information about the HIMACS and Viatera product lines, please visit www.lxhausys.com. To contact LX Hausys, please visit https://www.lxhausys.com/us/contactUs/pro.