EPD

Environmental Product Declaration for Ready Mixed Concrete FCK 40 São Paulo

Programme: The International EPD® System
Programme operator: EPD International AB
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In accordance with ISO 14025 and EN 15804:2022+A2:2019

Programme Information

Programme:	The International EPD® System
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product category rules (PCR):

PCR 2019:14 Construction products (EN 15804:A2); Version 1.11; 2021-02-05

c-PCR-003 Concrete and concrete elements (EN 16757); Version 2019-12-20

UN CPC 375

PCR review was conducted by The Technical Committee of the International EPD® System

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒ EPD verification

Third party verifier: Maurizio Fieschi, fieschi@studiofieschi.it, www.studiofieschi.it

Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.
EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025

Company Information

Owner of the EPD: Votorantim Cimentos S.A, Gomes de Carvalho Street - 11ºfloor - 12º floor - 04547-006 – São Paulo, SP, Brazil.

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Description of the organisation: Building materials manufacturer

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Votorantim Cimentos is an international building materials and sustainable solutions company, in operation since 1933. The company is part of the Votorantim Group and is present in 11 countries through the South America, North America, Europe, Middle East and Africa.

Votorantim Cimentos is one of the most vertically integrated companies in the industry, with a diverse portfolio that includes cement, concrete, aggregates, mortars, grouts, finishing products, plasticizers, aglime and waste management (co-processing).

Sustainability is part of Votorantim Cimentos strategy, and the company has a long history in this constant pursuit of more advanced technologies to reduce the environmental footprint, improve energy efficiency, ensure the health, safety and well being and promote social and environmental development of the communities around its operation.

VOTORANTIM CIMENTOS HAS 32 CEMENT PLANTS AND 16 GRINDING PLANTS WORLDWIDE.

Product Information

Product name:

CONS 400 C40 B0 SL22±3 HC, 6161201
CONS C40 B0 SL22±3 HC, 6173089
CONS C40 B01 SL22±3 PD, 6173101
CONV C40 B0 S100, 6134626
CONV C40 B0 S160, 6138936
CONV C40 B0 S220, 6144882
CONV C40 B0 SL10±2, 6054700
CONV C40 B0 SL12±2, 6054985
CONV C40 B0 SL14±2, 6104471
CONV C40 B0 SL16±3, 6104472
CONV C40 B0 SL18±3, 6102892
CONV C40 B0 SL20±3, 6055081
CONV C40 B0 SL22±3, 6169395
CONV C40 B01 S100, 6134586
CONV C40 B01 S160, 6134588
CONV C40 B01 S220, 6172720
CONV C40 B01 SL10±2, 6100260
CONV C40 B01 SL12±2, 6054523
CONV C40 B01 SL14±2, 6066310
CONV C40 B01 SL16±3, 6140482
CONV C40 B01 SL18±3, 6174556
CONV C40 B01 SL20±3, 6142430
CONV C40 B01 SL22±3, 6167273
CONV C40 B1 S100, 6190475
CONV C40 B1 S160, 6190473
CONV C40 B1 SL10±2, 6054514
CONV C40 B1 SL12±2, 6054520
CONV C40 B1 SL14±2, 6104360
CONV C40 B1 SL16±3, 6134534
CONV C40 B1 SL18±3, 6177606
CONV C40 B1 SL20±3, 6156861

Product identification: Compressive Strength 28 days (Mpa): 40

Product description: Concrete is a mix of cement, coarse and fine aggregate and water with or without the incorporation of admixture. Concrete is manufactured at ready mix plants and is delivered to the construction site in bulk with ready-mix trucks.

Since the concrete is cast in a liquid state it can be shapped in different forms and has a wide range of applications, this material is mostly used to build concrete structures for high-rises or small buildings and houses and infraestructure for roads and dams.

The technical characteristics and composition of the product are shown in the table below:

Technical characteristics according to ABNT NBR 5739 and 8953		
Mechanical properties	Minimum Compressive Strength $f_{ck,cylindrical}$ (Mpa)	40
Specific Mass	kg/m3	2000<X >2800

Content Information

Specific Mass (Kg/m3)	Cement	Coarse Aggregate	Fine Aggregate	Water	Admixtures
2384	19%~12%	46%~36%	37%~33%	10%~7%	0,23%~0,06%

1 **Input** - The concrete is produced by mixing cement, aggregates (sand and gravel), water and additives - the most used is a plasticizer that, besides giving plasticity to the mixture, delays the onset of the concrete handhold, allowing their delivery within two hours and a half. The receipt of the materials that compound the concrete is carried out in the central ordinance by a person who is trained in the company's procedures. The material is checked and only then discharged to respective storage sites. The incoming materials are tested in the Quality Control Laboratory, according to the technical standards and operational procedures of the company.

2 **Aggregates storage and transport to the hopper** - The raw materials, sand, gravel and rubber are stocked in aggregate bays, and then the wheel loader carries the aggregate to the hopper, which supplies the aggregate cash. All the raw materials have their own box, and an automated system alerts when one of the boxes has low inventory and needs to be replenished.

3 **Loading station** - The materials that compound the concrete are separated and weighed in the aggregate box and transported by conveyor to the loading station, which are inserted into the concrete mixer. The water and the additive are also added, as well as cement that falling from the silos that are located just above. This entire process is automated and controlled by the control room. After this, the concrete is mixed for about ten minutes.

4 **Output** - With the concrete mixed and ready to be delivered, the mixer goes to the concierge where it is placed the seal – guarantee for the costumer that the truck left the central and reached the delivery place without being misplaced and be given the invoice correctly.

Functional unit / declared unit: The declared unit is one (1) cubic meter (m3).

Reference service life: 50 years.

Time representativeness: The data used in this study cover from January 2021 to December 2021.

Database(s) and LCA software used: GCCA Industry EPD Tool for Cement and Concrete and Ecoinvent database (v.3.5).

Goal and scope: This EPD evaluates the environmental impacts of one cubic meter of concrete from Cradle to grave, and module D (A+B+C+D).

Data quality: ISO 14044 was applied in terms of data collection and quality requirements. The data concerning the modules A1 (raw material supply), A2 (transportation) and A3 (product manufacturing) were provided by Votorantim Cimentos S.A. and involved all input and output materials to each ready-mix plant, the consumed utilities (energy) and the distances and means of transport for each input stream. Votorantim Cimentos used the national electricity mix supply of 2020 as published in the Brazilian Energy Balance 2021 (https://www.epe.gov.br). The background data for the module A1 e.g. raw materials (amount used by type) as well energy consumption, waste production and transport distances of raw materials and aggregates from cement plants, quarries have been obtained from the company's ERP system (SAP) and correspond the exact and accurate mix designs for each ready-mix plant.

The GCCA Environmental Product Declaration tool (v3.1). GCCA's Industry EPD Tool for Cement and Concrete is a web based calculation tool for EPDs of clinker, cement, concrete, mortars and precast elements, available in both International and North American versions. The present report refers to the International version only.

The latter complies with PCR 2019:14 Construction products (EN 15804:A2) and complementary PCRs c-PCR-001 Cement and building limes (EN 16908) and c-PCR-003 Concrete and concrete elements (EN 16757), as well as with the General Programme Instructions (GPI 3.01) of the International EPD® System.

The GCCA EPD tool (v3.1) is developed by Quantis https://quantis-intl.com/ and verified by Studio Fieschi http://www.studiofieschi.it/en. The International EPD® System, which provides the framework to develop and publish EPDs based on ISO 14025 and EN 15804, gives the final approval of the tool's compliance with the rules. The underpinning database for the GCCA EPD tool is the version of the Ecoinvent database (v.3.5) and cement manufacturing data obtained through the GNR process (https://gccassociation.org/sustainability-innovation/gnrgcca-in-numbers/).

There is no missing data for this concrete mix, since all the required raw data were provided from the ERP system (SAP) that company uses.

Geographical scope: São Paulo Metropolitan Region (Brazil)

Assumptions: This EPD was developed by using GCCA international modelling of energy use and environmental impact to obtain a suitable estimation for products manufactured.

Pre-defined data from GCCA tool for cement and clinker was not used. For this EDP was used data from Votorantim Cimentos' cement plant called Santa Helena.

All modelling assumptions adopted from the GCCA EPD tool.

Raw material (inbound) transport distances are generated from Votorantim Cimentos SAP system and are accurate across operations.

The calculation of the bill of materials for every plant is based on Votorantim Cimentos SAP.

As for the concrete recipes for the products listed in this document, they were all taken from the BetonTec software. A simple average was made using data of 2021 to find the average of each product.

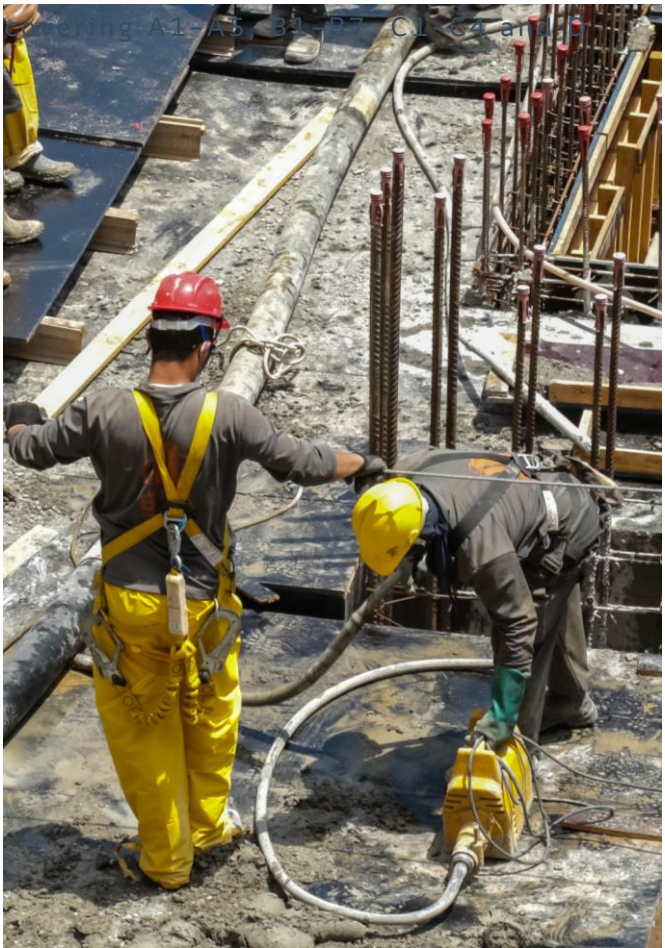
The tables in chapter "Environmental Impact Data" contain the environmental indicators from ABC plant, Santo Amaro plant and Zona Norte plant. These plants are located in Greater São Paulo, in the municipalities of São Paulo and Santo Andre. The distance between these plants is a maximum of 22 km away. The numbers in the tables were generated from the weighted average of the environmental indicators, taking into account the ready mixed concrete production in each of the factories

Variation Product calculation was based on the "worst" concrete recipe, containing the highest amount of cement and additive from the most distant plant, and the "best" concrete recipe with the lowest amount of cement and additive from the closest plant input distributors compared to the sites weighted average GWP-GHG declared in this document.

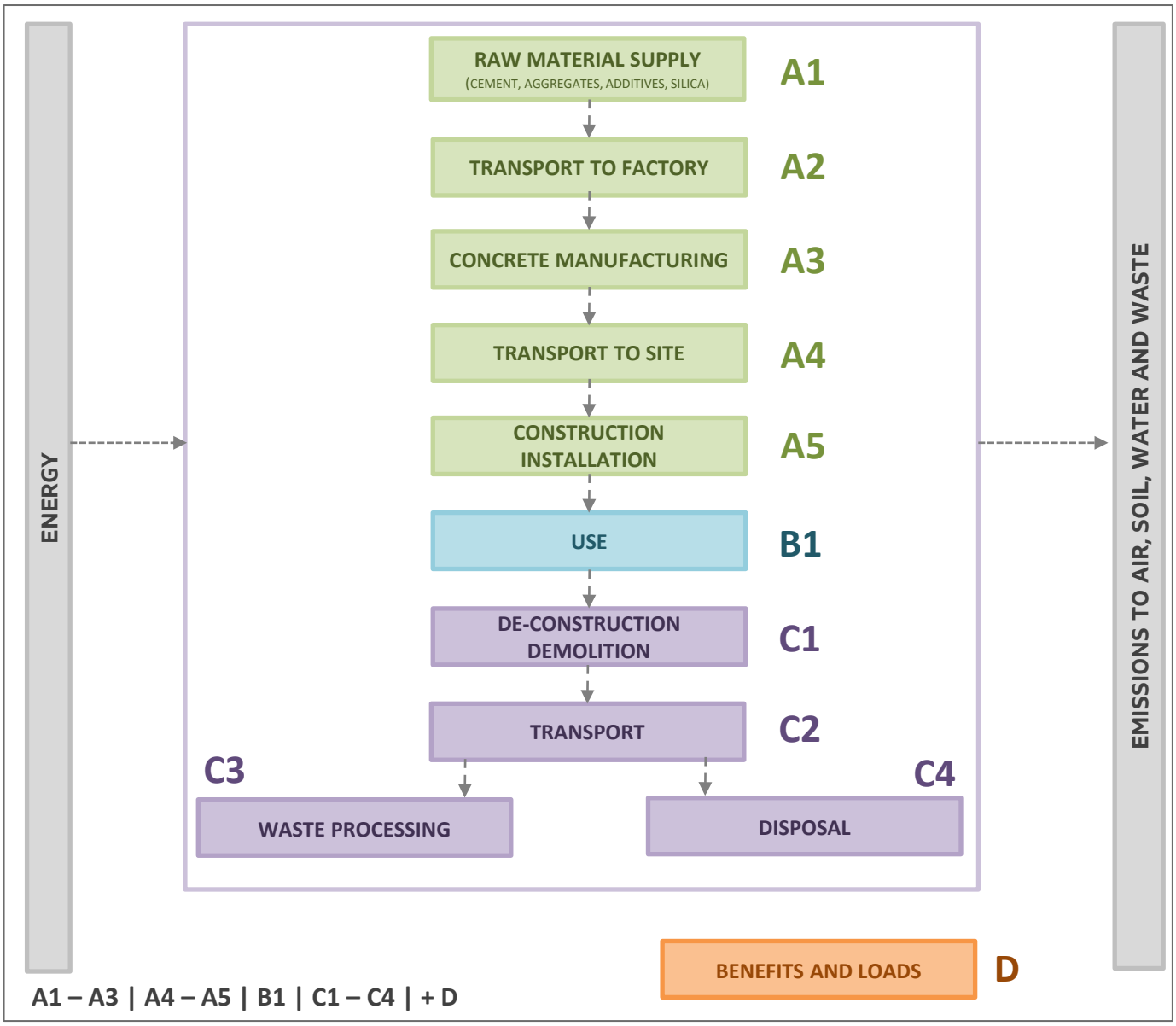
Variation Sites calculation was based on the GWP-GHG of each plant compared to the sites weighted average GWP-GHG declared in this document.

Comparability: EPD performance for construction products that they do not comply with EN 15804 may not be comparable. EPDs from separate programs but within the same product category may not be comparable as well.

Description of system boundaries: The scope of this study is "Cradle to grave" covering A1-A3, B1-B7, C1-C4 and D.



System diagram



The scope of this study is Cradle to grave, A1-A5, B1-B7, C1-C4 and D.

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA	BRA
Variation – products		> ±10%															
Variation – sites		< ±10%															

*X = Module Declared

The scope of this study is Cradle to grave, A1-A5, B1-B7, C1-C4 and D.
The final product does not contain dangerous substances of high concern from the candidate list of SVHC for Authorization.

- **A1-A3 Product stage**

  A1 Raw materials supply: Includes the production of raw materials and fuels, recycling processes of secondary materials and energy required in the production process.

  A2 Transport: Transportation up to factory gate and internal transport

  A3 Manufacturing: Cement and packaging manufacturing and waste treatment and transport

•**A4-A5 Construction process**

A4 Transport

PARAMETER	VALUE / DESCRIPTION
Fuel type and consumption of vehicle used for transport[1]	Truck of 32 tn. Fuel consumption according to GCCA model
Distance (Delivery/ready-mix truck)	Ready-mix truck, 20 Km (declared average)
Capacity Utilization (including empty returns)[1]	100%
Bulk density of transported concrete[1]	Expressed in LCA information section
Volume capacity utilization factor[1]	99%

[1] Default parameters from GCCA tool

A5 Construction/Installation: The product is directly transferred from the truck to the construction site

PARAMETER	VALUE / DESCRIPTION
Auxiliary materials for installation[1]	No auxiliary material used
Water[1]	669 kg/m³ of ready-mix concrete
Wastewater[1]	0.669 m³/ m³ of ready-mix concrete
Other resources[1]	No other resource consumption
Quantitative description of the energy (regional mix) and the consumption during the installation[1]	Electricity: 2.776 Kwh/m³ of ready-mix concrete
Quantitative description of diesel and the consumption during the installation[1]	Diesel: 1.669 lt/m³ of ready-mix concrete
Wastage of materials at job site before waste processing, generated by the product's installation[1]	Product losses 3%

[1] Default parameters from GCCA tool

•**B Use stage:** the product's fix CO2, by carbonatation during the use phase (B1), and do not require maintenance (B2), repair (B3), replacement (B4), refurbishment (B5), operational energy use (B6) or operational water use (B7) during its Reference Service Life. CO2 by carbonatation of cement during the use phase has been included as required in c-PCR, following the methodology explained in EN 16757.

•**C End of life stage**

C1 Deconstruction/demolition: the use of diesel during the demolition process has been included.

C2 Transport to waste processing: the model use for the transportation (see A4, transportation to the building site) is applied.

C3 Waste processing for reuse, recovery and/or recycling: the product is 5% recycled.

C4 Disposal: the product is 95% landfilled.

PARAMETERS FOR C End of life	
PARAMETER	**VALUE / DESCRIPTION**
Collection process specified by type[1]	The product is collected mixed with construction waste
Recovery system specified by type	5% recycled
Disposal specified by type	95% landfilled
Assumptions for scenario development (e.g. transportation)[1]	16-32 tn truck, Fuel consumption according to GCCA model
Diesel in building/demolition equipment[1]	2.674 lt / m3
Transport distances (truck)[1]	31.5 km

[1] Default parameters from GCCA tool

•D Reuse-Recovery-Recycling potential the product is recycled in 5% . As a consequence, the module D has been calculated where the results of recycled content that the product already includes has been taken into account. The avoided product is considered crushed aggregate.

PRODUCT DATA SOURCES		**In Accordance with Environdec c-PCR-003 Concrete, concrete elements (EN | 16757), ISO 14025 and EN15804:A2**		
LCA Stage	Input/output	Data Source	Temporal Scope	Quality
Product Description	Product description and specific density	Software BetonTec	January 2021 to December 2021	High
A1	Raw Materials	Votorantim Cimentos SAP	January 2021 to December 2021	High
A2	Cement and Aggregate Transport	Actual transport distances - Votorantim Cimentos SAP invoices	January 2021 to December 2021	High
A3	Concrete Batching	Votorantim Cimentos SAP	January 2021 to December 2021	High
		Votorantim Cimentos SAP	January 2021 to December 2021	High
		Votorantim Cimentos SAP	January 2021 to December 2021	High
		As published in Empresa de Pesquisa Energética (EPE)	January 2021 to December 2021	High
	Waste	Invoices for waste transportation	January 2021 to December 2021	High
A4-A5 Construction	Outbound travel distance	Average distances to construction sites	January 2021 to December 2021	High
B Use	Re-carbonation*	Default GCCA Quantis tool settings	N/A	Proxy-Medium
C1. End of Life Demolition	Demolition	Default GCCA Quantis tool settings	N/A	Proxy-Medium
C2. End of Life Transport	Transport	Default GCCA Quantis tool settings	N/A	Proxy-Medium
C3. End of Life Waste Processing	Recycling Rate at End of life	Default GCCA Quantis tool settings	N/A	Proxy-Medium
C4. End of Life Disposal	Disposal Rate at End of life	Default GCCA Quantis tool settings	N/A	Proxy-Medium
D. Benefits and Loads		Default GCCA Quantis tool settings	N/A	N/A
GENERAL	General	Ecoinvent database	As updated	Secondary, High

* Regarding recarbonation benefits the scenaria are 10m2 free surface per m3 of concrete and 50 years of Reference Life Cycle.

The numbers in the tables were generated from the weighted average of the environmental indicators, taking into account the ready mixed concrete production in each of the factories as mentioned in the Assumption Chapter.

Core Enviromental Impact Indicators

Indicators	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-tot	kg CO_2 eq.	3.05E+2	4.33E+0	1.61E+1	-1.86E+0	0	0	0	0	0	0	8.99E+0	9.13E+0	2.78E-1	-8.30E+0	-9.12E-1
GWP-fos	kg CO_2 eq.	3.05E+2	4.33E+0	1.61E+1	-1.86E+0	0	0	0	0	0	0	8.99E+0	9.12E+0	2.76E-1	-8.32E+0	-9.06E-1
GWP-bio	kg CO_2 eq.	1.36E-1	1.69E-3	9.88E-3	0.00E+0	0	0	0	0	0	0	1.60E-3	6.52E-3	1.25E-3	8.21E-3	-3.66E-3
GWP-luc	kg CO_2 eq.	1.56E-1	1.46E-3	1.16E-2	0.00E+0	0	0	0	0	0	0	1.13E-3	5.30E-3	9.52E-4	6.67E-3	-1.59E-3
ODP	kg CFC 11 eq.	1.55E-5	8.25E-7	1.85E-6	0.00E+0	0	0	0	0	0	0	1.62E-6	1.53E-6	2.41E-8	4.05E-6	-6.21E-8
AP	mol H+ eq.	1.41E+0	2.24E-2	1.15E-1	0.00E+0	0	0	0	0	0	0	9.42E-2	5.51E-2	2.55E-3	1.19E-1	-6.44E-3
EP-fw	kg PO_4 eq.	5.54E-2	9.88E-4	4.24E-3	0.00E+0	0	0	0	0	0	0	1.23E-3	3.74E-3	6.08E-4	4.47E-3	-1.17E-3
EP-fw	kg P eq.	1.81E-2	3.22E-4	1.38E-3	0.00E+0	0	0	0	0	0	0	4.02E-4	1.22E-3	1.98E-4	1.46E-3	-3.81E-4
EP-mar	kg N eq.	1.41E-3	2.80E-5	6.52E-4	0.00E+0	0	0	0	0	0	0	3.34E-5	9.01E-5	1.37E-5	1.38E-4	-2.47E-5
EP-ter	mol N eq.	4.77E+0	8.01E-2	4.56E-1	0.00E+0	0	0	0	0	0	0	4.44E-1	1.94E-1	4.76E-3	4.27E-1	-1.61E-2
POCP	kg NMVOC eq.	1.18E+0	2.41E-2	1.22E-1	0.00E+0	0	0	0	0	0	0	1.22E-1	5.67E-2	1.34E-3	1.25E-1	-4.07E-3
ADPE*	kg Sb eq.	3.36E-4	8.07E-6	1.63E-5	0.00E+0	0	0	0	0	0	0	2.66E-6	1.61E-5	2.97E-7	1.35E-5	-1.04E-5
ADPF*	MJ, net calorific value	1.34E+3	6.67E+1	1.51E+2	0.00E+0	0	0	0	0	0	0	1.29E+2	1.31E+2	4.16E+0	3.41E+2	-9.28E+0
WDP*	m^3 world eq. deprived	1.00E+2	5.02E-1	1.63E+0	0.00E+0	0	0	0	0	0	0	7.67E-1	1.18E+0	6.94E-2	1.67E+1	-1.77E+0

GWP-tot (Global Warming Potential total) • GWP-fos (Global Warming Potential fossil fuels) • GWP-bio (Global Warming Potential biogenic) • GWP-luc (Global Warming Potential land use and land use change) • ODP (Depletion potential of the stratospheric ozone layer) • AP (Acidification potential, Accumulated Exceedance) • EP-fw (Eutrophication potential, fraction of nutrients reaching freshwater end compartment) • EP-fw* (Eutrophication potential, fraction of nutrients reaching freshwater end compartment*) • EP-mar (Eutrophication potential, fraction of nutrients reaching marine end compartment) • EP-ter (Eutrophication potential, Accumulated Exceedance) • POCP (Formation potential of tropospheric ozone) • ADPE (Abiotic depletion potential for non- fossil resources) • ADPF (Abiotic depletion for fossil resources potential) • WDP (Water (user) deprivation potential, deprivationweighted water consumption)

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

Potential environmental impact – additional mandatory

Indicators	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG	kg CO_2 eq.	3.05E+2	4.33E+0	1.61E+1	-1.86E+0	0	0	0	0	0	0	8.99E+0	9.13E+0	2.78E-1	-8.30E+0	-9.12E-1

The GWP-GHG indicator is not calculated by GCCA EPD Tool. The GWP-GHG indicator can be assimilated to the GWP-tot indicator

Parameters describing resource use

Indicators	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ, net calorific value	2.9E+2	1.97E+0	2.23E+1	0E+0	0	0	0	0	0	0	7.59E-1	4.97E+0	5.41E-1	8.99E+0	-8.55E-1
PERM	MJ, net calorific value	0E+0	0E+0	0E+0	0E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ, net calorific value	2.9E+2	1.97E+0	2.23E+1	0E+0	0	0	0	0	0	0	7.59E-1	4.97E+0	5.41E-1	8.99E+0	-8.55E-1
PENRE	MJ, net calorific value	1.49E+3	7.09E+1	1.65E+2	0E+0	0	0	0	0	0	0	1.38E+2	1.42E+2	5.27E+0	3.68E+2	-1.11E+1
PENRM	MJ, net calorific value	0E+0	0E+0	0E+0	0E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	MJ, net calorific value	1.49E+3	7.09E+1	1.65E+2	0E+0	0	0	0	0	0	0	1.38E+2	1.42E+2	5.27E+0	3.68E+2	-1.11E+1
SM	kg	4.84E+1	0E+0	0E+0	0E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ, net calorific value	0E+0	0E+0	0E+0	0E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ, net calorific value	0E+0	0E+0	0E+0	0E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NFW	m^3	2.51E+0	1.50E-2	1.89E-1	0E+0	0	0	0	0	0	0	1.99E-2	3.64E-2	2.81E-3	3.89E-1	-4.23E-2

PERE (Use of renewable primary energy excluding renewable primary energy resources used as raw materials) • PERM (Use of renewable primary energy resources used as raw materials) • PERT (Total use of renewable primary energy resources) • PENRE (Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials) • PENRM (Use of non-renewable primary energy resources used as raw materials) • PENRT (Total use of non-renewable primary energy resources) • SM (Use of secondary materials) • RSF (Use of renewable secondary fuels) • NRSF (Use of non-renewable secondary fuels) • NFW (Net use of fresh water)

Other environmental information describing waste categories

Indicators	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg	1.30E-2	0E+0	0E+0	0E+0	0	0	0	0	0	0	0E+0	0E+0	0E+0	0E+0	0E+0
NHWD	kg	4.97E+1	0.00E+0	0.00E+0	0.00E+0	0	0	0	0	0	0	0,00E+0	0,00E+0	0,00E+0	2,26E+3	0,00E+0
RWD	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

HWD (Hazardous waste disposed) • NHWD (Non-hazardous waste disposed) • RWD (Radioactive waste disposed)

Environmental information describing output flows

Indicators	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
CRU	kg	0E+0	0E+0	0E+0	0E+0	0	0	0	0	0	0	0E+0	0E+0	0E+0	0E+0	0E+0
MFR	kg	1.06E+2	0.00E+0	0.00E+0	0.00E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	1.19E+2	0.00E+0	0.00E+0
MER	kg	1.82E-2	0E+0	0E+0	0E+0	0	0	0	0	0	0	0E+0	0E+0	0E+0	0E+0	0E+0
EE	MJ per energy carrier	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0	0	0	0	0	0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

CRU (Components for re-use) • MFR (Materials for recycling) • MER (Materials for energy recovery) • EE (Exported energy)

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