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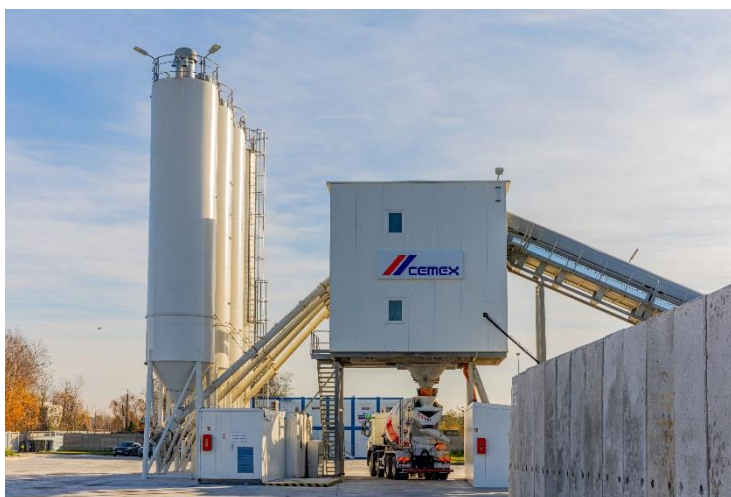
Vertua® concrete groups (based on CEM II) produced by Cemex Polska

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Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A3 in accordance with EN 15804 (Cradle to Gate) +C1-C4+D

The year of preparing the EPD: 2022 (validated 2024)

Product standard: PN-EN 206

Service Life: no reference service life of concretes is declared as they are intermediate products used in construction

PCR: ITB-PCR A (PCR based on EN 15804) and EN 16908

Declared unit: 1 ton (Mg) of concrete – generic (EPD additionally provides results on 1 m³)

Reasons for performing LCA: B2B

Representativeness: Polish product, year 2022

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BASIC INFORMATION

Declaration covers 12 groups of concretes (generic) produced by 45 Cemex plants in Poland. Cements used for these concretes are produced in Poland in 3 factories located at Chełm, Rudniki and Gdynia. The life-cycle assessment was carried out according to the following standards: PN-EN 15804, PN-EN ISO 14025, PN-EN ISO 14040 and the product categorization rules provided in document ITB PCR-A. Declared reference unit is 1 ton of concrete. All LCI data was collected by CEMEX from own plants between January and December 2022 (12 months) and gathered data is representative for production technology used in 2020. LCA assessment was carried out using internal ITB algorithms dedicated to calculate the LCA and data collected by the industry. CEM production (used in concretes) is characterized by high use of alternative fuels (80-90%) and consumed electricity based on renewable energy at the level of 100%. Also 30% (average) of renewable energy was used in the production of concrete in the factories.

PRODUCTS DESCRIPTION

Concrete is specified and supplied in accordance with EN 206. Delivered to site on a just-in-time basis, mixed concrete may be cast into any conceivable shape with almost no limit on volume. When hardened, concrete can carry substantial compressive loads by itself, but is more frequently reinforced to substantially increase its tensile and flexural strength. Concrete is used for site-mixed structures, precast structures and structural precast products in buildings prefabricated structures and structural prefabricated products in buildings and buildings.

Cemex products specified in accordance with the documents: PN-EN 206, PN-S-9612, PN-EN 14227-1, PN-EN 14227-3, PN-EN 14227-5, PN-EN 998-2 and National Technical Assessments of Cemex products cited on the website www.cemex.com

The product assessed is a generic 1 ton of CEM II-based concrete, where the constituent proportions for 12 groups are provided in Table 1.

Table 1. Concrete mix recipes for each group

Group of concrete	cement	ash	sand	coarse aggregate	potential recycled based aggregates*	admixtures	water
Group I	0-2%	0-20%	20-90%	0-50%	0-100%	0-1%	2-18%
Group II	2-4%	0-20%	20-90%	0-50%	0-100%	0-1%	2-18%
Group III	4-6%	0-20%	20-90%	0-50%	0-100%	0-1%	2-18%
Group IV	6-8%	0-15%	30-60%	20-50%	0-50%	0-1%	2-15%
Group V	8-10%	0-15%	30-60%	20-50%	0-50%	0-1%	2-15%
Group VI	10-12%	0-10%	25-50%	30-60	0-50%	0-1%	2-15%
Group VII	12-14%	0-10%	25-50%	30-60	0-50%	0-1%	2-15%
Group VIII	14-16%	0-7,5%	25-50%	30-60	0-50%	0-1%	2-12%
Group IX	16-18%	0-7,5%	20-40%	40-60%	0-50%	0-1%	2-12%
Group X	18-20%	0-5%	20-40%	40-60%	0-30%	0-1%	2-12%
Group XI	20-22%	0-5%	20-40%	40-60%	0-30%	0-1%	2-12%
Group XII	22-24%	0-5%	20-40%	40-60%	0-30%	0-1%	2-12%

Table 1 values represent a generic (averaged) factory produced CEM II based concrete produced in Poland by CEMEX. The composition of products complying with the EPD will vary depending on client's specification and application. More detailed information is available in the respective manufacturer's documentation (e.g. product data sheets).

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton of representative concretes *Vertua®* (based on CEM-II A and B and C) for a group I to XII (according to Table 1). Additionally, the results are also presented for 1 m³ of the product.

System boundary

The EPD covers the product stage analysis (“cradle to gate”) based on 45 concrete production plants data analyzed. The selected system boundaries comprise the production of input raw materials’ extraction up to the finished product at the factory gate (ready concrete). The product stage contains: Module A1: extraction and processing of raw materials (ash, sand, gravel, additives, water, and cement and fuels), Module A2: transportation up to factory gate of raw materials and fuels, Module A3: concrete production (mixing). Inputs and processes of product system are presented in Figure 1.

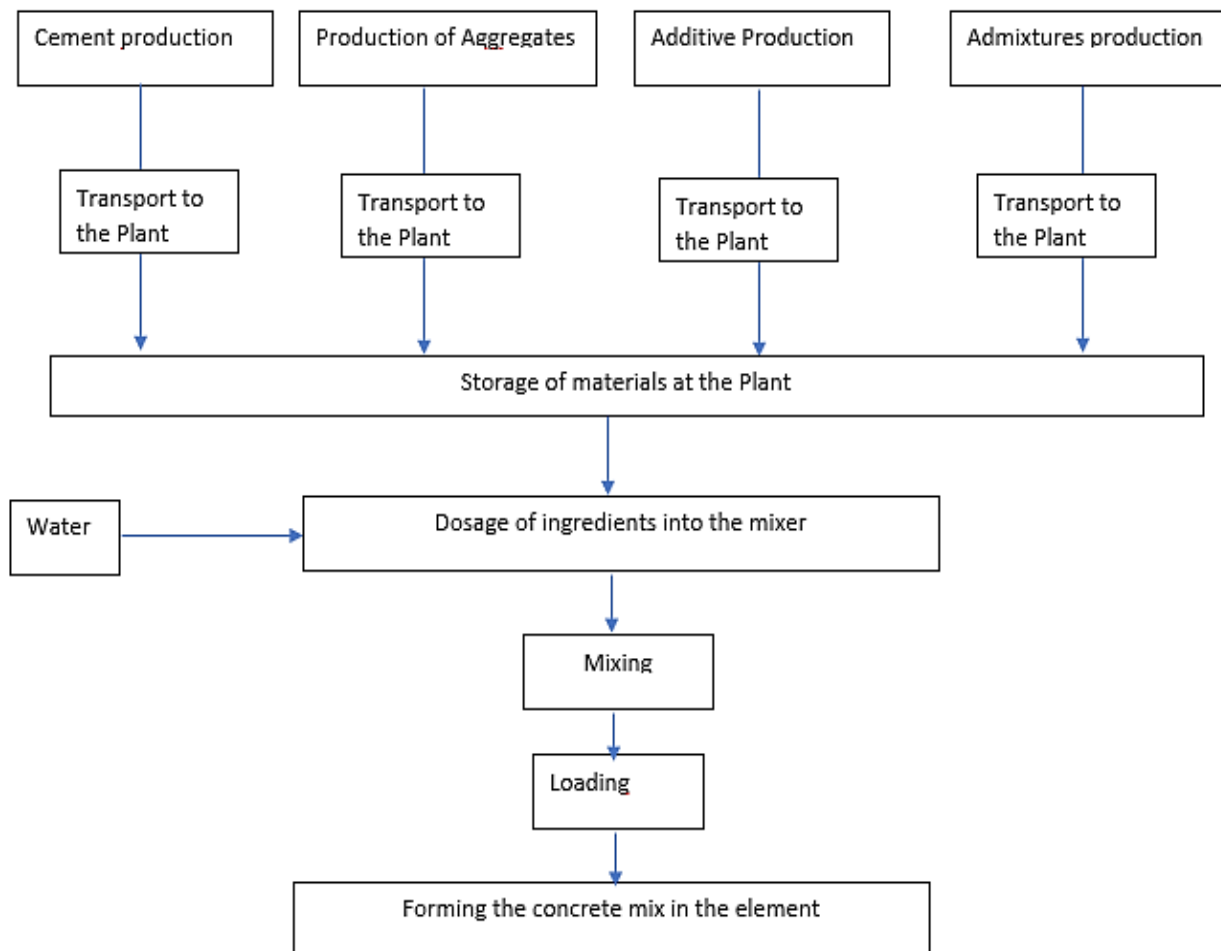


Figure 1. Concrete mix production - inputs and processes of the product system.

Allocation rules

The allocation rules used for this EPD are based on general requirements provided in ITB PCR A and EN 15804. As no co-products are produced, the flow of materials and energy and the associated release of substances and energy into the environment are related exclusively to the concrete mix produced. Cements (produced by 3 cement plants of CEMEX in Poland) were used identified as the weighted average mass of

production for each plant. In the case of fly ash, eco-product from electricity production used as a cement constituent, economic allocation was applied. Minimum 99.5% of impacts from the production lines were allocated to product covered by this declaration. Emissions allocated in clinker/cement production (module A1) are assessed using international methods for ETS system declaration. The specific prices for fly ash declared by the producer were used for the economic allocation. Calculations for GWP indicator are made taking into account gross and net emissions. The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels), net-value excluding impacts from alternative waste-based fuels.

System limits

In this assessment, all information gathered from data collection for the production of concrete has been modelled, i.e. all raw materials used, the electrical energy and other fuels used, use of ancillary materials and all direct production waste. Transport data on input was considered. No cut-offs have been made in accordance with EN 15804. The machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees. Calculations for GWP indicator are made taking into account gross and net emissions.

A1 – A2 Modules: Raw materials supply and transport

Concrete according to EN 206 is made by mixing coarse and fine aggregates, cement and water in controlled proportions. Chemical admixtures are used to reduce water content and improve fresh and hardened concrete properties. The averaged compositions of each class mix is provided in Table 1. Cement production used (A1) in concrete are characterized by high use of alternative fuels (80-90%) and consumed renewable electric energy at the level of 100%. Transport of input materials to production plants was inventoried. Most of the other additives, such as ash and aggregates, come from local suppliers.

A3 Module Production

Substrates for concrete production are transported to the plant and then stored in silos. Electricity is used for production (mixing). Substrates are weighed and mixed according to of the process shown in Figure 1. The production uses cements produced by the national CEMEX cement plants. The average level of renewable energy in the production of concrete is at the level of 30%. Environmental impacts related to ash have been taken into account on the basis of the economical allocation.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2022 – 31.12.2022 (1 year). The life cycle assessments were done for Poland as reference area.

Data quality - production

The values determined to calculate A1 (cement) and A3 originate from verified CEMEX LCI inventory data. A1 values (raw materials) were prepared considering specific EPDs, Ecoinvent data and economic allocation data processed for the ashes.

Assumptions and estimates

The impacts of the representative products were aggregated for Poland using weighted average. Data regarding production per 1 ton and 1 m³ of product were averaged for the analyzed production of each product class. Due to the difficulty of separating the cement production processes from concrete in six cases, the data were aggregated as A1-A3. For the calculations, the arithmetical averages of the ranges of possible substances included in the mix were adopted, in accordance with the manufacturer's declaration.

Calculation rules

LCA was done in accordance with ITB PCR A document. Characterization factors are CML ver. 4.2 based. ITB-LCA algorithms were used for impact calculations. Module A1 was calculated based on data from the database and specific EPDs (CEM II). A3 and A2 are calculated based on the LCI questionnaire provided by the manufacturer.

Databases

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The background data for the processes come from the following databases: Ecoinvent v.3.7 (sand, water, wind electricity production for Poland, transport), specific EPD and specific emission reporting data for cement production by Cemex in each of 3 plants, specific EPDs for a raw material (sand, aggregate, admixtures), allocated impacts for ash production calculated by ITB based on price and electricity production impacts, KOBiZE 2020 (combustion factors for selected fuels, polish electricity mix). The energy supplier PGE guarantees the certificate of origin of 100% renewable energy used by Cemex plants (Gdynia, Rudniki and Chełm). Specific (LCI) data quality analysis was a part of audit. The time related quality of the data used is valid (5 years).

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account. In practice, this means that concrete may be compared in a specific application with the selected usage scenario.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit DU – 1 ton of concrete CEM II (A and B and C) of group I to XII produced by CEMEX in Poland. The LCA results are presented for 1 ton and 1 m³.

Table 2. System boundaries (life stage modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
MA	MA	MA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MA	MA	MA	MA	MA

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Table 3. Environmental product characteristic – 1 ton of concrete group I Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,82E+01	1,76E+01	1,72E+01
Global warming potential (gross value) ²	kg eq CO ₂	2,35E+01	2,27E+01	2,22E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	2,35E-06	2,31E-06	2,27E-06
Acidification potential of soil and water	kg SO ₂	1,82E-01	1,82E-01	1,82E-01
Formation potential of tropospheric ozone	kg Ethene	2,21E-02	2,19E-02	2,16E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,14E-01	1,14E-01	1,14E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1,83E-01	1,80E-01	1,79E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,48E+02	3,50E+02	3,48E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,38E+02	1,40E+02	1,39E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,99E+02	4,00E+02	3,99E+02
Use of secondary material	kg	7,26E-01	7,31E-01	6,18E-01
Use of renewable secondary fuels	MJ	2,27E+01	1,74E+01	1,45E+01
Use of non-renewable secondary fuels	MJ	1,00E+01	6,80E+00	4,68E+00
Net use of fresh water	m ³	1,89E+00	1,88E+00	1,87E+00
Hazardous waste disposed	kg	6,54E-03	6,55E-03	6,55E-03
Non-hazardous waste disposed	kg	9,51E+00	9,53E+00	9,51E+00
Radioactive waste disposed	kg	1,18E-03	1,18E-03	1,18E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	9,11E-02	8,96E-02	7,63E-02
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 4. Environmental product characteristic – 1 ton of concrete group II Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	2,69E+01	2,51E+01	2,39E+01
Global warming potential (gross value) ²	kg eq CO ₂	3,47E+01	3,24E+01	3,08E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	2,92E-06	2,81E-06	2,70E-06
Acidification potential of soil and water	kg SO ₂	1,90E-01	1,91E-01	1,88E-01
Formation potential of tropospheric ozone	kg Ethene	2,70E-02	2,63E-02	2,55E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,15E-01	1,15E-01	1,15E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,09E-01	2,02E-01	1,99E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,56E+02	3,60E+02	3,56E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,55E+02	1,62E+02	1,60E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,07E+02	4,11E+02	4,07E+02
Use of secondary material	kg	2,18E+00	2,19E+00	1,85E+00
Use of renewable secondary fuels	MJ	6,44E+01	4,87E+01	3,99E+01
Use of non-renewable secondary fuels	MJ	3,00E+01	2,04E+01	1,40E+01
Net use of fresh water	m ³	2,03E+00	2,00E+00	1,98E+00
Hazardous waste disposed	kg	6,68E-03	6,72E-03	6,72E-03
Non-hazardous waste disposed	kg	9,76E+00	9,81E+00	9,76E+00
Radioactive waste disposed	kg	1,18E-03	1,18E-03	1,18E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,73E-01	2,69E-01	2,29E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 5. Environmental product characteristic – 1 ton of concrete group III Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	3,56E+01	3,25E+01	3,05E+01
Global warming potential (gross value) ²	kg eq CO ₂	4,59E+01	4,19E+01	3,93E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	3,50E-06	3,31E-06	3,13E-06
Acidification potential of soil and water	kg SO ₂	1,97E-01	1,99E-01	1,95E-01
Formation potential of tropospheric ozone	kg Ethene	3,19E-02	3,07E-02	2,94E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,17E-01	1,17E-01	1,16E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,35E-01	2,24E-01	2,19E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,63E+02	3,70E+02	3,64E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,71E+02	1,83E+02	1,80E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,14E+02	4,22E+02	4,15E+02
Use of secondary material	kg	3,63E+00	3,66E+00	3,09E+00
Use of renewable secondary fuels	MJ	1,06E+02	8,00E+01	6,53E+01
Use of non-renewable secondary fuels	MJ	5,00E+01	3,40E+01	2,34E+01
Net use of fresh water	m ³	2,17E+00	2,11E+00	2,08E+00
Hazardous waste disposed	kg	6,82E-03	6,88E-03	6,88E-03
Non-hazardous waste disposed	kg	1,00E+01	1,01E+01	1,00E+01
Radioactive waste disposed	kg	1,18E-03	1,19E-03	1,18E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	4,55E-01	4,48E-01	3,81E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 6. Environmental product characteristic – 1 ton of concrete group IV Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	4,38E+01	3,95E+01	3,67E+01
Global warming potential (gross value) ²	kg eq CO ₂	5,65E+01	5,10E+01	4,73E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	4,07E-06	3,80E-06	3,55E-06
Acidification potential of soil and water	kg SO ₂	2,03E-01	2,06E-01	2,01E-01
Formation potential of tropospheric ozone	kg Ethene	3,53E-02	3,36E-02	3,18E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,19E-01	1,18E-01	1,18E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,57E-01	2,42E-01	2,35E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,67E+02	3,77E+02	3,68E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,88E+02	2,04E+02	2,00E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,17E+02	4,28E+02	4,18E+02
Use of secondary material	kg	5,08E+00	5,12E+00	4,33E+00
Use of renewable secondary fuels	MJ	1,48E+02	1,11E+02	9,07E+01
Use of non-renewable secondary fuels	MJ	7,00E+01	4,76E+01	3,28E+01
Net use of fresh water	m ³	2,30E+00	2,21E+00	2,17E+00
Hazardous waste disposed	kg	6,67E-03	6,76E-03	6,75E-03
Non-hazardous waste disposed	kg	1,02E+01	1,03E+01	1,02E+01
Radioactive waste disposed	kg	1,18E-03	1,19E-03	1,19E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	6,37E-01	6,27E-01	5,34E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 7. Environmental product characteristic – 1 ton of concrete group V Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	5,25E+01	4,69E+01	4,34E+01
Global warming potential (gross value) ²	kg eq CO ₂	6,77E+01	6,05E+01	5,60E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	4,64E-06	4,30E-06	3,97E-06
Acidification potential of soil and water	kg SO ₂	2,11E-01	2,14E-01	2,07E-01
Formation potential of tropospheric ozone	kg Ethene	4,02E-02	3,81E-02	3,56E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,20E-01	1,20E-01	1,19E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,83E-01	2,64E-01	2,55E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,74E+02	3,87E+02	3,75E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,05E+02	2,26E+02	2,20E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,25E+02	4,39E+02	4,26E+02
Use of secondary material	kg	6,53E+00	6,58E+00	5,56E+00
Use of renewable secondary fuels	MJ	1,90E+02	1,43E+02	1,16E+02
Use of non-renewable secondary fuels	MJ	9,01E+01	6,12E+01	4,21E+01
Net use of fresh water	m ³	2,45E+00	2,34E+00	2,29E+00
Hazardous waste disposed	kg	6,82E-03	6,93E-03	6,92E-03
Non-hazardous waste disposed	kg	1,05E+01	1,06E+01	1,05E+01
Radioactive waste disposed	kg	1,18E-03	1,19E-03	1,19E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	8,20E-01	8,07E-01	6,86E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 8. Environmental product characteristic – 1 ton of concrete group VI Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	6,10E+01	5,41E+01	4,98E+01
Global warming potential (gross value) ²	kg eq CO ₂	7,87E+01	6,98E+01	6,42E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	5,27E-06	4,84E-06	4,45E-06
Acidification potential of soil and water	kg SO ₂	2,21E-01	2,25E-01	2,17E-01
Formation potential of tropospheric ozone	kg Ethene	4,38E-02	4,12E-02	3,82E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,24E-01	1,24E-01	1,23E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,09E-01	2,86E-01	2,74E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,85E+02	4,01E+02	3,86E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,25E+02	2,51E+02	2,43E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,37E+02	4,53E+02	4,38E+02
Use of secondary material	kg	7,98E+00	8,05E+00	6,80E+00
Use of renewable secondary fuels	MJ	2,31E+02	1,74E+02	1,41E+02
Use of non-renewable secondary fuels	MJ	1,10E+02	7,48E+01	5,15E+01
Net use of fresh water	m ³	2,62E+00	2,48E+00	2,43E+00
Hazardous waste disposed	kg	6,68E-03	6,82E-03	6,81E-03
Non-hazardous waste disposed	kg	1,08E+01	1,10E+01	1,08E+01
Radioactive waste disposed	kg	1,21E-03	1,23E-03	1,22E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,00E+00	9,86E-01	8,39E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 9. Environmental product characteristic – 1 ton of concrete group VII Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	6,97E+01	6,16E+01	5,64E+01
Global warming potential (gross value) ²	kg eq CO ₂	8,99E+01	7,95E+01	7,28E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	5,84E-06	5,34E-06	4,87E-06
Acidification potential of soil and water	kg SO ₂	2,29E-01	2,33E-01	2,23E-01
Formation potential of tropospheric ozone	kg Ethene	4,87E-02	4,56E-02	4,21E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,26E-01	1,26E-01	1,24E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,35E-01	3,08E-01	2,94E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,93E+02	4,11E+02	3,94E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,42E+02	2,72E+02	2,63E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,44E+02	4,64E+02	4,46E+02
Use of secondary material	kg	9,43E+00	9,51E+00	8,04E+00
Use of renewable secondary fuels	MJ	2,73E+02	2,05E+02	1,67E+02
Use of non-renewable secondary fuels	MJ	1,30E+02	8,84E+01	6,09E+01
Net use of fresh water	m ³	2,76E+00	2,60E+00	2,53E+00
Hazardous waste disposed	kg	6,82E-03	6,98E-03	6,97E-03
Non-hazardous waste disposed	kg	1,11E+01	1,13E+01	1,11E+01
Radioactive waste disposed	kg	1,21E-03	1,23E-03	1,22E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,18E+00	1,17E+00	9,91E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 10. Environmental product characteristic – 1 ton of concrete group VIII Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	7,81E+01	6,88E+01	6,28E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,01E+02	8,88E+01	8,10E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	6,41E-06	5,84E-06	5,30E-06
Acidification potential of soil and water	kg SO ₂	2,36E-01	2,40E-01	2,30E-01
Formation potential of tropospheric ozone	kg Ethene	5,28E-02	4,92E-02	4,52E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,28E-01	1,27E-01	1,26E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,59E-01	3,28E-01	3,12E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,98E+02	4,20E+02	4,00E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,58E+02	2,94E+02	2,83E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,50E+02	4,72E+02	4,51E+02
Use of secondary material	kg	1,09E+01	1,10E+01	9,27E+00
Use of renewable secondary fuels	MJ	3,15E+02	2,36E+02	1,92E+02
Use of non-renewable secondary fuels	MJ	1,50E+02	1,02E+02	7,02E+01
Net use of fresh water	m ³	2,89E+00	2,70E+00	2,62E+00
Hazardous waste disposed	kg	6,82E-03	7,00E-03	6,99E-03
Non-hazardous waste disposed	kg	1,13E+01	1,16E+01	1,13E+01
Radioactive waste disposed	kg	1,21E-03	1,23E-03	1,22E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,37E+00	1,34E+00	1,14E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 11. Environmental product characteristic – 1 ton of concrete group IX Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	8,66E+01	7,60E+01	6,93E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,12E+02	9,80E+01	8,94E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	6,94E-06	6,29E-06	5,68E-06
Acidification potential of soil and water	kg SO ₂	2,39E-01	2,45E-01	2,33E-01
Formation potential of tropospheric ozone	kg Ethene	5,76E-02	5,35E-02	4,89E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,26E-01	1,26E-01	1,24E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,81E-01	3,46E-01	3,28E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,99E+02	4,23E+02	4,00E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,72E+02	3,12E+02	3,00E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,49E+02	4,75E+02	4,51E+02
Use of secondary material	kg	1,23E+01	1,24E+01	1,05E+01
Use of renewable secondary fuels	MJ	3,57E+02	2,68E+02	2,18E+02
Use of non-renewable secondary fuels	MJ	1,70E+02	1,16E+02	7,96E+01
Net use of fresh water	m ³	2,99E+00	2,77E+00	2,68E+00
Hazardous waste disposed	kg	6,95E-03	7,15E-03	7,14E-03
Non-hazardous waste disposed	kg	1,14E+01	1,17E+01	1,14E+01
Radioactive waste disposed	kg	1,18E-03	1,21E-03	1,19E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,55E+00	1,52E+00	1,30E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 12. Environmental product characteristic – 1 ton of concrete group X Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	9,50E+01	8,33E+01	7,57E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,23E+02	1,07E+02	9,77E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	7,51E-06	6,79E-06	6,10E-06
Acidification potential of soil and water	kg SO ₂	2,46E-01	2,52E-01	2,39E-01
Formation potential of tropospheric ozone	kg Ethene	6,17E-02	5,72E-02	5,21E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,28E-01	1,28E-01	1,26E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,06E-01	3,66E-01	3,46E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,04E+02	4,31E+02	4,06E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,89E+02	3,33E+02	3,21E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,55E+02	4,83E+02	4,56E+02
Use of secondary material	kg	1,38E+01	1,39E+01	1,17E+01
Use of renewable secondary fuels	MJ	3,98E+02	2,99E+02	2,43E+02
Use of non-renewable secondary fuels	MJ	1,90E+02	1,29E+02	8,90E+01
Net use of fresh water	m ³	3,13E+00	2,89E+00	2,79E+00
Hazardous waste disposed	kg	6,94E-03	7,17E-03	7,16E-03
Non-hazardous waste disposed	kg	1,16E+01	1,20E+01	1,16E+01
Radioactive waste disposed	kg	1,18E-03	1,21E-03	1,20E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,73E+00	1,70E+00	1,45E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 13. Environmental product characteristic – 1 ton of concrete group XI Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,04E+02	9,07E+01	8,24E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,34E+02	1,17E+02	1,06E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	8,09E-06	7,29E-06	6,53E-06
Acidification potential of soil and water	kg SO ₂	2,54E-01	2,60E-01	2,45E-01
Formation potential of tropospheric ozone	kg Ethene	6,66E-02	6,16E-02	5,60E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,30E-01	1,29E-01	1,27E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,32E-01	3,88E-01	3,66E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,12E+02	4,42E+02	4,14E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,06E+02	3,55E+02	3,41E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,63E+02	4,94E+02	4,65E+02
Use of secondary material	kg	1,52E+01	1,54E+01	1,30E+01
Use of renewable secondary fuels	MJ	4,40E+02	3,30E+02	2,68E+02
Use of non-renewable secondary fuels	MJ	2,10E+02	1,43E+02	9,83E+01
Net use of fresh water	m ³	3,27E+00	3,00E+00	2,89E+00
Hazardous waste disposed	kg	7,09E-03	7,34E-03	7,32E-03
Non-hazardous waste disposed	kg	1,19E+01	1,23E+01	1,19E+01
Radioactive waste disposed	kg	1,18E-03	1,21E-03	1,20E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,91E+00	1,88E+00	1,60E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 14. Environmental product characteristic – 1 ton of concrete group XII Vertua® based on CEM II

Environmental impacts: (DU) 1 ton				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,12E+02	9,80E+01	8,90E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,44E+02	1,26E+02	1,15E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	8,67E-06	7,79E-06	6,95E-06
Acidification potential of soil and water	kg SO ₂	2,61E-01	2,69E-01	2,52E-01
Formation potential of tropospheric ozone	kg Ethene	7,15E-02	6,60E-02	5,98E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,31E-01	1,31E-01	1,28E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,58E-01	4,10E-01	3,86E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,19E+02	4,52E+02	4,22E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,23E+02	3,76E+02	3,61E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,70E+02	5,05E+02	4,73E+02
Use of secondary material	kg	1,67E+01	1,68E+01	1,42E+01
Use of renewable secondary fuels	MJ	4,82E+02	3,61E+02	2,94E+02
Use of non-renewable secondary fuels	MJ	2,30E+02	1,56E+02	1,08E+02
Net use of fresh water	m ³	3,41E+00	3,12E+00	2,99E+00
Hazardous waste disposed	kg	7,23E-03	7,51E-03	7,49E-03
Non-hazardous waste disposed	kg	1,21E+01	1,25E+01	1,21E+01
Radioactive waste disposed	kg	1,18E-03	1,21E-03	1,20E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,09E+00	2,06E+00	1,75E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 15. Environmental product characteristic – 1 m³ of concrete group I Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	4,20E+01	4,06E+01	3,97E+01
Global warming potential (gross value) ²	kg eq CO ₂	5,42E+01	5,24E+01	5,12E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	2,35E-03	5,31E-06	5,22E-06
Acidification potential of soil and water	kg SO ₂	1,82E+02	4,20E-01	4,18E-01
Formation potential of tropospheric ozone	kg Ethene	2,21E+01	5,03E-02	4,97E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,14E+02	2,62E-01	2,62E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1,83E+02	4,15E-01	4,13E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,48E+05	8,04E+02	8,01E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,38E+05	3,22E+02	3,20E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	#ARG!	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	#ARG!	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,99E+05	9,20E+02	9,17E+02
Use of secondary material	kg	7,26E+02	1,68E+00	1,42E+00
Use of renewable secondary fuels	MJ	2,27E+04	4,01E+01	3,34E+01
Use of non-renewable secondary fuels	MJ	1,00E+04	1,56E+01	1,08E+01
Net use of fresh water	m ³	1,89E+03	4,32E+00	4,31E+00
Hazardous waste disposed	kg	6,54E+00	1,51E-02	1,51E-02
Non-hazardous waste disposed	kg	9,51E+03	2,19E+01	2,19E+01
Radioactive waste disposed	kg	1,18E+00	2,71E-03	2,71E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	9,11E+01	2,06E-01	1,75E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 16. Environmental product characteristic –1 m³ of concrete group II Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	6,20E+01	5,77E+01	5,50E+01
Global warming potential (gross value) ²	kg eq CO ₂	8,00E+01	7,44E+01	7,10E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	2,92E-03	6,46E-06	6,21E-06
Acidification potential of soil and water	kg SO ₂	1,90E+02	4,38E-01	4,33E-01
Formation potential of tropospheric ozone	kg Ethene	2,70E+01	6,05E-02	5,86E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,15E+02	2,65E-01	2,65E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,09E+02	4,65E-01	4,58E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,56E+05	8,28E+02	8,19E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,55E+05	3,72E+02	3,67E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,07E+05	9,45E+02	9,36E+02
Use of secondary material	kg	2,18E+03	5,05E+00	4,27E+00
Use of renewable secondary fuels	MJ	6,44E+04	1,12E+02	9,17E+01
Use of non-renewable secondary fuels	MJ	3,00E+04	4,69E+01	3,23E+01
Net use of fresh water	m ³	2,03E+03	4,59E+00	4,55E+00
Hazardous waste disposed	kg	6,68E+00	1,55E-02	1,54E-02
Non-hazardous waste disposed	kg	9,76E+03	2,26E+01	2,24E+01
Radioactive waste disposed	kg	1,18E+00	2,72E-03	2,72E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,73E+02	6,18E-01	5,26E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 17. Environmental product characteristic – 1 m³ of concrete group III Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	8,20E+01	7,49E+01	7,03E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,06E+02	9,66E+01	9,07E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	3,50E-03	7,61E-06	7,19E-06
Acidification potential of soil and water	kg SO ₂	1,97E+02	4,57E-01	4,49E-01
Formation potential of tropospheric ozone	kg Ethene	3,19E+01	7,07E-02	6,76E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,17E+02	2,69E-01	2,68E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,35E+02	5,16E-01	5,04E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,63E+05	8,52E+02	8,36E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,71E+05	4,21E+02	4,13E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,14E+05	9,70E+02	9,54E+02
Use of secondary material	kg	3,63E+03	8,41E+00	7,11E+00
Use of renewable secondary fuels	MJ	1,06E+05	1,84E+02	1,50E+02
Use of non-renewable secondary fuels	MJ	5,00E+04	7,82E+01	5,39E+01
Net use of fresh water	m ³	2,17E+03	4,86E+00	4,79E+00
Hazardous waste disposed	kg	6,82E+00	1,58E-02	1,58E-02
Non-hazardous waste disposed	kg	1,00E+04	2,32E+01	2,30E+01
Radioactive waste disposed	kg	1,18E+00	2,73E-03	2,72E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	4,55E+02	1,03E+00	8,77E-01
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 18. Environmental product characteristic – 1 m³ of concrete group IV Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,01E+02	9,10E+01	8,50E+01
Global warming potential (gross value) ²	kg eq CO ₂	1,30E+02	1,17E+02	1,10E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	4,07E-03	8,74E-06	8,16E-06
Acidification potential of soil and water	kg SO ₂	2,03E+02	4,73E-01	4,62E-01
Formation potential of tropospheric ozone	kg Ethene	3,53E+01	7,74E-02	7,31E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,19E+02	2,73E-01	2,71E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,57E+02	5,58E-01	5,40E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,67E+05	8,67E+02	8,45E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1,88E+05	4,70E+02	4,59E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,17E+05	9,84E+02	9,61E+02
Use of secondary material	kg	5,08E+03	1,18E+01	9,95E+00
Use of renewable secondary fuels	MJ	1,48E+05	2,56E+02	2,09E+02
Use of non-renewable secondary fuels	MJ	7,00E+04	1,09E+02	7,54E+01
Net use of fresh water	m ³	2,30E+03	5,09E+00	5,00E+00
Hazardous waste disposed	kg	6,67E+00	1,55E-02	1,55E-02
Non-hazardous waste disposed	kg	1,02E+04	2,38E+01	2,35E+01
Radioactive waste disposed	kg	1,18E+00	2,74E-03	2,73E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	6,37E+02	1,44E+00	1,23E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 19. Environmental product characteristic –1 m³ of concrete group V Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,21E+02	1,08E+02	1,00E+02
Global warming potential (gross value) ²	kg eq CO ₂	1,56E+02	1,39E+02	1,29E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	4,64E-03	9,89E-06	9,14E-06
Acidification potential of soil and water	kg SO ₂	2,11E+02	4,92E-01	4,77E-01
Formation potential of tropospheric ozone	kg Ethene	4,02E+01	8,75E-02	8,20E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,20E+02	2,76E-01	2,74E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2,83E+02	6,08E-01	5,86E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,74E+05	8,90E+02	8,63E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,05E+05	5,20E+02	5,06E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,25E+05	1,01E+03	9,80E+02
Use of secondary material	kg	6,53E+03	1,51E+01	1,28E+01
Use of renewable secondary fuels	MJ	1,90E+05	3,28E+02	2,67E+02
Use of non-renewable secondary fuels	MJ	9,01E+04	1,41E+02	9,69E+01
Net use of fresh water	m ³	2,45E+03	5,37E+00	5,26E+00
Hazardous waste disposed	kg	6,82E+00	1,59E-02	1,59E-02
Non-hazardous waste disposed	kg	1,05E+04	2,45E+01	2,41E+01
Radioactive waste disposed	kg	1,18E+00	2,74E-03	2,73E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	8,20E+02	1,86E+00	1,58E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 20. Environmental product characteristic – 1 m³ of concrete group VI Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,40E+02	1,25E+02	1,15E+02
Global warming potential (gross value) ²	kg eq CO ₂	1,81E+02	1,61E+02	1,48E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	5,27E-03	1,11E-05	1,02E-05
Acidification potential of soil and water	kg SO ₂	2,21E+02	5,17E-01	4,98E-01
Formation potential of tropospheric ozone	kg Ethene	4,38E+01	9,47E-02	8,79E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,24E+02	2,86E-01	2,83E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,09E+02	6,58E-01	6,31E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,85E+05	9,22E+02	8,89E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,25E+05	5,76E+02	5,59E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,37E+05	1,04E+03	1,01E+03
Use of secondary material	kg	7,98E+03	1,85E+01	1,56E+01
Use of renewable secondary fuels	MJ	2,31E+05	4,00E+02	3,25E+02
Use of non-renewable secondary fuels	MJ	1,10E+05	1,72E+02	1,18E+02
Net use of fresh water	m ³	2,62E+03	5,72E+00	5,58E+00
Hazardous waste disposed	kg	6,68E+00	1,57E-02	1,57E-02
Non-hazardous waste disposed	kg	1,08E+04	2,53E+01	2,49E+01
Radioactive waste disposed	kg	1,21E+00	2,82E-03	2,80E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,00E+03	2,27E+00	1,93E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 21. Environmental product characteristic – 1 m³ of concrete group VII Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,60E+02	1,42E+02	1,30E+02
Global warming potential (gross value) ²	kg eq CO ₂	2,06E+02	1,83E+02	1,68E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	5,84E-03	1,23E-05	1,12E-05
Acidification potential of soil and water	kg SO ₂	2,29E+02	5,35E-01	5,14E-01
Formation potential of tropospheric ozone	kg Ethene	4,87E+01	1,05E-01	9,68E-02
Eutrophication potential	kg (PO ₄) ³⁻	1,26E+02	2,90E-01	2,86E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,35E+02	7,08E-01	6,76E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,93E+05	9,46E+02	9,07E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,42E+05	6,26E+02	6,06E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,44E+05	1,07E+03	1,02E+03
Use of secondary material	kg	9,43E+03	2,19E+01	1,85E+01
Use of renewable secondary fuels	MJ	2,73E+05	4,72E+02	3,84E+02
Use of non-renewable secondary fuels	MJ	1,30E+05	2,03E+02	1,40E+02
Net use of fresh water	m ³	2,76E+03	5,98E+00	5,82E+00
Hazardous waste disposed	kg	6,82E+00	1,61E-02	1,60E-02
Non-hazardous waste disposed	kg	1,11E+04	2,60E+01	2,54E+01
Radioactive waste disposed	kg	1,21E+00	2,83E-03	2,81E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,18E+03	2,68E+00	2,28E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 22. Environmental product characteristic – 1 m³ of concrete group VIII Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,80E+02	1,58E+02	1,45E+02
Global warming potential (gross value) ²	kg eq CO ₂	2,32E+02	2,04E+02	1,87E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	6,41E-03	1,34E-05	1,22E-05
Acidification potential of soil and water	kg SO ₂	2,36E+02	5,53E-01	5,28E-01
Formation potential of tropospheric ozone	kg Ethene	5,28E+01	1,13E-01	1,04E-01
Eutrophication potential	kg (PO ₄) ³⁻	1,28E+02	2,93E-01	2,89E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,59E+02	7,54E-01	7,17E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,98E+05	9,65E+02	9,20E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,58E+05	6,75E+02	6,52E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,50E+05	1,09E+03	1,04E+03
Use of secondary material	kg	1,09E+04	2,52E+01	2,13E+01
Use of renewable secondary fuels	MJ	3,15E+05	5,44E+02	4,42E+02
Use of non-renewable secondary fuels	MJ	1,50E+05	2,35E+02	1,62E+02
Net use of fresh water	m ³	2,89E+03	6,21E+00	6,02E+00
Hazardous waste disposed	kg	6,82E+00	1,61E-02	1,61E-02
Non-hazardous waste disposed	kg	1,13E+04	2,66E+01	2,60E+01
Radioactive waste disposed	kg	1,21E+00	2,83E-03	2,81E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,37E+03	3,09E+00	2,63E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 23. Environmental product characteristic – 1 m³ of concrete group IX Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	1,99E+02	1,75E+02	1,59E+02
Global warming potential (gross value) ²	kg eq CO ₂	2,57E+02	2,26E+02	2,05E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	6,94E-03	1,45E-05	1,31E-05
Acidification potential of soil and water	kg SO ₂	2,39E+02	5,63E-01	5,35E-01
Formation potential of tropospheric ozone	kg Ethene	5,76E+01	1,23E-01	1,13E-01
Eutrophication potential	kg (PO ₄) ³⁻	1,26E+02	2,90E-01	2,86E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	3,81E+02	7,96E-01	7,55E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3,99E+05	9,73E+02	9,21E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,72E+05	7,17E+02	6,91E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,49E+05	1,09E+03	1,04E+03
Use of secondary material	kg	1,23E+04	2,86E+01	2,42E+01
Use of renewable secondary fuels	MJ	3,57E+05	6,16E+02	5,01E+02
Use of non-renewable secondary fuels	MJ	1,70E+05	2,66E+02	1,83E+02
Net use of fresh water	m ³	2,99E+03	6,38E+00	6,17E+00
Hazardous waste disposed	kg	6,95E+00	1,65E-02	1,64E-02
Non-hazardous waste disposed	kg	1,14E+04	2,69E+01	2,62E+01
Radioactive waste disposed	kg	1,18E+00	2,77E-03	2,75E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,55E+03	3,50E+00	2,98E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 24. Environmental product characteristic – 1 m³ of concrete group X Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	2,19E+02	1,92E+02	1,74E+02
Global warming potential (gross value) ²	kg eq CO ₂	2,83E+02	2,48E+02	2,24E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	7,51E-03	1,56E-05	1,40E-05
Acidification potential of soil and water	kg SO ₂	2,46E+02	5,80E-01	5,49E-01
Formation potential of tropospheric ozone	kg Ethene	6,17E+01	1,31E-01	1,20E-01
Eutrophication potential	kg (PO ₄) ³⁻	1,28E+02	2,94E-01	2,89E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,06E+02	8,42E-01	7,96E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,04E+05	9,92E+02	9,34E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,89E+05	7,67E+02	7,37E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,55E+05	1,11E+03	1,05E+03
Use of secondary material	kg	1,38E+04	3,20E+01	2,70E+01
Use of renewable secondary fuels	MJ	3,98E+05	6,88E+02	5,59E+02
Use of non-renewable secondary fuels	MJ	1,90E+05	2,97E+02	2,05E+02
Net use of fresh water	m ³	3,13E+03	6,64E+00	6,41E+00
Hazardous waste disposed	kg	6,94E+00	1,65E-02	1,65E-02
Non-hazardous waste disposed	kg	1,16E+04	2,76E+01	2,68E+01
Radioactive waste disposed	kg	1,18E+00	2,78E-03	2,75E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,73E+03	3,92E+00	3,33E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 25. Environmental product characteristic – 1 m³ of concrete group XI Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	2,39E+02	2,09E+02	1,90E+02
Global warming potential (gross value) ²	kg eq CO ₂	3,08E+02	2,70E+02	2,45E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	8,09E-03	1,68E-05	1,50E-05
Acidification potential of soil and water	kg SO ₂	2,54E+02	5,99E-01	5,65E-01
Formation potential of tropospheric ozone	kg Ethene	6,66E+01	1,42E-01	1,29E-01
Eutrophication potential	kg (PO ₄) ³⁻	1,30E+02	2,98E-01	2,92E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,32E+02	8,93E-01	8,41E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,12E+05	1,02E+03	9,52E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,06E+05	8,16E+02	7,84E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,63E+05	1,14E+03	1,07E+03
Use of secondary material	kg	1,52E+04	3,53E+01	2,99E+01
Use of renewable secondary fuels	MJ	4,40E+05	7,60E+02	6,17E+02
Use of non-renewable secondary fuels	MJ	2,10E+05	3,28E+02	2,26E+02
Net use of fresh water	m ³	3,27E+03	6,91E+00	6,65E+00
Hazardous waste disposed	kg	7,09E+00	1,69E-02	1,68E-02
Non-hazardous waste disposed	kg	1,19E+04	2,82E+01	2,73E+01
Radioactive waste disposed	kg	1,18E+00	2,79E-03	2,76E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	1,91E+03	4,33E+00	3,68E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 26. Environmental product characteristic – 1 m³ of concrete group XII Vertua® based on CEM II

Environmental impacts: (DU) 1 m ³				
Indicator	Unit	A1-A3	A1-A3	A1-A3
		CEM II A	CEM II B	CEM II C
Global warming potential (net value) ¹	kg eq CO ₂	2,59E+02	2,26E+02	2,05E+02
Global warming potential (gross value) ²	kg eq CO ₂	3,34E+02	2,92E+02	2,64E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	8,67E-03	1,79E-05	1,60E-05
Acidification potential of soil and water	kg SO ₂	2,61E+02	6,18E-01	5,80E-01
Formation potential of tropospheric ozone	kg Ethene	7,15E+01	1,52E-01	1,38E-01
Eutrophication potential	kg (PO ₄) ³⁻	1,31E+02	3,01E-01	2,95E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4,58E+02	9,43E-01	8,87E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4,19E+05	1,04E+03	9,70E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3,23E+05	8,66E+02	8,30E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4,70E+05	1,16E+03	1,09E+03
Use of secondary material	kg	1,67E+04	3,87E+01	3,27E+01
Use of renewable secondary fuels	MJ	4,82E+05	8,31E+02	6,76E+02
Use of non-renewable secondary fuels	MJ	2,30E+05	3,60E+02	2,48E+02
Net use of fresh water	m ³	3,41E+03	7,17E+00	6,89E+00
Hazardous waste disposed	kg	7,23E+00	1,73E-02	1,72E-02
Non-hazardous waste disposed	kg	1,21E+04	2,89E+01	2,79E+01
Radioactive waste disposed	kg	1,18E+00	2,79E-03	2,76E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	2,09E+03	4,74E+00	4,03E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00

¹net-value excludes alternative waste-based fuels in CEM production

²The indicated gross value includes the CO₂ emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

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Table 27 Environmental product characteristic – end of life – 1 m³ of all concrete groups (I-XII)

Environmental impacts: (DU) 1 m ³						
Indicator	Unit	C1	C2	C3	C4	D
Global warming potential (gross value)	kg eq CO ₂	7,88E+00	5,41E+01	1,58E+01	2,55E+00	-2,07E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	1,55E-07	2,30E-06	3,10E-06	6,74E-07	-5,20E-06
Acidification potential of soil and water	kg SO ₂	3,31E-02	7,08E+00	6,62E-02	1,90E-02	-3,87E-01
Formation potential of tropospheric ozone	kg Ethene	4,14E-02	5,18E-01	8,28E-02	1,17E-03	-1,74E-02
Eutrophication potential	kg (PO ₄) ³⁻	9,69E-04	1,25E+00	1,94E-03	3,68E-03	-2,83E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1,04E-01	0,00E+00	2,07E-01	2,88E-05	-3,63E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2,88E+01	1,83E+02	5,75E+01	5,75E+01	-7,53E+02
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	6,21E+00	1,28E-01	1,24E+01	1,22E+01	-8,29E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2,99E+01	1,92E+02	5,98E+01	6,00E+01	-8,67E+02
Use of secondary material	kg	0,00E+00	5,70E+02	0,00E+00	3,10E+01	2,07E+03
Use of renewable secondary fuels	MJ	0,00E+00	9,59E-02	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net use of fresh water	m ³	2,07E-03	1,74E-02	4,14E-03	2,35E-03	-4,45E+00
Hazardous waste disposed	kg	8,05E-03	5,82E-08	1,61E-02	1,12E-04	-1,58E-03
Non-hazardous waste disposed	kg	8,05E-01	5,41E-05	1,61E+00	2,30E+02	-1,26E+01
Radioactive waste disposed	kg	0,00E+00	0,00E+00	0,00E+00	3,77E-04	-3,05E-03
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recover	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

RESULTS INTERPRETATION

The environmental impact of concrete production of a given class is mainly dependent on the environmental footprint of cement used (80% to 90%). The rest 10-20% of the impact depends on the environmental footprint of the aggregates, transport and the plant's energy use. The impact of production is mainly influenced by the following factors: content of clinker in the product mix, share of alternative fuels in clinker production (80-90%), specific process emission of clinker production, electricity (100% wind electricity – clinker production) used. The gross value of eq. CO₂ emissions (EN 15804/ISO 14067 based method) for assessed concrete based on CEM II production by CEMEX in Poland is 35-131 kg of CO₂/ton concrete (group I to class XII). The net value of eq. CO₂ emissions excluding impact of alternative waste-based fuels is 24-96 kg of CO₂/ton of concrete (class I to class XII).

VERIFICATION

The process of verification of this EPD was in accordance with ISO 14025 and ISO 21930. After verification this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804:2012+A1 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) <input checked="" type="checkbox"/> external <input type="checkbox"/> internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA \ LCI audit and input data verification: Ph.D. D.Sc. Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl

The purpose of this EPD is to provide the basis for assessing buildings and other construction works. A comparison of EPD data is only meaningful if all the data sets compared were developed according to EN 15804 and the product-specific performance characteristics and its impacts on the construction works are taken into account.

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 206: Concrete. Specification – performance -production and conformity (with amendments)
- EN 197-1:2011: Cement - part 1: Composition. specifications and conformity criteria for common cements
- PN-EN ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures2.
- PN-EN 15804+A2:2020-03 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products3.
- PN-EN 16908:2017-02 Cement and building lime. Environmental product declarations. Product category rules complementary to EN 158044.
- PN-EN ISO 14040:2009 Environmental management - Life cycle assessment - Principles and framework
- ECRA (European Cement Research Academy) – Background report “TR-ECRA 0181/2014 Environmental Product Declarations for representative European cements “



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CERTIFICATE No 332/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Vertua® concrete groups

(based on CEM II) produced by Cemex Polska

Manufacturer:

CEMEX Polska Sp. z o.o.

ul. Krakowiaków 46, 02-255 Warszawa, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804

Sustainability of construction works.

Environmental product declarations.

Core rules for the product category of construction products.

This certificate, issued for the first time on 27th June 2022 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics
and Environment Department


Agnieszka Winkler-Skalna, PhD



Deputy Director
for Research and Innovation


Krzysztof Kulczyński, PhD

Warsaw, June 2022