ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	Eternit NV
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ELH-20180137-CAC1-EN
Issue date	25.01.2019
Valid to	24.01.2024

Cedral Fibre-Cement Façade Panels

ETEX

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CEDRAL
Timelessly beautiful facades

1. General Information

Eternit NV	CEDRAL
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Eternit NV Kuiermansstraat 1 1880 Kapelle-op-den-Bos Belgium
Declaration number EPD-ELH-20180137-CAC1-EN	**Declared product / declared unit** 1m² CEDRAL, total life cycle
This declaration is based on the product category rules: Fibre cement / Fibre concrete, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The Environmental Product Declaration includes the environmental parameters for the Cedral façade panels produced by Eternit N.V. This document refers to the façade panels manufactured in the Kapelle-op-den-Bos plan (Belgium). The production data used refers to production year 2016. Based on plausible, transparent and comprehensible basic data, the Life Cycle Assessment fully represents the Eternit products in question. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 25.01.2019	**Verification** The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Valid to 24.01.2024	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Dipl. Ing. Hans Peters (Head of Board IBU)	Mr Carl-Otto Neven (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

The products under review involve smooth or structured panels made from steam-hardened cellulose-reinforced fibre cement. The CEDRAL panels are available with smooth and structured finishing. Both products are coated fibre cement panels. For the placing on the market of the product in the EU/EFTA (with exception of Switzerland) Regulation (EU) No. 305/2011 (PCR) applies (alternative 1a in the PCR). The product has a Declaration of Performance taking into consideration EN12467:2012, dated 20-06-2013 and CE-marking. For the application and use the respective national provisions apply.

2.2 Application

Cedral façade panels are used as board-like façade cladding for back-ventilated façades. For both smooth and structured panels two installation methods are provided. The “click” application has a tongue and groove system, while the “lap” application foresees an overlap of the panels. For both CEDRAL smooth and structured, the click and lap application is declared.

Once installed correctly according to the manufacturers guidelines CEDRAL needs no further maintenance, repair, replacement or refurbishment during the full life span of the product. Since the installation losses are highly depending on the design of the building and user preferences, the installation losses are assumed out of the scope for this LCA. The impact for a default amount of 5% installation losses and calculation rules to include the impact to the required amount are provided under 2.8.

2.3 Technical Data

Constructional data

Name	Value	Unit
Thermal conductivity	0.19	W/(mK)
Calculation value for thermal conductivity	0.19	W/(mK)
Water vapour diffusion resistance factor acc. to DIN V 4108-4, EN ISO 12572	250	-
Swelling (air-dry to water-saturated)	1	mm/m

Gross density	1300	kg/m^3
Tensile strength	0.8 - 1.2	N/mm^2
Flexural strength	11 - 23	N/mm^2
Modulus of elasticity	5500 - 7500	N/mm^2
Coefficient of thermal expansion	0.01	$10^{-6}K^{-1}$
Permanent temperature resistance	80	°C

Product according to the CPR, based on EN 12467. Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 12467, No. S650_01_107-159_VO01, dated 20-06-2013.

2.4 Delivery status

	CEDRAL LAP / CLICK
Dimensions (mm)	190 x 3600 / 186 x 3600
Thickness (mm)	10 / 12
Weight per piece (kg)	11,2 / 12,2
Density (kg/m3)	1 300 / 1 300

2.5 Base materials / Ancillary materials

Base materials in % mass (dry mass)
30-40% Portland cement to DIN EN 197-1, (CEM I 32.5 R and 42.5 R) (binding agent)
45-55% Quartz sand, mineral aggregates
5-10% Cellulose (as filter and reinforcement fibres)
<5% Aluminium hydroxide
And water for mixing the cement

Coating
Primer: Application volume (incl. water): 64g/m², application volume (dry): 40 g/m²
Top Coat: Application volume (incl. water): 272g/m², application volume (dry): 73 g/m²
Steel clips and screws are foreseen for installation of the panels on a wooden framework.
Once installed correctly the product needs no further maintenance or refurbishment.
The panels are treated as landfill after the end of life of the product.

2.6 Manufacture

Both Click and Lap façade panels made of fibre cement are manufactured largely in accordance with an automated winding process: the raw materials are mixed with water to prepare a homogenous mixture. The rotating screen cylinders drain internally. The screen surface is covered in a thin film of fibre cement which is transferred onto an infinite conveyor belt from where it is conveyed to a format roller, which can be smooth or structured. The format roller is gradually covered in an increasingly thicker layer of fibre cement. Once the requisite material thickness is achieved, the still moist and malleable fibre cement layer (fibre cement fleece) is separated and removed from the format roller. The fibre cement fleece is cut to size. Leftovers of the wet process are returned to the production process preventing any waste from being incurred. The panels are then set aside for curing before stacking on pallets and steam-hardened in an autoclave for approx. two hours. The setting time lasts approx. three days. Waste from damaged or broken panels is recycled by an external company as raw material for cement production. For the Click application a tongue and groove closure is milled out from the panels. Finally the façade panels are coated in acrylic paint.

The production facilities are SGS-certified in accordance with ISO 9001:2015.

2.7 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures extending beyond the legally specified industrial protection measures for commercial enterprises are required.

- Air: Any dust arising is collected in filter systems and partially recycled. Emissions are significantly lower than the limit values specified by the “TA Air”.
- Water/Ground: Water incurred during manufacturing and plant cleaning is treated mechanically in waste water treatment systems on the plant site and re-used in the production process.
- Noise: Noise emitted by the production equipment into the environment is below the permissible limit values.

Environment Management:
The production facilities are SGS-certified in accordance with ISO 14001:2015.

2.8 Product processing/Installation

The products under review involve smooth or structured lap or click panels made from steam-hardened cellulose-reinforced fibre cement. All products are coated fibre cement panels. For both panels two installation methods are provided. The “click” application has a tongue and groove system, while the “lap” application foresees an overlap of the panels. For both Cedral smooth and structured, the click and lap application is declared. Special low-dust equipment such as slow-running, carbide-tipped splitting saws or cutting burs and hand-operated tools such as guillotine shears etc. are available for processing. Drill holes can be made using standard HSS drills. Additional products necessitated by design for installing the product referred to above include: wood substructures including the requisite anchoring and joining equipment (studs, screws, nails) and joint tape made of EPDM and edge profiles made of aluminum. As the installation losses are highly depending on the design of the building and user preferences, a default impact for 5% installation losses is presented in the table below. The user can add the impact of installation losses to the impact of the installation phase (A5) declared in the EPD. Additional impact due to the production (A1-A3) and transport to the building site (A4) of these installation losses can be calculated by adding the percentage of the installation losses (eg. 5%) to the impact of A1-A3 and A4.

Impact of waste treatment of 5% installation losses

Global warming potential : 1,18E-02 [kg CO2-Eq.]
Ozone depletion : 1,82E-09 [kg CFC11-Eq.]
Acidification land and water : 6,44E-05 [kg SO2-Eq.]
Eutrophication potential : 1,52E-05 [kg (PO4)3--Eq.]
Photochemical ozone oxidation : 3,65E-06 [kg ethene-Eq.]
Abiotic depletion – non fossil : 2,05E-08 [kg Sb-Eq.]
Abiotic depletion – fossil : 1,62E-01 [MJ]

When selecting any requisite constructive products, please ensure that they do not have a negative influence on the designated function of the building products referred to.
The set of rules laid out the employers’ liability insurance association shall apply.

The typical health and safety measures in line with the manufacturer's instructions must be maintained when processing the products in question. Please note that processing dust can incur alkaline reactions (pH value: approx. 12). The general dust value as per TRGS 900 of ≤6 mg/m³ can be easily adhered to using the processing equipment recommended by Eternit AG (please refer to the homepage).
According to the current state of knowledge, hazards for water, air and soil cannot arise when processed as designated.

2.9 Packaging

packaging material

- PE foil,
- PE shrinking foil,
- wooden pallets and
- PE straps

2.10 Condition of use

When the cement and water mixture sets (hydration), cement stone (calcium silicate hydrate) is formed with embedded fibres and fillers as well as micro air voids. Over the service life, free lime in the cement reacts with carbon dioxide in the air to form calcium carbonate (carbonation).
The fibre cement products comprise approx. 15% water (equilibrium moisture) and a proportion by volume of approx. 35% air (contained in the micro-pores).
In the condition of use, the coating substances are bonded as solids via hot-coating. The water evaporates.
Fibre cement products can be used as designated and for practically any application after the cement has set as a bonding agent.

2.11 Environment and health during use

Environmental protection: According to the current state of knowledge, hazards for water, air and soil cannot arise when processed as designated (please refer to the section on Requisite evidence).
Health protection: There are no known health risks attributable to the base materials used and their performance in use when the construction products are used as designated (please also refer to the section on Requisite evidence).

2.12 Reference service life

The reference service life of fibre cement panels is comparable with the RSL of buildings. In accordance with the BMVBS Guidelines on Sustainable Building dating from 2000, this corresponds with 40 to 60 years. There are no verifiable influences on ageing when the recognized rules of technology are applied.

2.13 Extraordinary effects

Fire

Fire protection

Name	Value
Building material class	A2
Burning droplets	d0
Smoke gas development	s1

Water

No ingredients are washed out which could be hazardous to water (please refer to the section on Evidence: Eluate analyses). The pH-value is alkaline (ph≥10).

Mechanical destruction

Not of relevance.

2.14 Re-use phase

Depending on the mounting system the fibre cement products can be removed non-destructively by unscrewing or opening the studs.

2.15 Disposal

Fibre cement panels are 100% landfilled. The waste is classified under code 10 13 11 according to the European Waste Catalogue (EWC).

2.16 Further information

Additional information and safety data sheets available online at www.eternit.de

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit refers to the whole life cycle (manufacturing, installation, use and end-of-life treatment) of 1m² Cedral produced in the Eternit N.V. plant in Kapelle-op-den-Bos. The results of the LCA are valid for both Click and Lap application, and are based on a weighted average of the market shares of both products. The weight of 1m² installed CEDRAL is 19,5 kg or 0,0195 ton.

Declared unit 1m² applied

Name	Value	Unit
Declared unit	1	m²
Gross density	1300	kg/m³
Conversion factor to 1 kg	0.05129	-
Conversion factor to 1 m²	19.5	kg

3.2 System boundary

Type of the EPD: cradle to to grave.
The modules considered in the Life Cycle Assessment are product stage A1-A3, installation stage A4-A5, use stage B, end-of-life stage C1-C4 and module D. For the life cycle assessment SimaPro version 8.5 software is used. The underlying database is EcoInvent version 3.4.

3.3 Estimates and assumptions

For two raw materials, cellulose and acrylic paint, no specific match was found in the EcoInvent database, therefore dry wood chips and acrylic varnish are modeled as a proxy. The waste of the packaging of the raw materials is neglected due to the low quantity. The ancillary materials that have an impact lower than 1% of the total impact are treated as cut offs.
All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and

electricity consumption, all direct waste as well as all emission measurements available were taken into account in the analyses. Ancillary materials needed in the production process with mass and impact less than 1% are treated as cut-offs.
The biogenic carbon included in the wooden pallets for packaging is not included in the LCA. No uptake nor release of biogenic carbon is modeled.

3.4 Cut-off criteria
All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct waste as well as all emission measurements available were taken into account in the analyses. Ancillary materials needed in the production process with mass and impact less than 1% are treated as cut-offs.
The biogenic carbon included in the wooden pallets for packaging is not included in the LCA. No uptake nor release of biogenic carbon is modeled.

3.5 Background data
In order to model fibre cement production SimaPro 8.5 and Ecoinvent 3.04 was used.

3.6 Data quality
Corresponding consistent data records were available for most of the relevant preliminary products and ancillary materials. The background data used was last revised less than 2 years ago. The production data involves up-to-date industrial data on Eternit AG from 2016. The Variability of the data is low since the production process is identical except for the finishing as here a tongue and groove closure is milled for the Click application. All materials and processes are declared and integrated in the LCA. As both products are sold on the German market, there is no relevant geographical variability for the results.

3.7 Period under review
The data applied for this LCA is based on data recorded by Eternit N.V. for the manufacturing of façade panels in 2016. The volumes of raw materials energy, ancillary materials are considered as average annual values in the Kapelle-op-den-Bos plant.

3.8 Allocation
Cedral façade panels are manufactured in the Kapelle-op-den-Bos plant. All plant data relates to the declared product. Part of the dry production waste is recycled in cement production. All impacts related to the transport and treatment of this production waste and the avoided impacts in the cement production are allocated to module D. The production of both Click and Lap panels is identical until the finishing, here a tongue and groove closure is milled out for the Click application. For the LCA of the average product the inventory data are modeled based on a mass allocation according to the market share of the two applications.
The panels under review contain cement as a binding agent for the manufacture of which secondary fuels are used. As the secondary fuels used only have a negative or no economic value, they are included in the system without representing any negative impact on the environment. Transport to the plant by truck was taken into consideration. The contributions to the Global Warming Potential as a result of incineration were also considered in the model for renewable and non-renewable primary and secondary fuels. Ultimately, renewable secondary fuels give rise to neutral CO2 values as they contain the same volume as they release.

3.9 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.

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4. LCA: Scenarios and additional technical information

Transport to the building site (A4)

Name	Value	Unit
Transport distance	600	km

Installation into the building (A5)

Name	Value	Unit
Auxiliary	1.87	kg
Electricity consumption	0.02	kWh
Material loss	0.975	kg
Output substances following waste treatment on site	0.99	kg

Use or application of the installed product (B1) see section 2.12 "Use"

Name	Value	Unit
No impact during use phase	0	-

Once installed correctly according to the manufacturers guidelines CEDRAL needs no further maintenance, repair, replacement or refurbishment during the full life span of the product.

Maintenance (B2)

Name	Value	Unit
Information on maintenance Requires no maintenance	0	-

Repair (B3)

Name	Value	Unit
Information on the repair process Requires no repairs	0	-

Replacement (B4) / Refurbishment (B5)

Name	Value	Unit
Replacement cycle Requires no replacement	0	Number/ RSL

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	40 - 60	a

Operational energy use (B6) and Operational water use (B7)

Name	Value	Unit
Water consumption	0	m^3
Electricity consumption	0	kWh

Other energy carriers	0	MJ
Equipment output	0	kW

End of life (C1-C4)

Name	Value	Unit
Collected separately waste type	19.5	kg
Landfilling	19.5	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Reuse of production losses in external cement production	1.448	kg

5. LCA: Results

The environmental impacts of 1m² Cedral manufactured by Eternit N.V. are outlined below. The modules to DIN EN 15804 marked "x" in the overview are addressed here.
The following tables depict the results of estimated impact, the use of resources as well as the waste and output flows relating the declared unit.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² CEDRAL

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	6.97E+0	5.39E-1	2.87E+0	2.53E+0	1.56E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-2	2.11E-1	0.00E+0	2.36E-1	-5.70E-1
ODP	[kg CFC11-Eq.]	3.22E-7	8.80E-8	3.76E-7	4.46E-7	8.99E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.06E-9	3.72E-8	0.00E+0	3.63E-8	7.33E-6
AP	[kg SO_2-Eq.]	2.07E-2	7.14E-3	7.96E-3	9.54E-3	5.31E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.12E-4	7.95E-4	0.00E+0	1.29E-3	-6.36E-4
EP	[kg $(PO_4)^{3-}$-Eq.]	2.44E-3	7.43E-4	9.89E-4	1.65E-3	7.32E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.99E-5	1.38E-4	0.00E+0	3.04E-4	-9.81E-5
POCP	[kg ethene-Eq.]	1.20E-3	2.34E-4	2.03E-4	4.18E-4	3.41E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.87E-6	3.48E-5	0.00E+0	7.30E-5	-4.60E-5
ADPE	[kg Sb-Eq.]	9.55E-6	7.15E-7	6.45E-6	9.00E-6	1.34E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.00E-9	7.50E-7	0.00E+0	4.10E-7	4.42E-8
ADPF	[MJ]	4.17E+1	7.46E+0	5.23E+1	3.70E+1	1.20E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.58E-1	3.08E+0	0.00E+0	3.24E+0	1.85E+0

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² CEDRAL

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	16.30	0.15	19.50	0.52	72.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.07	0.32
PENRE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	49.40	8.22	83.30	40.10	14.10	0.00	0.00	0.00	0.00	0.29	3.34	0.00	3.54	8.88
SM	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	6.24E-3	1.57E-4	9.35E-3	9.15E-4	7.60E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.26E-5	7.63E-5	0.00E+0	6.72E-5	-5.08E-4

Caption	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 material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² CEDRAL

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	5.38E-5	4.83E-6	5.25E-5	2.48E-5	2.99E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.18E-8	2.07E-6	0.00E+0	3.58E-6	0.00E+0
NHWD	[kg]	8.02E-1	1.40E-1	1.78E+0	1.47E+0	8.43E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.44E-4	1.23E-1	0.00E+0	3.66E+0	0.00E+0
RWD	[kg]	1.82E-4	5.07E-5	3.26E-4	2.50E-4	5.28E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.39E-7	2.09E-5	0.00E+0	1.99E-5	0.00E+0
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.77E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	1.45E+0	0.00E+0	1.92E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	4.40E-3	0.00E+0	1.68E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.97E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

6. LCA: Interpretation

In the manufacturing (A1-A3) if 1m² Cedral, the use of non-renewable primary energy sources accounts for 36 MJ/m². The use of renewable primary energy sources accounts for 141 MJ/m².

The use of **non-renewable primary energy sources** during Cedral manufacturing is largely determined by the use of energy carriers in the plant, whereby the

provision of electricity and thermal energy required from natural gas are important.

The use of **renewable primary energy sources** is determined by the transport to the building site with large trucks.

Secondary raw materials are not used for the manufacturing of Cedral.

Secondary fuels are used in the upstream process of cement manufacturing.
During the manufacture (A1-A3) of 1m² Cedral, around 0,02m³ of **water** is used. The water is used as process water and for mixing the cement.

Non-hazardous **waste** depicts the largest amount at the end of life stage, due to the landfill of the product. Radioactive waste is exclusively incurred in generating electricity in nuclear power plants.

Considering the results for the impact categories, the provision of raw materials (A1), the manufacturing (A3) and End of Life stage (C4) have a decisive influence on the results.

The **global warming potential** of 1m² Cedral is primarily dominated by carbon dioxide emissions. This is essentially attributable to the upstream chains associated with cement and paint manufacturing, the use of natural gas in the manufacturing and the transport to the building site.

The impact of the upstream processes for cement production, energy production and diesel production make the primary contribution towards the **Ozone Depletion Potential, Acidification, Eutrophication and Photochemical Ozone oxidation**.

The impact of the upstream processes for cement and paint production, the upstream process for the packaging and the steel balls used in the production process and diesel production make the primary contribution towards the **fossil and non-fossil abiotic depletion**.

The overall **data quality** can be regarded as good for modeling the Cedral façade panels. Corresponding consistent data records were available for almost all of the preliminary products and auxiliaries used.

The production data involves up-to-date primary data supplied by Eternit N.V. for the Kapelle-op-den-Bos plant in 2016.

7. Requisite evidence

7.1 Leaching

Measuring agency / Protocol / Date: *Hygiene-Institut des Ruhrgebietes*, Gelsenkirchen; No. A-234757-13-To,12.09.2013.
Result: the result of the analyses of leaching by the panels examined in accordance with DIN 38414, Part 4 indicate that the eluate allocation values for class I landfills in the Landfill Ordinance are adhered to with regard to any landfilling of non-recyclable residual construction panels.

In term of use in construction, a comparison of the leaching data with the limit and guideline values outlined in the German Drinking Water Ordinance date 21 May 2001 indicate that the limit values are exceeded concerning the pH value and concentration of water-soluble organic ingredients.

7.2 VOC emissions

Cedral façade panels are only used in outdoor applications. Evidence of VOC emissions is therefore not of relevance.

VOC emissions

Name	Value	Unit
Overview of Results (28 days)	-	µg/m³
TVOC (C6 - C16)	-	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³
R (dimensionless)	-	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	-	µg/m³

8. References

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