ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Etex
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ETE-20220190-ICA2-EN
Issue date	31.10.2022
Valid to	23.10.2027

Cedral sidings
ETEX

Institut Bauen und Umwelt e.V.

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1. General Information

Etex Lithuania

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number
EPD-ETE-20220190-ICA2-EN

This declaration is based on the product category rules:
Fibre cement / Fibre concrete, 01.2019
(PCR checked and approved by the SVR)

Issue date
31.10.2022

Valid to
23.10.2027

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Cedral sidings

Owner of the declaration
Etex Lithuania
J. Dalinkevičiaus str. 2H
Naujoji Akmené, 85118

Declared product / declared unit
Covering 1 m^2 of wall with Cedral sidings, over a reference service life of 60 years.

Scope:
This EPD presents the Cedral fibre cement sidings. This product is an autoclaved fibre cement panel produced by ETEX at Akmene factory in Lithuania and sold in Europe.

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.

The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2011*
☐ internally ☒ externally

Vito D'Incognito
(Independent verifier)

2. Product

2.1 Product description/Product definition

Cedral sidings are steam-hardened cellulose-reinforced fibre cement panels. They exist in two finishes: smooth or structured (wood relief). Panels are coated and available in various colours.

The manufacturer can - within the framework of the *European Regulation N° 305/2011 (CPR)* - present the Declaration of Performance (DOP) of the product confirming that the product has a CE marking

2.2 Application

Cedral sidings are used as board-like façade cladding for back-ventilated façades. Cedral sidings come as Cedral Click or Cedral Lap. This EPD only considers Cedral Lap, as Cedral Click is not produced in Akmene. The "lap" application foresees an overlap of the panels. Once installed correctly according to the manufacturer's guidelines Cedral needs no further maintenance, repair, replacement or refurbishment during the full life span of the product.

2.3 Technical Data

The following tables include technical data specific to the Cedral sidings.

Constructional data

Name	Value	Unit
Gross density	1300	kg/m^3
Standard panel thickness	10	mm
Thermal conductivity	0.212	W/(mK)
Flexural strength parallel	23	N/mm^2
Flexural strength perpendicular	11	N/mm^2
Modulus of elasticity parallel	4000	N/mm^2
Modulus of elasticity perpendicular	5500	N/mm^2
Coefficient of thermal expansion	<0.01	$10^{-6}K^{-1}$
Swelling (air-dry to water-saturated) Hygric movement	1.75	mm/m
Durability classification EN12467	Category A	-
Strength classification EN12467	Class 2	

For the use and application of the product the respective (national) provisions at the place of use apply: European standard *EN 12467:2012 + A1:2016 + A2:2006* 'Fibre-cement flat sheets'.

2.4 Delivery status

The products are packed: pallet, PE cover foil, Coverage carton, PE plastic foam layers and PE band.

The sheets have the following dimensions:

- Thickness: 10 mm

- Cedral classic (length x width): 190 mm x 3600 mm
- Cedral smooth (length x width): 190 mm x 3600 mm

2.5 Base materials/Ancillary materials

Base materials included in the composition of Cedral sidings are:

- Sand: 45-55 %
- Cement: 25-35 %
- Cellulose: <10 %
- Additives: <3 %
- Coating: <3 %
- Water: 10-20 %

This product/article/at least one partial article contains substances listed in the candidate list (date: 10.10.2022) exceeding 0.1 percentage by mass: no.

This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): no

2.6 Manufacture

Cedral sidings are manufactured largely in accordance with an automated winding process: the raw materials are mixed with water to prepare a homogenous mixture. Rotating screen cylinders are immersed in this fibre cement pulp which 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 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 fibres cement fleece is cut to size. Leftovers 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. Finally the façade panels are coated in acrylic paint.

2.7 Environment and health during manufacturing

Environmental, occupational health, safety and quality management at the Akmene plant are in accordance with the following standards:

- *ISO 14001;2015*
- *ISO 9001;2015*
- *ISO 45001:2018*

2.8 Product processing/Installation

Description of the type of processing, machinery and tools used, dust extraction etc., auxiliary materials needed for installation as well as measures for noise reduction.
Information on the rules of technology as well as on workers safety and environmental protection is possible.

2.9 Packaging

A wooden pallet, PE cover foil, coverage carton, PE plastic foam layers and PE band are used to pack and transport the Cedral sidings to the installation site.

2.10 Condition of use

Maintenance requirement will depend on the specific design and application. Usually, Cedral sidings won't change the composition of the materials and thus no maintenance is needed.

2.11 Environment and health during use

Under normal conditions of use, Cedral sidings do not cause any adverse health effects or release of volatile organic compounds (VOCs) into indoor air.
No environmental impact on water, air or soil is expected due to the extremely low metal release from the low maintenance requirements.

2.12 Reference service life

The RSL of the Cedral sidings are estimated at 60 years.
Justification for this assumption: Cedral sidings are a rather new product on the market (°2007), and there is not yet extensive evidence regarding its reference service life. However, there are some studies that suggest that it is feasible to assume that this product lasts for the average lifetime of a building.[1]
The RSL is valid under normal conditions of use.

[1] Durability of Autoclaved Cellulose Fiber Cement Composites", A.M.Cooke, Managing Director, Building Materials and Technology Pty Ltd, Sydney, NSW, Australia
https://www.nachhaltigesbauen.de/fileadmin/pdf/baustoff_gebauededaten/BNB_Nutzungsdauern_von_Bauteilen__2011-11-03.pdf

2.13 Extraordinary effects

Fire

Fire protection

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

Water

Tests on the product performance including possible impacts on the environment following the unforeseeable influence of water, e.g. flooding showed that no risks are expected to occur in terms of environment and human health.

Mechanical destruction

In case of mechanical destruction, no risks are

expected to occur in terms of environment and human health.

2.14 Re-use phase
Cedral sidings will be disassembled at the end of its reference life service (RLS), which is 60 years.
The boards are only held in the walls with screws. The disassembly only requires the removal of the screws. The same energy as at the installation is necessary for this process.

2.15 Disposal
Two end-of-life scenario have been calculated.

Scenario A: 100 % landfill
Scenario B: While studies (LUBW, 2017) showed that Cedral sidings can be re-used and recycled, the current EPD includes a second end-of-life scenario in which 100 % of the fibre cement boards are recycled (7 % is recycled in cement clinker and 93 % as backfill in screed). Sidings are designed for recyclability and are already being recycled in the plant at Kapelle-op-den-Bos (Belgium).

2.16 Further information
Additional information on Cedral sidings can be found at: https://www.cedral.world/en/

3. LCA: Calculation rules

3.1 Declared Unit
Covering 1 m^2 of wall with Cedral sidings, over a reference service life of 60 years.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Area density	19.5	kg/m^2

3.2 System boundary

This is a cradle-to-grave EPD for the Cedral sidings with the following life cycle stages included: A1, A2, A3, A4, A5, B1-7, C1, C2, C3, C4 and D.
For A1, A2 and A3 specific quantities and distances were collected by ETEX NV and processed by *Enperas*. For transportation the default capacity utilisation factor of the transportation datasets was used, as all transportations were mass-based.

3.3 Estimates and assumptions
All assumptions made and the limitations of the LCA study are commented in the report. The results of the LCA are interpreted in agreement with the goal and scope and therefore with the *ISO 14040* and *ISO 14044* guidelines.

3.4 Cut-off criteria
The following processes are considered below cut-off:

- Wearable sieves and cutting knives
- Transport of packaging of raw material
- Infrastructure and land use of the factory
- Packaging and transport of ancillary materials used during installation
- Waste treatment of ancillary materials used during installation
- Environmental impacts caused by the personnel of the production plants are not included in the LCA, e.g. waste from the cafeteria and sanitary installations, accidental pollution caused by human mistakes, or environmental effects caused by commuter traffic. Heating or cooling of the plants in order to ensure a comfortable indoor climate for the personnel for example is also neglected.

3.5 Background data
The life cycle assesment was done using the LCA software package "*SimaPro 9.3.0.3" (PRé Consultants, 2021)*" in combination with a specific LCA software for ETEX. The main LCA database used in the study is the *Ecoinvent v3.6* database (September 2019). For some materials the *ELCD* or *Industry 2.0 database* has been used as no data was available in *Ecoinvent* or because these databases better describe the respective material.

3.6 Data quality
An estimate should be made as regards data quality (addressing both foreground and background data), whereby the age of background data used must be indicated.

For average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representatively and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

3.7 Period under review
Data were collected for 2020 for the production process of Cedral sidings in Akmene, Lithuania.

3.8 Allocation
At ETEX, different types of fibre cement boards are produced. Only facility level data were available for the use of electricity, natural gas, propane and water. The facility-level data have been allocated to the individual product using the annual production volume of the products materials (physical relationship). Material inputs and outputs which were not available at the product level, such as waste, were allocated similarly.

EN15804+A2 also describes the rules for joint co-production, where the processes cannot be divided. The production waste is partly externally recycled. However, it has been assumed that the recycled waste has no economic value, so 100 % of the impacts of the production are allocated to the product and 0 % to recycled production waste.

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.

The main LCA database used in the study is the *Ecoinvent v3.6 database* (September 2019). For some materials, the *European Reference Life Cycle Database (ELCD)* or *Industry 2.0 database* has been used as no data was available in *Ecoinvent* or because these databases better describe the respective material.

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic carbon
The product contains biogenic carbon in the form of cellulose. Its accompanying packaging contains biogenic carbon in the form of wooden pallets and carton. Note: 1 kg biogenic Carbon is equivalent to 44/12 kg of CO_2.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in product	0.47	kg C
Biogenic carbon content in accompanying packaging	0.469	kg C

Transport to the building site (A4)
The following transport scenario has been used to model the transport from the manufacturing plant in Akmene (Lithuania) to the installation site in Europe.

- 29 % directly to the construction site over 709 km with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U'

- 71 % to a supplier over 1274 km with a >32 ton lorry (ecoinvent record: 'Transport, freight, lorry >32 metric ton, EURO5 {RER}| transport, freight, lorry >32 metric ton, EURO5 | Cut-off, U') and from the supplier to the installation site over 35 km with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')

Losses during transport are considered during the installation phase, as it is difficult to separately quantify the specific transport and installation losses.

Name	Value	Unit
Litres of fuel	25.6	l/100km
Transport distance (29 % directly to construction site)	709	km
Transport distance (71 % to a supplier)	1274	km
Transport distance (71 % from supplier to construction site)	35	km
Capacity utilisation (including empty runs)	50	%
Gross density of products transported	Scenario Ecoinvent	kg/m^3
Capacity utilisation volume factor	Scenario Ecoinvent	-

Installation into the building (A5)
12.5 inox screws (or 0.038 kg) are necessary per functional unit for Cedral sidings. The installation involves an amount of 0.00176 kWh per screw used to fix the Cedral sidings. So in total 0,022 kWh of electricity is declared.
During the installation, depending on how the Cedral sheets are cut, there is a loss rate, depending on the building shape. For this EPD an average loss rate of 5 % is used.

All packaging material for the Cedral sidings is transported to End of Life (EoL) and disposed of in line with the default EoL scenarios for Germany described in Annexe C of the Product Environmental Footprint Pilots (PEFCR) 6.3 guidance.

The packaging of the ancillary materials used during installation are considered below cut-off.

Name	Value	Unit
Auxiliary Inox screws	0.038	kg
Electricity consumption To fix the screws	0.022	kWh
Material loss	5	%
Output substances following waste treatment on site	Packaging final product: wooden pallet, PE-band, PE cover foil, PE plastic foam layers, coverage carton	

Use phase B1-7
Over the 60 years of reference service life (RSL), if correctly installed, there are no impacts for the use phase (B1-7), except for the carbonation in module B1. The calculations for the carbonation are described in section 5.

Name	Value	Unit

Maintenance (B2)
The product does not require maintenance.

Name	Value	Unit

Repair (B3)
The product does not require repair.

Name	Value	Unit

Replacement (B4) / Refurbishment (B5)
No replacement/refurbishment required.

Name	Value	Unit

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	60	a

Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	-	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	-	-
Outdoor environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	-	-
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	-	-
Usage conditions, e.g. frequency of use, mechanical exposure	-	-
Maintenance e.g. required frequency, type and quality and replacement of components	-	-

Operational energy use (B6) and Operational water use (B7)
The product does not require operational energy/water use.

Name	Value	Unit

End of life (C1-C4)
The dismantling of Cedral sidings involves the same amount of energy as for the installation, which is 0,022 kWh.

In module C2, the impacts due to the transport of waste from the final product to waste processing are calculated.
- to recycling - 200 km
- to incineration - 150 km
- to landfill - 50 km

Two end-of-life scenarios have been calculated.
Scenario A: 100 % of the fibre cement board and 5 % of the steel screws are landfilled, The end-of-waste state is not reached. 95 % of the steel screws are recycled at their end of life. The end-of-waste state is reached after the sorting.
Scenario B: While studies showed that Cedral sidings can be re-used and recycled, the current EPD includes a second end-of-life scenario in which 100 % of the fibre cement boards are recycled (7 % is recycled in cement clinker and 93 % as backfill in screed) and 95 % of the steel screws are recycled. The end end-of-waste state is reached after sorting. 5 % of the steel screws are landfilled. The end-of-waste state is not reached.

Name	Value	Unit
Collected separately waste type	19.538	kg
Collected as mixed construction waste	0	kg
Reuse	0	kg
Reuse (Scenario B)	0	kg
Recycling	0.036	kg
Recycling (Scenario B)	19.536	kg
Energy recovery	0	kg
Energy recovery (Scenario B)	0	kg
Landfilling	19.502	kg
Landfill (Scenario B)	0.002	kg

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

Following waste streams are considered after their end-of-waste point in this study: steel screws in C3 (of which 95 % are recycled), wooden pallets in A3 and A5 (of which 30 % are recycled and respectively 7 % and 32 % are incinerated with efficiency <60 %), plastic packaging in A3 and A5 (of which respectively 27 % and 29 % are recycled and respectively 27 % and 32 % are incinerated with efficiency <60 %), paper and cardboard in A3 and A5 (of which 75 % are recycled and respectively 3 % and 11 % are incinerated), and steel cables in A3 (of which respectively 95 % are recycled).

For the additional end-of-life scenario (Scenario B), 100 % of the fiber cement boards are recycled and reaches the end-of-waste state. This is taken into account in module D of Scenario B.

Name	Value	Unit
Quantitative description of the loads beyond the system boundaries Treatment of scrap steel to prepare it for to prepare it for recycling at the remelter	0.039	kg
Quantitative description of the benefits beyond the system boundaries Sorting of waste wood to prepare it for recycling	0.313	kg
Quantitative description of the benefits beyond the system boundaries Treatment kg plastic to prepare it for recycling	0.061	kg
Quantitative description of the benefits beyond the system boundaries Avoided production of heat using natural gas	1.51	MJ
Quantitative description of the benefits beyond the system boundaries Avoided production of European electricity mix	0.75	MJ
Quantitative description of the benefits beyond the system boundaries Avoided production of primary steel	0.039	kg
Quantitative description of the benefits beyond the system boundaries Avoided production of primary softwood	0.313	kg
Quantitative description of the benefits beyond the system boundaries Avoided production of primary polypropylene/polypropylene granulates	0.061	kg
Quantitative description of the benefits beyond the system boundaries (only EoL scenario B) Avoided production of primary limestone	1.635	kg
Quantitative description of the benefits beyond the system boundaries (only EoL scenario B) Avoided production of primary sand	18.135	kg

5. LCA: Results

While studies [2] showed that Cedral sidings can be reused and recycled, the current EPD assumes 100 % landfilling of the product at its end of life.

Sidings are designed for recyclability and are already being recycled in the plant at Kapelle-op-den-Bos (Belgium). The waste of the fibre cement and calcium silicate boards (both pre- and post-consumer waste), will no longer go to landfill: 7 % in cement clinker and 93 % as backfill in screed. Therefore, also a 100 % recycling scenario has been calculated and included in the results (see columns C2/1, C3/1, C4/1 and D/1 in the results tables).

[2] Landesanstalt für Umwelt, Messungen und Naturschutz Baden -Württemberg, Steckbrief „Asbestfreie Faserzementprodukte“

Note that the effect of carbonation has been included in module B1. Using the formula below a CO_2 uptake of 1.93 kgCO_2 eq due to carbonation during the use phase is calculated
Carbonation = Dc x Qcem x %Ccem x 0.65 x m.m CO_2/m.m CaO

- m.mCO_2 = molecular mass of CO_2
- m.m CaO = molecular mass of CaO
- 0.65 = % of CaO in cement clinker
- Qcem= amount of cement used for producing 1m² of Cedral sidings
- %Ccem = percentage of clinker in cement which is at least 90 % in Portland cement (used in Cedral siding) according to *EN16757*
- Dc = degree of carbonation according to *EN16757* whereas Dc will depend on the exposure conditions. 75 % has been assumed.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

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	X	X	X	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m^2 wall covered with Cedral sidings

Core Indicator	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
GWP-total	[kg CO_2-Eq.]	4.01E+0	1.01E+0	4.20E-1	2.55E+0	2.89E+0	-1.93E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.53E-3	1.73E-1	8.23E-1	1.66E-4	1.77E+0	1.85E+0	4.33E-5	-5.23E-1	-2.29E+0
GWP-fossil	[kg CO_2-Eq.]	5.77E+0	1.01E+0	2.04E+0	2.55E+0	1.17E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.44E-3	1.73E-1	8.22E-1	1.63E-4	4.85E-2	1.32E-1	4.29E-5	-5.23E-1	-5.67E-1
GWP-biogenic	[kg CO_2-Eq.]	-1.77E+0	3.93E-4	-1.62E+0	1.05E-3	1.72E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.61E-5	7.04E-5	3.35E-4	2.70E-6	1.72E+0	1.72E+0	4.17E-7	6.67E-4	-1.72E+0
GWP-luluc	[kg CO_2-Eq.]	2.19E-3	4.03E-4	2.36E-3	7.93E-4	5.90E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.20E-5	6.03E-5	2.87E-4	1.94E-7	5.12E-5	6.74E-5	2.20E-8	-6.99E-4	-7.28E-4
ODP	[kg CFC11-Eq.]	2.53E-7	2.26E-7	2.69E-7	5.93E-7	9.73E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.95E-10	3.92E-8	1.87E-7	6.59E-12	3.03E-9	4.37E-8	9.31E-12	-4.65E-8	-5.46E-8
AP	[mol H^+-Eq.]	1.74E-2	8.24E-3	8.55E-3	1.06E-2	4.25E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.51E-5	7.05E-4	3.36E-3	4.86E-7	1.90E-4	1.01E-3	2.61E-7	-1.98E-3	-2.43E-3
EP-freshwater	[kg P-Eq.]	9.74E-5	7.43E-6	5.19E-5	1.96E-5	2.11E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.01E-6	1.36E-6	6.46E-6	2.43E-8	6.37E-6	6.97E-6	1.91E-9	-2.20E-5	-2.31E-5
EP-marine	[kg N-Eq.]	4.19E-3	2.20E-3	2.71E-3	3.18E-3	1.06E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.99E-6	2.09E-4	9.97E-4	7.83E-8	4.84E-5	3.54E-4	8.00E-8	-3.88E-4	-5.43E-4
EP-terrestrial	[mol N-Eq.]	4.87E-2	2.44E-2	2.98E-2	3.52E-2	1.18E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.62E-5	2.31E-3	1.10E-2	1.21E-6	6.22E-4	3.99E-3	9.01E-7	-4.41E-3	-6.29E-3
POCP	[kg NMVOC-Eq.]	1.29E-2	6.88E-3	1.03E-2	1.11E-2	3.50E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.19E-5	7.09E-4	3.38E-3	2.40E-7	1.47E-4	1.11E-3	2.75E-7	-1.67E-3	-2.15E-3
ADPE	[kg Sb-Eq.]	3.35E-6	1.80E-6	2.83E-6	3.73E-6	6.42E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.29E-8	3.36E-7	1.60E-6	2.73E-10	7.28E-8	1.31E-7	7.04E-11	-5.13E-7	-6.87E-7
ADPF	[MJ]	3.84E+1	1.49E+1	4.32E+1	3.93E+1	1.08E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.94E-1	2.60E+0	1.24E+1	2.21E-3	6.59E-1	3.35E+0	7.99E-4	-1.05E+1	-1.13E+1
WDP	[m^3 world-Eq deprived]	2.20E+0	3.92E-2	1.32E+0	1.22E-1	2.32E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.18E-3	7.24E-3	3.45E-2	8.65E-6	2.37E-3	1.05E-2	2.22E-5	-1.32E-1	-1.71E-1

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; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m^2 wall covered with Cedral sidings

Indicator	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
PERE	[MJ]	2.27E+1	1.92E-1	2.91E+1	5.04E-1	8.06E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.63E-2	3.60E-2	1.71E-1	3.94E-4	1.03E-1	1.43E-1	3.16E-5	0.00E+0	0.00E+0
PERM	[MJ]	1.54E+1	0.00E+0	1.43E+1	0.00E+0	-7.70E+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	-1.52E+1	0.00E+0	0.00E+0	4.60E+0	1.98E+1
PERT	[MJ]	3.81E+1	1.92E-1	4.35E+1	5.04E-1	3.60E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.63E-2	3.60E-2	1.71E-1	3.94E-4	-1.51E+1	1.43E-1	3.16E-5	4.60E+0	1.98E+1
PENRE	[MJ]	4.30E+1	1.50E+1	3.72E+1	3.95E+1	1.44E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.33E-1	2.62E+0	1.25E+1	2.97E-3	8.58E-1	3.53E+0	8.68E-4	0.00E+0	0.00E+0
PENRM	[MJ]	5.55E-2	0.00E+0	8.92E+0	0.00E+0	-2.41E+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	0.00E+0	1.48E-2	1.48E-2
PENRT	[MJ]	4.31E+1	1.50E+1	4.61E+1	3.95E+1	1.20E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.33E-1	2.62E+0	1.25E+1	2.97E-3	8.58E-1	3.53E+0	8.68E-4	1.48E-2	1.48E-2
SM	[kg]	1.13E-3	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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.48E-1	2.14E+1
RSF	[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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	1.40E-1	1.00E-3	3.17E-2	3.06E-3	1.06E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.43E-4	1.88E-4	8.96E-4	6.53E-7	1.73E-4	3.34E-3	5.09E-7	-3.41E-3	-2.91E-2

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m^2 wall covered with Cedral sidings

Indicator	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
HWD	[kg]	3.29E-5	3.59E-5	6.23E-5	9.77E-5	1.90E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.30E-7	6.82E-6	3.25E-5	2.90E-9	9.83E-7	3.98E-6	1.53E-9	-1.78E-5	-1.97E-5
NHWD	[kg]	3.62E-1	6.29E-1	2.01E-1	2.92E+0	1.79E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.87E-4	1.25E-1	5.93E-1	9.86E-6	2.67E-3	1.95E+1	2.84E-3	-4.00E-2	-4.54E-2
RWD	[kg]	1.31E-4	1.02E-4	7.67E-5	2.68E-4	4.51E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.38E-6	1.78E-5	8.45E-5	8.91E-9	2.90E-6	2.12E-5	4.47E-9	-2.61E-5	-3.19E-5
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	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
MFR	[kg]	0.00E+0	0.00E+0	5.38E-1	0.00E+0	4.11E-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	0.00E+0	0.00E+0	1.95E+1	0.00E+0	0.00E+0	-9.49E-1	-2.14E+1
MER	[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	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	2.59E-3	0.00E+0	7.52E-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	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-7.55E-1	-7.55E-1
EET	[MJ]	0.00E+0	0.00E+0	5.19E-3	0.00E+0	1.50E+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	0.00E+0	-1.51E+0	-1.51E+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; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m^2 wall covered with Cedral sidings

Indicator	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
PM	[Disease Incidence]	1.55E-7	6.47E-8	1.81E-7	2.13E-7	5.64E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.44E-10	1.20E-8	5.72E-8	2.23E-12	2.26E-9	1.96E-8	7.99E-12	-1.83E-8	-2.73E-8
IRP	[kBq U235-Eq.]	1.46E-1	6.49E-2	7.45E-2	1.72E-1	3.85E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.68E-3	1.14E-2	5.42E-2	6.94E-6	2.17E-3	1.39E-2	2.95E-6	-2.84E-2	-3.49E-2
ETP-fw	[CTUe]	5.94E+1	1.17E+1	3.06E+1	3.13E+1	1.60E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.33E-1	2.08E+0	9.93E+0	1.90E-3	5.47E-1	2.03E+0	1.52E-3	-6.01E+0	-9.81E+0
HTP-c	[CTUh]	2.47E-9	3.76E-10	1.54E-9	8.07E-10	4.01E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.44E-12	5.86E-11	2.79E-10	5.93E-14	1.72E-11	4.85E-11	8.70E-14	-6.02E-10	-6.52E-10
HTP-nc	[CTUh]	6.32E-8	1.24E-8	2.49E-8	3.52E-8	1.99E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.17E-10	2.27E-9	1.08E-8	1.75E-12	5.00E-10	1.31E-9	1.06E-12	-6.15E-9	-7.09E-9
SQP	[-]	1.44E+2	9.25E+0	2.36E+2	3.92E+1	2.40E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.75E-2	1.79E+0	8.55E+0	1.65E-3	4.40E-1	6.38E+0	1.18E-3	-8.25E+1	-8.37E+1

Caption	PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

6. LCA: Interpretation

The results show the contribution of the various steps in the life cycle, per environmental impact category, for 1 m2 of Cedral sidings produced in Akmene. Te raw materials used in the formulation mix have the highest contribution on most impact categories followed by the transportation of the final product, the production process of Cedral siding, the installation and the transport of the raw materials, depending on the impact category. Outside the system boundaries, module D shows benefits from the energy recovery and recycling processes which are related to packaging materials for Cedral sidings. For the additional end-of-life scenario (Scenario B) module D also takes the benefits from recycling of the fiber cement board itself into account.

7. Requisite evidence

7.1 Radioactivity

Not measured

7.2 Leaching

No leaching test was done since 2020 at Akmene due to the changed Lithuanian legal acts

7.3 VOC emissions

Not applicable as Cedral sidings are designed for external applications

AgBB overview of results (28 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	-	µg/m³
Sum SVOC (C16 - C22)	-	µg/m³

R (dimensionless)	-	-
VOC without NIK	-	µg/m³
Carcinogenic Substances	-	µg/m³

AgBB overview of results (3 days [µg/m³])

Name	Value	Unit
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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Publisher
Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Programme holder
Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Author of the Life Cycle Assessment
Enperas
Thorpark 8300
3600 Genk
Belgium

Tel +32 3 376 00 19
Fax -
Mail info@enperas.com
Web **https://www.enperas.com/en/**

Owner of the Declaration
Etex Building Performance International
Rue Marcel Demonque 500
84915 Avignon Cedex 9
France

Tel +32 2 778 12 11
Fax +32 2 778 12 12
Mail info@etexgroup.com
Web **http://www.etexgroup.com**