

Unboxing Carbon: The Catalog

Exterior Materials

Version 2024



Unboxing Carbon: The Catalog

Exterior Materials



This graphic collection of architectural materials presents complex data from Environmental Product Declarations (EPDs) in a visually accessible way, and converted into a unit that is readily understandable for architects: by square meter.

The Catalog is intended to give architects the means of assessing global warming potential (GWP) in the product production phases, thereby the means to align projects currently on the drawing boards with the recommendations of climate scientists. This Exterior Catalog complements the Interior Catalog.

The critical window for a serious response to catastrophic climate change is now and the next few years. For this reason, the temporal aspect of carbon emissions, that is, the emissions from the production phase, the up-front carbon, must be the decision driver in the design process. Biogenic materials have the capacity to store carbon until the materials are destroyed, which is reflected in the negative number in the production phases.

The UN's 2023 report, *Building Materials and the Climate: Constructing a New Future* indicates an urgent system-wide transformation is needed to deliver the enormous CO₂e cuts in the construction sector. The report identifies various reduction strategies in the building sector, calling on the built environment sector to learn to design with nature-based processes and to reduce the burdens on the geobiosphere from “extracted”, toxic, non-renewable materials, and to cautiously increase regenerative, renewable and circular materials.

Reduction strategies must include building markedly less new construction, instead focusing on renovation and transformation, and implementing material strategies which prioritize reused products and sufficiency.

Material selection is the realm of the architect and designer. Since material manufacturing processes are directly linked to measurable environmental impacts, the architecture profession must evolve to meet the serious global challenges. Raising the bar of knowledge is essential for architects, a process that Henning Larsen has driven with the Unboxing Carbon Course: a carbon literacy course focusing on material impacts.

The Catalog is a product of the data workshop in the course, which has been conducted internally at Henning Larsen offices, as well as with many other Danish architecture studios.

How to read the data

The Catalog is organized by building component categories and presents the material with the lowest CO₂e impacts per meter squared on the left of the page.

Some categories range over multiple pages. The data is derived from currently valid product-specific or branch organization EPDs available in Northern European databases such as EPD Danmark, EPD Norge, IBU, and International EPD. Each catalog entry lists the source of data; all EPD numbers in this catalog are hyperlinked. The GWP calculations include the CO₂e from life cycle stages A1 to A3 (production phases) expressed per one square meter. The thickness of the material is, therefore essential information.

When available in the EPD, the density, the fire rating, and length of life information is also included. Sub-structure, joints and surface treatment are not included in the EPD data, unless noted. Gray entries indicate a recently expired EPD.

Data from transportation to building site (A4), replacements over a building's lifetime (B4) and end-of-state (C3, C4) are not included in these calculations. This is an editorial decision to heighten the understanding that the impacts here and now (production phases) are contributing to current global emissions. Future scenarios based on current waste treatment processes

are necessary for whole building life cycle calculations; however, due to the uncertainty of the future scenarios, this data is less relevant as a basis for material selection.

The current data from timber products is being challenged with the argument that it is not reflective of the actual CO₂ emissions associated with harvesting of trees. Climate data in EPDs does not currently reflect impacts on biodiversity. We encourage the industry and standardization to address these discrepancies, and we look forward to more accurate global warming potential data, particularly for biogenic products.

Climate data is useful; however, judicious use of all resources, whether or not they are renewable is key in this climate and biodiversity emergency.

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Despite efforts to ensure accuracy in reproduction of data and hyperlinks, errors can slip through.

Please let us know at carbon@henninglarsen.com.
Copenhagen, October 2024.

Contents

Facade	5	Roofing	26
Wood Cladding	6	Roof Cladding	27
Natural Stone	8		
Slate	9	Insulation	28
Bricks	10	Bio-based	30
Terra Cotta without Sub-structure	16	Finishes	32
Ceramic Cladding	18	Paint	33
Cement-based Panels	19		
Metal Cladding	22	Appendix	34
Glass Panels	24	Unboxing Carbon: The Course	35
		Acknowledgements	36

Facade

Wood Cladding

Treated Cladding
Bergene Holm



-12.70 kg CO2e

Type: pine and spruce
Thickness: 19 mm
Density: 480 kg/m3
Lifetime: 60 years
Fire rating: D-s2, d0
EPD no: NEPD-1936-857

Painted Cladding
InnTre Kjeldstad



-11.70 kg CO2e

Type: painted spruce
Thickness: 19 mm
Density: 467 kg/m3
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-3279-1921-NO

Pressure Treated Spruce
Bergene Holm AS



-11.50 kg CO2e

Type: cladding
Thickness: 19 mm
Density: 375 kg/m3
Lifetime: 60 years
Fire rating: D-s1, d0
EPD no: NEPD-1935-857-NO

Surface treated once, cladding
Superwood



-11.40 kg CO2e

Type: fully impregnated
Thickness: 21 mm
Density: 436.8 kg/m3
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-3704-2649-EN

Fire Treated Spruce EXT.
Woodify



-10.80 kg CO2e

Type: fire impregnated
Thickness: 19 mm
Density: 465 kg/m3
Lifetime: 60 years
Fire rating: B-s1,d0 if on A2-s1,d0
EPD no: NEPD-3304-1943-NO

Optimum Termowood
Woodify



-10.50 kg CO2e

Type: fire impregnated, modified pine
Thickness: 21 mm
Density: 380 kg/m3
Lifetime: 60 years
Fire rating: B-s1,d0
EPD no: NEPD-1867-805-NO

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Wood Cladding

Fire treated cladding
Superwood



-9.33 kg CO2e

Type: fire impregnated
Thickness: 21 mm
Density: 436.8 kg/m3
Lifetime: 60 years
Fire rating: B-s2, d0
EPD no: NEPD-6472-5735-EN

Thermo Treated Cladding
Frøslev



-8.82 kg CO2e

Type: NZ Abodo wood cladding
Thickness: 20 mm
Density: 420 kg/m3
Lifetime: not listed
Fire rating: D-s1, d0
EPD no: MD-20032-EN

Fire Treated Heatwood Pine
Woodify



-8.80 kg CO2e

Type: fire impregnated cladding
Thickness: 19 mm
Density: 553 kg/m3
Lifetime: 60 years
Fire rating: B-s1,d0 if on A2-s1,d0
EPD no: NEPD-3299-1942-NO

Bamboo X-treme
Moso



-7.43 kg CO2e

Type: bamboo cladding, unfinished
Thickness: 18 mm
Density: 1150 kg/m3
Lifetime: 25 years
Fire rating: B-s1, d0
EPD no: EPD-NIBE-20210625-20247

Embla ThermoWood,
Frøslev



-6.96 kg CO2e

Type: scotts pine and Norway spruce
Thickness: 20 mm
Density: 430 kg/m3
Lifetime: not listed
Fire rating: D-s1, d0
EPD no: MD-20033-EN

Termofuru
Moelven



-5.16 kg CO2e

Type: water and fire impregnated pine
Thickness: 20 mm
Density: 435 kg/m3
Lifetime: 60 years
Fire rating: B-s1/2, d0
EPD no: NEPD-2554-1285-NO

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Natural Stone

Granite G386
Asker og Bærum Steinimport



3.62 kg CO2e

Type: natural granite from China
Thickness: 30 mm
Density: 78.6 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-6197-5461-NO

Semi-rijo, Pelsparite Limestone
Solancis, S.A.



4.52 kg CO2e

Type: Portuguese Branco Real, etc.
Thickness: 30 mm
Density: 70.5 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: DAP 001:2022

Pelsparite Limestone
Solancis



5.42 kg CO2e

Type: natural limestone
Thickness: 30 mm
Density: 75.0 kg/m2
Lifetime: years
Fire rating: A1
EPD no: DAP 002:2022

Limestone
Portland Stone firms



18.51 kg CO2e

Type: natural stone from the UK
Thickness: 30 mm
Density: 69.0 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: BREG EN_000389

Finnish Natural Stone
Kivi Ry (FI market average)



25.27 kg CO2e

Type: facade cladding
Thickness: 30 mm
Density: 81.0 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: EPD-RTS_56_20

Granite
Campolonghi



40.00 kg CO2e

Type:
Thickness: 30 mm
Density: not listed
Lifetime: 50 years
Fire rating: not listed
EPD no: S-P-04298

See also Henning Larsen's [Naturstens Klimapåvirkning](#)

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

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Slate

Offerdal
Minera Skifer



4.04 kg CO2e

Type: natural stone quartzite schist, natural cleft surface
Thickness: 30 mm
Density: 81.97 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-1584-609-EN

Oppdal
Minera Skifer



6.97 kg CO2e

Type: natural stone quartzite schist, natural cleft w broken edges
Thickness: 30 mm
Density: 81 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-2907-1588-EN

Oppdal
Minera Skifer



8.83 kg CO2e

Type: natural stone quartzite schist, natural cleft w sawn edges
Thickness: 30 mm
Density: 81 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-2907-1588-NO

Natural Stone Slate
Altaskifer



15.85 kg CO2e

Type: slate w sawn edges, no calibration
Thickness: 50 mm
Density: 135.5 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-1673-671-NO

Finnish Slate Facade Stone
Kivi ry



16.57 kg CO2e

Type: facade & outdoor pavement, FI market average
Thickness: 80 mm
Density: 216 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: RTS_57_20

Otta
Minera Skifer



23.88 kg CO2e

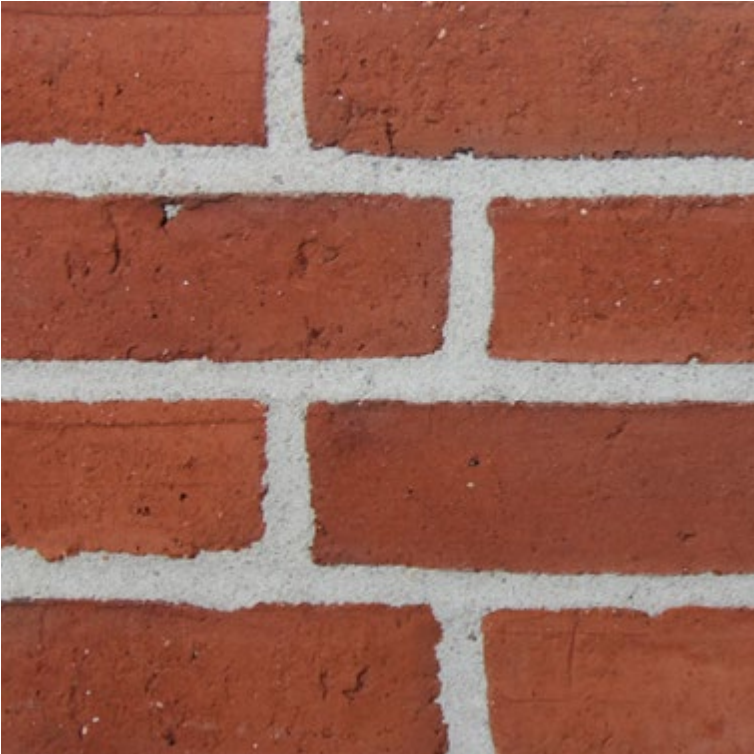
Type: natural stone phyllite schist, sawn/cut edge, calibrated
Thickness: 20 mm
Density: 56.18 kg/m2
Lifetime: 60 years
Fire rating: not listed
EPD no: NEPD-1585-609-EN

See also Henning Larsen's [Naturstens Klimapåvirkning](#)

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

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Bricks

Used Bricks Gamle Mursten  1.5 kg CO2e Type: used bricks (whole and half) Thickness: 108 mm Density: 1650 kg/m3 Lifetime: 50 years Fire rating: not listed EPD no: MD-23003-EN_rev2	Red Brick, Egernsund Wienerberger  10.7 kg CO2e Type: biogas without Mn-oxide Thickness: 108 mm Density: 1450 kg/m3 Lifetime: 150 years Fire rating: not listed EPD no: MD-22001-EN	LESS Red Brick, Egernsund Wienerberger  11.9 kg CO2e Type: biogas without Mn-oxide Thickness: 108 mm Density: 1438 kg/m3 Lifetime: 150 years Fire rating: not listed EPD no: MD-21027-EN	Greener Red Brick Randers Tegl  13.2 kg CO2e Type: biogas Thickness: 108 mm Density: 1620 kg/m3 Lifetime: 150 years Fire rating: not listed EPD no: MD-21001-EN	Red Brick Matzen Tegl  15.9 kg CO2e Type: biogas Thickness: 108 mm Density: 1600 kg/m3 Lifetime: 150 years Fire rating: not listed EPD no: MD-21012-EN	Red Brick, Egernsund Wienerberger  16.0 kg CO2e Type: biogas Thickness: 120 mm Density: 1750 kg/m3 Lifetime: 150 years Fire rating: not listed EPD no: MD-22023-EN
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Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bricks

Rose Brick, Egersund
Wienerberger



17.5 kg CO2e

Type: biogas, red-/yellow-firing clay
Thickness: 108 mm
Density: 1775 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21059-EN

LESS Red Brick , Egersund
Wienerberger



18.3 kg CO2e

Type: biogas
Thickness: 108 mm
Density: 1598 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21028-EN

“Greener” Red Brick
Randers Tegl



18.8 kg CO2e

Type: biogas w iron oxide
Thickness: 108 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21053-EN

“Greener” Red Brick
Randers Tegl



19.1 kg CO2e

Type: biogas w Mn-oxide
Thickness: 108 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: D-s1, d0 with no air gap
EPD no: MD-21052-EN

“Greener” Rose Brick
Randers Tegl



19.6 kg CO2e

Type: biogas, red-/yellow-firing clay
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: D-s1, d0 with no air gap
EPD no: MD-21055-EN

Brown Brick, Egersund
Wienerberger



20.4 kg CO2e

Type: red-firing clay w Mn-oxide
Thickness: 110 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: D-s1, d0 with no air gap
EPD no: MD-22024-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bricks

Yellow Brick, Egersund
Wienerberger



21.7 kg CO2e

Type: biogas, red- and yellow clay
Thickness: 108 mm
Density: 1650 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-22004-EN

“Greener” Yellow Brick
Randers Tegl



23.5 kg CO2e

Type: biogas, yellow-firing clay
Thickness: 108 mm
Density: 1700 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21054-EN

LESS Yellow Brick,
Egersund Wienerberger



23.6 kg CO2e

Type: biogas, red and yellow clay
Thickness: 108 mm
Density: 1525 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21062-EN

“Greener” Rosé Brick
Randers Tegl



23.9 kg CO2e

Type: biogas, red and yellow clay
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21003-EN

Red Brick, Egersund
Wienerberger



24.3 kg CO2e

Type: natural gas, w Mn-oxide
Thickness: 108 mm
Density: 1450 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-22001-EN

LESS Black and Grey-Brown Brick
Egersund Wienerberger



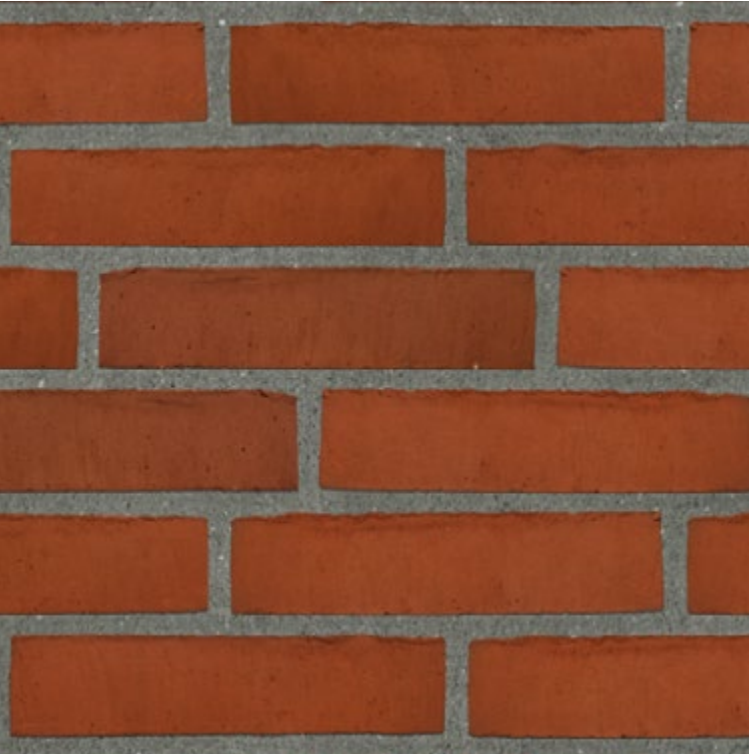
24.5 kg CO2e

Type: biogas, yellow- and red clay
Thickness: 110 mm
Density: 1600 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21064-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bricks

Red Brick
Strøjer Tegl



25.1 kg CO2e

Type: red-firing clay
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21045-EN

LESS Yellow Brick
Egernsund Wienerberger



25.6 kg CO2e

Type: biogas, yellow-firing clay
Thickness: 108 mm
Density: 1463 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21029-EN

Yellow Brick
Egernsund Wienerberger



26.4 kg CO2e

Type: biogas, yellow-/red clay
Thickness: 108 mm
Density: 1712 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21058-EN

Yellow and Sand-Colored Bricks
Egernsund Wienerberger



28.4 kg CO2e

Type: biogas, yellow-/red-firing clay
Thickness: 108 mm
Density: 1625 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-22025-EN

Rosé Brick
Egernsund Wienerberger



30.5 kg CO2e

Type: natural gas, yellow-/red clay
Thickness: 108 mm
Density: 1775 kg/m3
Lifetime: 150 years
Fire rating: D-s2, d0 with no air gap
EPD no: MD-21059-EN

Red Brick
Randers Tegl



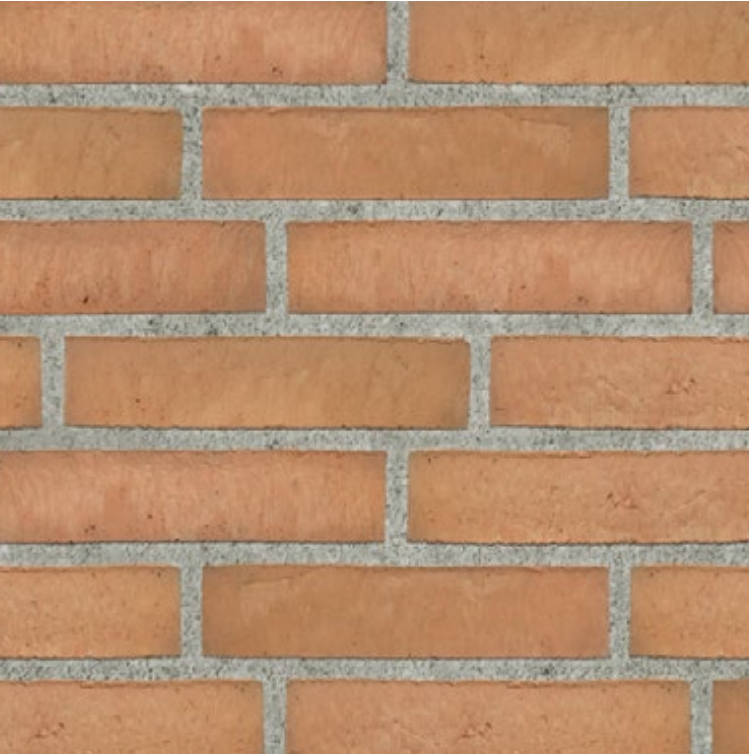
37.2 kg CO2e

Type: red clay with ironoxide
Thickness: 108 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21041-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bricks

Yellow-Red/Rosé Brick
Strøjer Tegl



37.2 kg CO2e

Type: red- and blue-firing clay
Thickness: 108 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21049-EN

Yellow Brick
Egernsund Wienerberger



38.5 kg CO2e

Type: natural gas, red and yellow clay
Thickness: 108 mm
Density: 1650 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-22004-EN

Yellow Brick
Egernsund Wienerberger



40.0 kg CO2e

Type: natural gas, yellow and red clay
Thickness: 108 mm
Density: 1712 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21058-EN

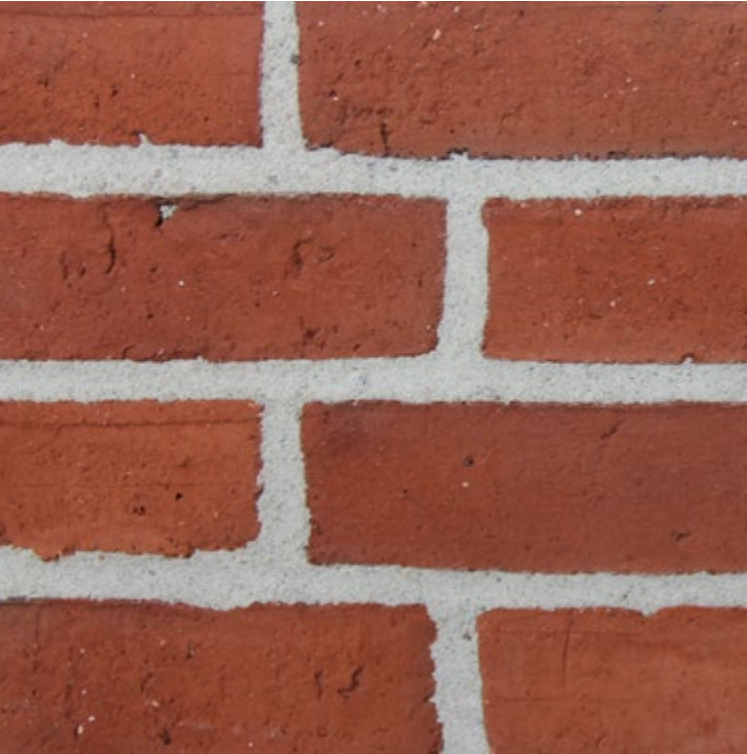
Yellow Brick
Randers Tegl



41.8 kg CO2e

Type: yellow-firing clay from Vindø
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-20030-EN

Red Brick
Branch Assoc.in Germany



45.0 kg CO2e

Type: facing bricks
Thickness: 115 mm
Density: 1530 kg/m3
Lifetime: 150 years
Fire rating: D-s2, d0 with no air gap
EPD no: EPD-ZWM-20210148-ICG1-EN

Yellow Brick
Matzen Tegl



47.8 kg CO2e

Type: yellow bricks
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-20043-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bricks

Yellow Brick
Matzen Tegl



50.1 kg CO2e

Type: yellow-firing clay
Thickness: 108 mm
Density: 1600 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-20044-EN

‘Red’ Subdued Brick
Strøjer Tegl



53.1 kg CO2e

Type: red-firing clay
Thickness: 108 mm
Density: 1800 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21046-EN

D-brick
Petersen Tegl A/S



59.7 kg CO2e

Type: German and British clay
Thickness: 108 mm
Density: 1825 kg/m3
Lifetime: 150 years
Fire rating: D-s2, d0 with no air gap
EPD no: MD-19006-EN

‘Yellow’ Subdued Brick
Strøjer Tegl



64.1 kg CO2e

Type: blue- and red-firing clay
Thickness: 108 mm
Density: 1700 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21048-EN

‘Yellow-Red/Rosé’ Subdued Brick
Strøjer Tegl



65.2 kg CO2e

Type: blue- and red-firing clay
Thickness: 108 mm
Density: 1750 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21050-EN

Black Kolumba Brick
Petersen Tegl A/S



105.1 kg CO2e

Type: gas fired
Thickness: 108 mm
Density: 1825 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-19006-EN_rev1

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Terra Cotta without Sub-structure

Colosseum Nordic
Komproment



9.6 kg CO2e

Type: fired clay tiles - Nordic Red
Thickness: 17/35 mm
Density: 43.0 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21020-EN

Urban T
ZZ Wancor



11.8 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 41.7 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Kolumba and Cover
Petersen Tegl A/S



11.9 kg CO2e

Type: gas fired and biogas
Thickness: 37 mm
Density: 1825 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21085-EN

Urban L
ZZ Wancor



13.6 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 47.7 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Urban U
ZZ Wancor



16.0 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 54.4 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Pantheon Nordic
Komproment



21.5 kg CO2e

Type: fired clay tiles - Peat Black
Thickness: 17/35 mm
Density: 46.6 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21020-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Terra Cotta without Sub-structure

Colosseum Nordic
Komproment



9.6 kg CO2e

Type: fired clay tiles - Nordic Red
Thickness: 17/35 mm
Density: 43.0 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21020-EN

Urban T
ZZ Wancor



11.8 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 41.7 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Urban L
ZZ Wancor



13.6 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 47.7 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Urban U
ZZ Wancor



16.0 kg CO2e

Type: red facade tile
Thickness: 19 mm
Density: 54.4 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: EPD-ZZW-20200283-CBB1

Pantheon Nordic
Komproment



21.5 kg CO2e

Type: fired clay tiles - Peat Black
Thickness: 17/35 mm
Density: 46.6 kg/m2
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-21020-EN

Cover
Petersen Tegl A/S



34.2 kg CO2e

Type: German and British clay
Thickness: 18/37 mm
Density: 1825 kg/m3
Lifetime: 150 years
Fire rating: not listed
EPD no: MD-19006-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Ceramic Cladding

Without sub-structure

Xtone Large Format
Urbatek, Porcelanosa Grupo



16.20 kg CO2e

Type: porcelain stoneware
Thickness: 6 mm
Density: 14,1 kg/m2
Lifetime: 50 years
Fire rating: A1FL/A1
EPD no: S-P-02909

Glazed & Unglazed
Tempio (Spain)



24.90 kg CO2e

Type: stoneware extruded facade tile
Thickness: not listed
Density: not listed
Lifetime: 50 years
Fire rating: A1FL/A1
EPD no: S-P-05854

Xtone Large Format
Urbatek, Porcelanosa Grupo



47.10 kg CO2e

Type: porcelain stoneware
Thickness: 20 mm
Density: 51.6 kg/m2
Lifetime: 50 years
Fire rating: A1FL/A1
EPD no: S-P-02909

Including sub-structure

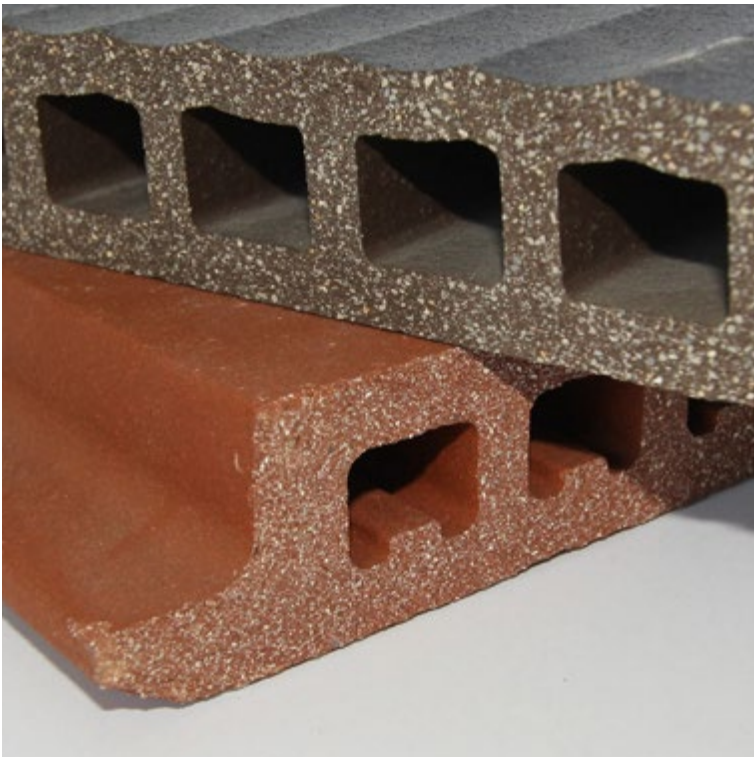
Ceramic Facade
Tonality



18.5 kg CO2e

Type: panels with substructure
Thickness: 60 mm
Density: 34.52 kg/m2
Lifetime: 50 years
Fire rating: A1
EPD no: NEPD-6708-6035-EN

Terrart-light 28
NBK Keramik



40.1 kg CO2e

Type: with aluminium substructure
Thickness: 28 mm
Density: 41.4 kg/m2
Lifetime: 50 years
Fire rating: -
EPD no: EPD-NBK-20240022-CBA1-EN

Ceramic Facade
Argeton

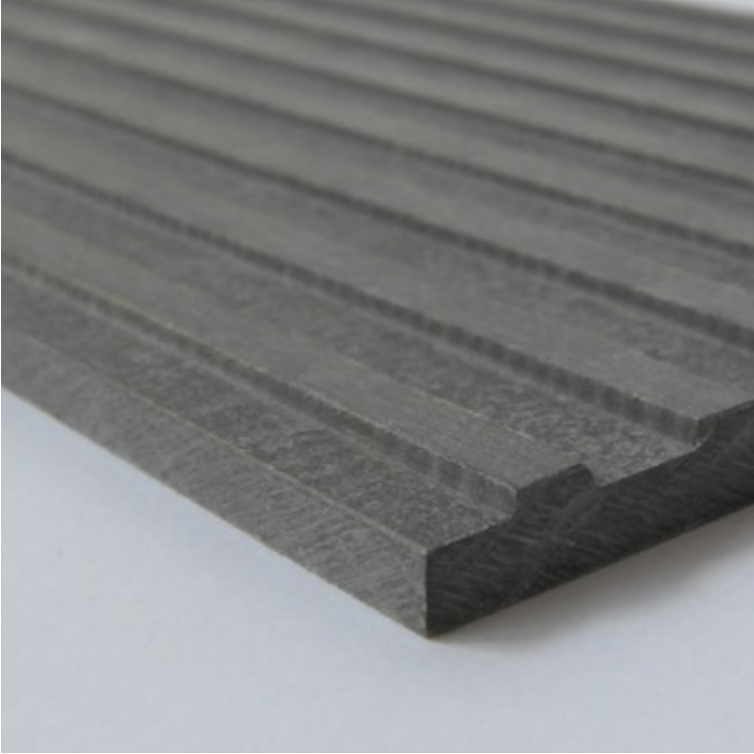
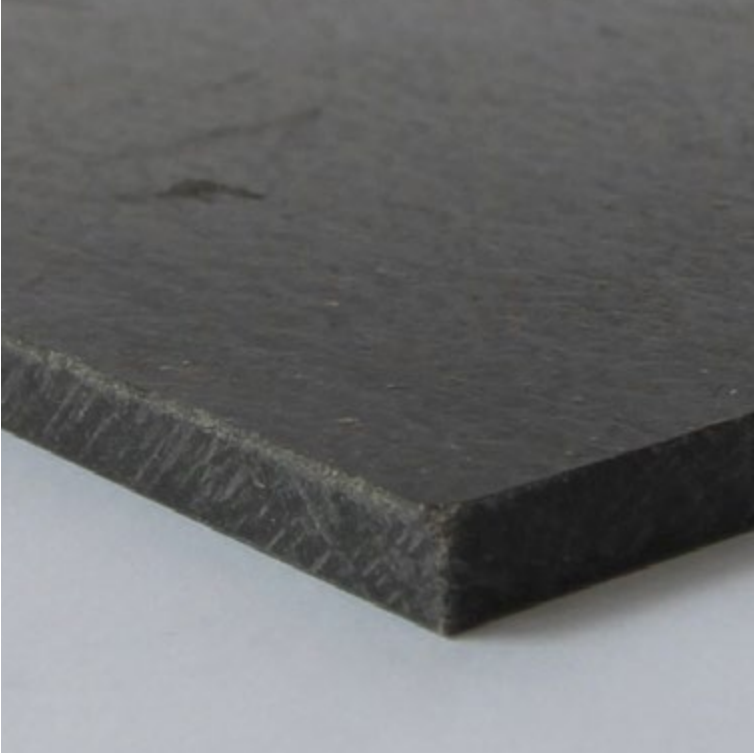
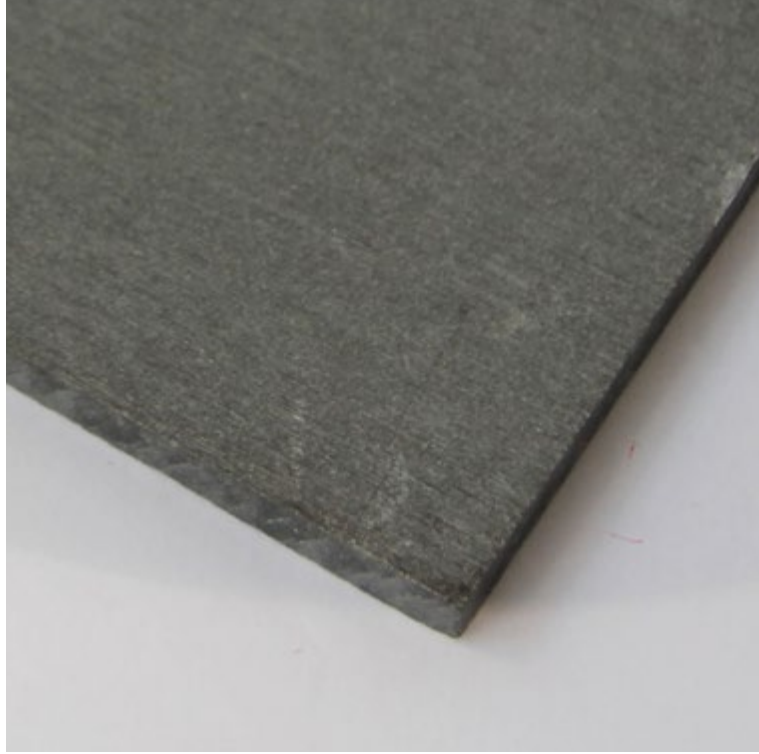


43.3 kg CO2e

Type: elements with substructure
Thickness: 24 mm
Density: 40.57 kg/m2
Lifetime: 50 years
Fire rating: A1
EPD no: EPD-WIN-20140143-ICA2

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Cement-based Panels

Hardie Plank James Hardie  7.17 kg CO2e Type: fiber cement panels Thickness: 8 mm Density: 11.2 kg/m2 Lifetime: 50 years Fire rating: A2-s1,d0 EPD no: S-P-10860	Hardie Panel James Hardie  8.94 kg CO2e Type: fiber cement panel Thickness: 8 mm Density: 11.2 kg/m2 Lifetime: 50 years Fire rating: A2-s1,d0 EPD no: S-P-01432	Linea & Lunara Equitone  9.79 kg CO2e Type: fiber cement panels Thickness: 10 mm Density: 15.8 kg/m2 Lifetime: 50 years Fire rating: A2-s1, d0 EPD no: EPD-ETE-20190128-CCA1	Deco Cembrit  10.00 kg CO2e Type: fiber cement panels Thickness: 8 mm Density: 11.7 kg/m2 Lifetime: 50 years Fire rating: A2-s1,d0 EPD no: MD-20045-EN_rev2	Patina Rough Cembrit  10.20 kg CO2e Type: fiber cement panels Thickness: 8 mm Density: 11.7 kg/m2 Lifetime: 50 years Fire rating: A2-s1,d0 EPD no: MD-20045-EN_rev2	Patina Incline Cembrit  10.70 kg CO2e Type: fiber cement panels Thickness: 8 mm Density: 11.9 kg/m2 Lifetime: 50 years Fire rating: A2-s1,d0 EPD no: MD-20045-EN_rev2
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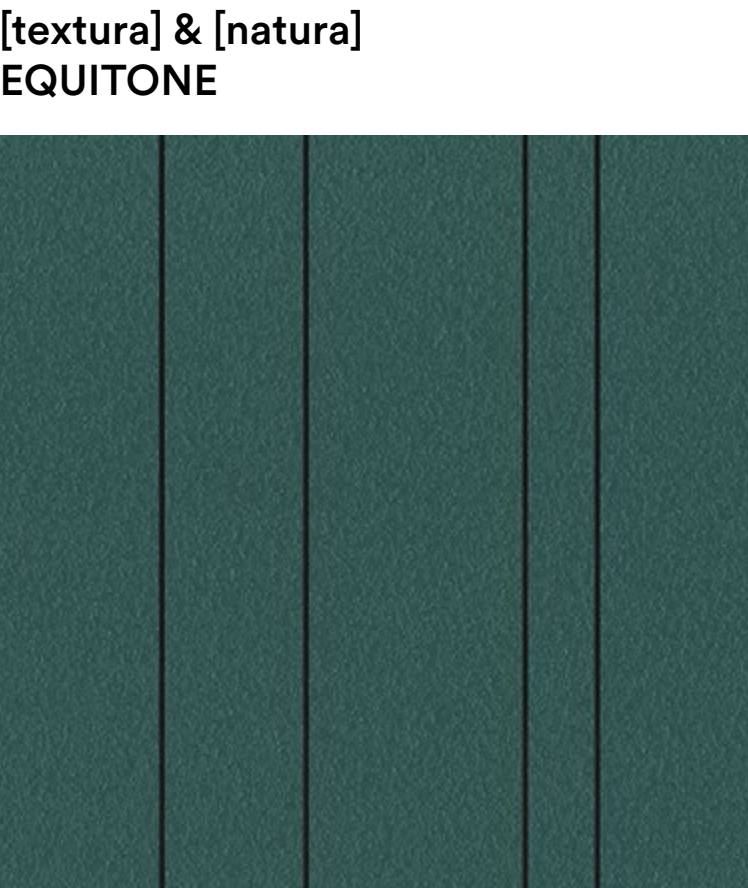
Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Cement-based Panels



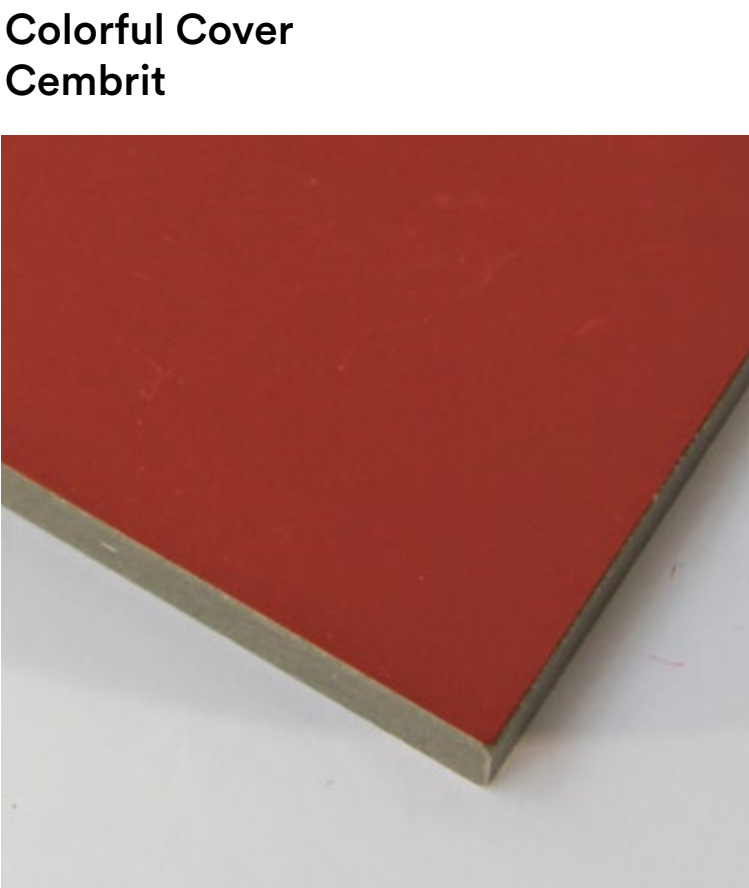
11.80 kg CO2e

Type: fiber cement panels
Thickness: 8 mm
Density: 11.9 kg/m2
Lifetime: 50 years
Fire rating: A2-s1,d0
EPD no: MD-20045-EN_rev2



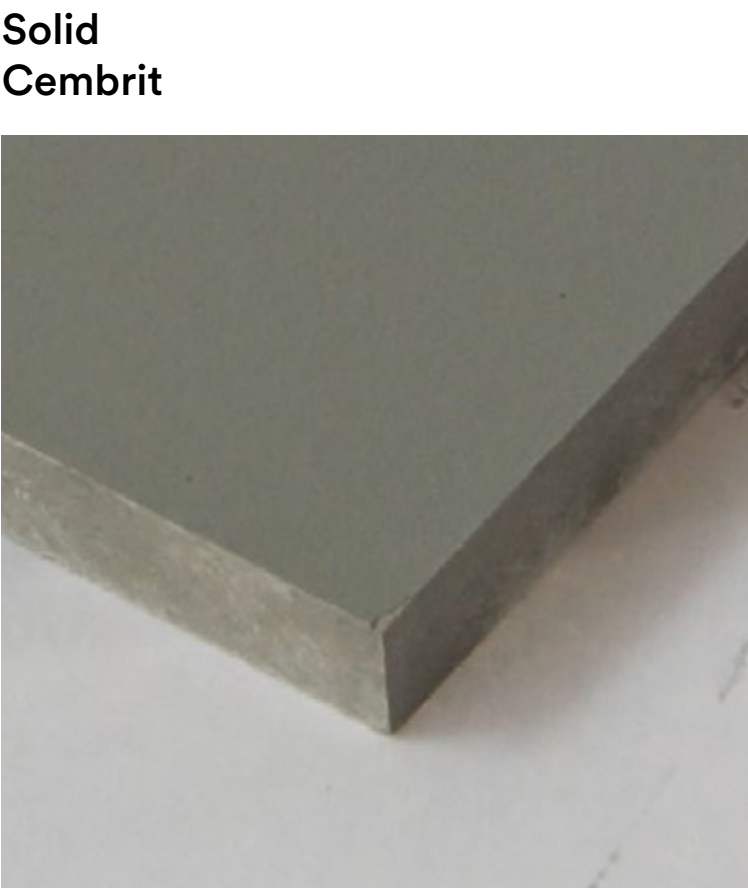
13.96 kg CO2e

Type: fiber cement panels
Thickness: 8 mm
Density: 13.2 kg/m2
Lifetime: 60 years
Fire rating: A2-s1,d0
EPD no: 21-0135-03-00-00-EN



16.10 kg CO2e

Type: fiber cement panels
Thickness: 8 mm
Density: 14.2 kg/m2
Lifetime: 50 years
Fire rating: A2-s1,d0
EPD no: MD-20045-EN_rev2



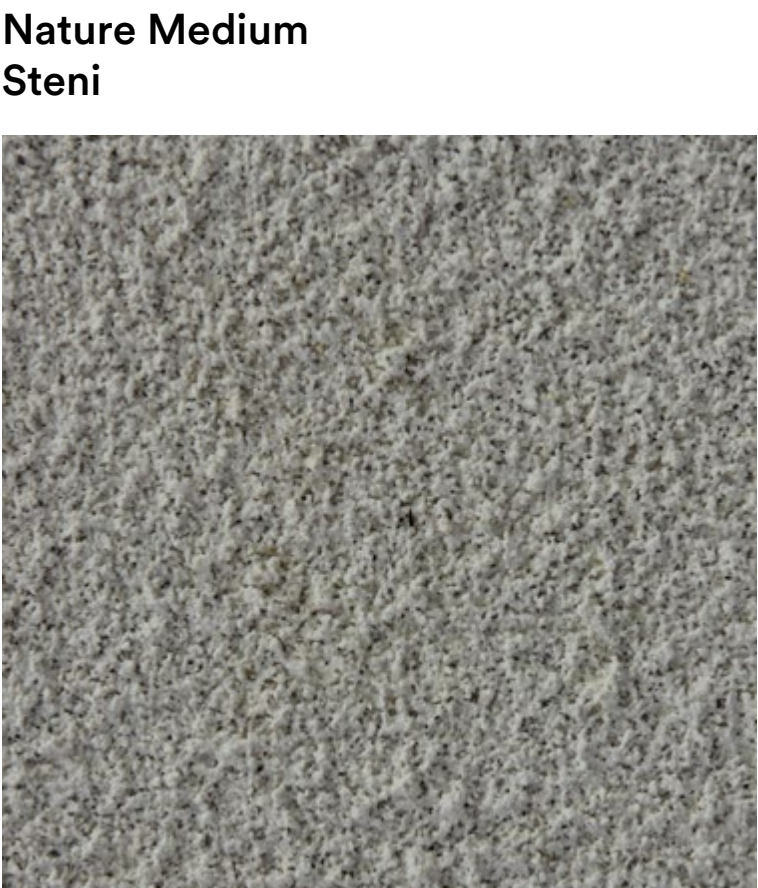
16.20 kg CO2e

Type: fiber cement panels
Thickness: 8 mm
Density: 14.1 kg/m2
Lifetime: 50 years
Fire rating: A2-s1,d0
EPD no: MD-20045-EN_rev2



16.31 kg CO2e

Type: fiber cement panels
Thickness: 8 mm
Density: 14.2 kg/m2
Lifetime: 50 years
Fire rating: A2-s1,d0
EPD no: EPD-ETE-20190179-CCC1



17.30 kg CO2e

Type: stone composite panels
Thickness: 8 mm
Density: 15 kg/m2
Lifetime: 60 years
Fire rating: B-S1,d0
EPD no: NEPD-2580-1307-EN

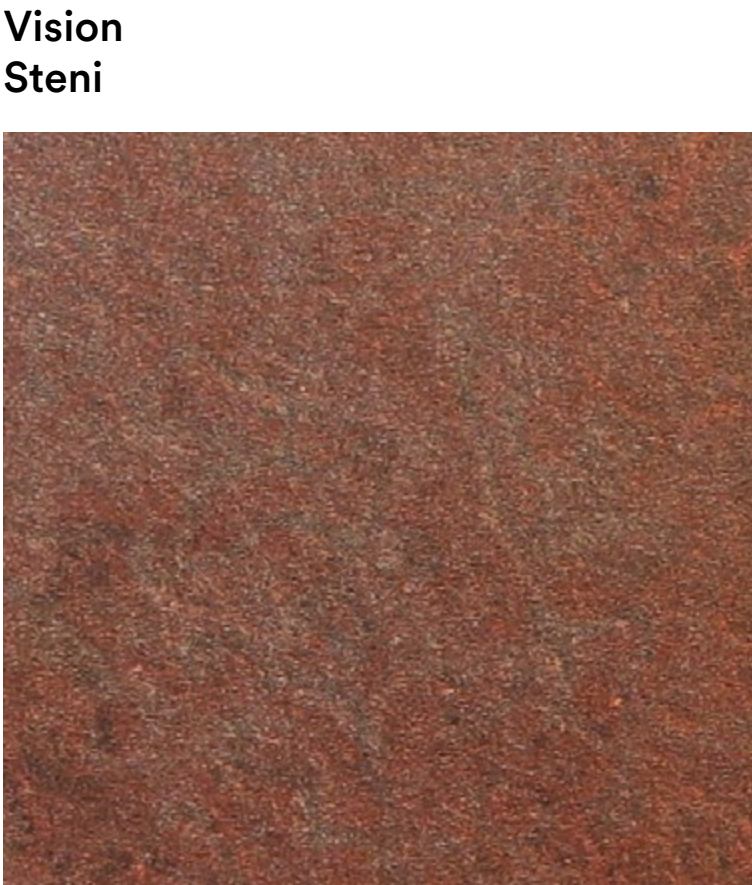
Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Cement-based Panels



17.80 kg CO2e

Type: stone composite panels
Thickness: 12 mm
Density: 12 kg/m2
Lifetime: 60 years
Fire rating: B-S1,d0
EPD no: NEPD-2581-1309-EN



17.90 kg CO2e

Type: stone composite panels
Thickness: 12 mm
Density: 12 kg/m2
Lifetime: 60 years
Fire rating: B-S1,d0
EPD no: NEPD-2657-1361-EN



19.72 kg CO2e

Type: fiberglass reinforced concrete
Thickness: 12 mm
Density: 23.4 kg/m2
Lifetime: 60 years
Fire rating: A2-s1,d0
EPD no: MD-21008-EN



23.40 kg CO2e

Type: natural colored fiber cement
Thickness: 10 mm
Density: 18 kg/m2
Lifetime: 50 years
Fire rating: A1 or A2-s1, d0
EPD no: S-P-03995



26.80 kg CO2e

Type: ventilated stone facade panels
Thickness: 12 mm
Density: 2300 kg/m3
Lifetime: not listed
Fire rating: not listed
EPD no: S-P-07728



35.08 kg CO2e

Type: white cement coated panel
Thickness: 12 mm
Density: 22.2 kg/m2
Lifetime: 50 years
Fire rating: A2-s1,d0
EPD no: EPD-SWP-20180032-IAD1

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Metal Cladding

Copper Cladding Cassettes
Ruuki and Vimpeli



7.74 kg CO2e

Type: all side foldes cassettes
Thickness: 1 mm
Density: 10.8 kg/m2
Lifetime: not listed
Fire rating: Class A1
EPD no: EPD RTS_190_22

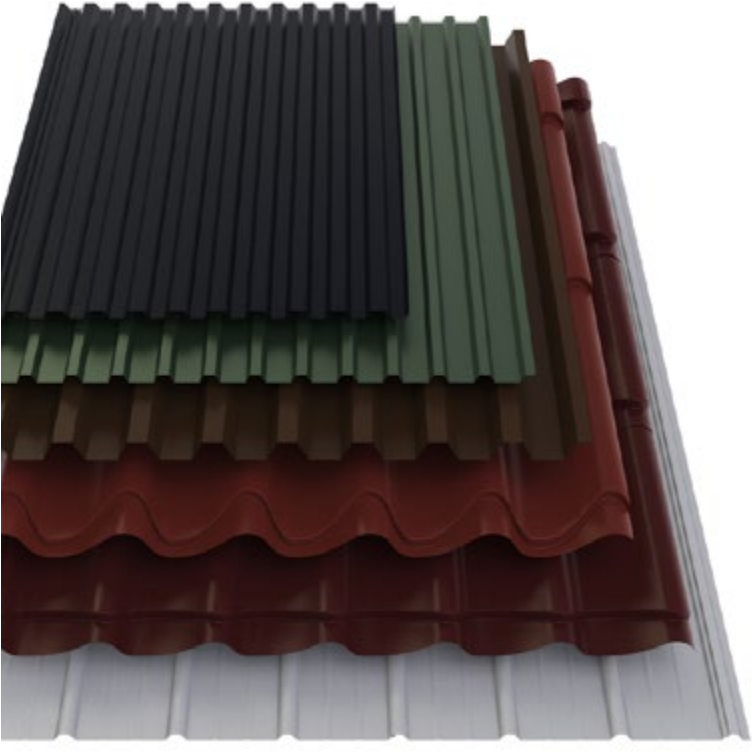
Bronze Cladding Cassettes
Ruuki and Vimpeli



10.50 kg CO2e

Type: all side foldes cassettes
Thickness: 1 mm
Density: 10.5 kg/m2
Lifetime: not listed
Fire rating: Class A1
EPD no: EPD RTS_190_22

LV 30 Profile Sheetting
Lindab



12.90 kg CO2e

Type: precoated steel plates
Thickness: 0.6 mm
Density: 4.68 kg/m2
Lifetime: 60 years
Fire rating: A2-s1,d0
EPD no: NEPD-2814-1511-EN

Coloured Steel Plate
Greencoat



16.50 kg CO2e

Type: steel plates for facade
Thickness: 0.8 mm
Density: 6.28 kg/m2
Lifetime: 50 years
Fire rating: A2-s1, d0
EPD no: S-P-01922

Classic
Rheinzink



17.40 kg CO2e

Type: electrolytic high-grade fine zinc
Thickness: 0.7 mm
Density: 5.70 kg/m2
Lifetime: 50 years
Fire rating: Class A1
EPD no: MD-20034-EN

Brass Cladding Cassettes
Ruuki and Vimpeli



19.00 kg CO2e

Type: all side foldes cassettes
Thickness: 1 mm
Density: 10.5 kg/m2
Lifetime: not listed
Fire rating: Class A1
EPD no: EPD-SWP-20180032-IAD1

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Metal Cladding

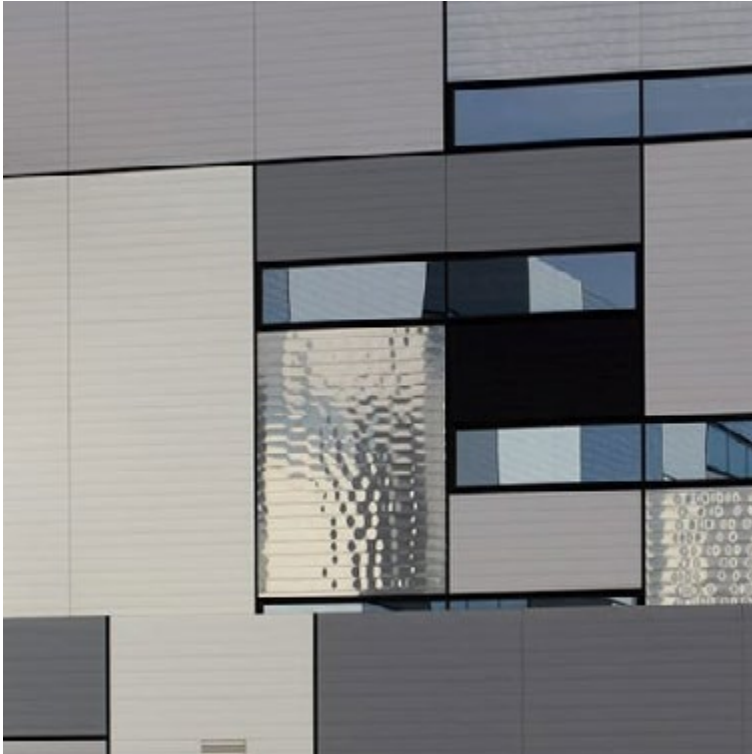
prePATINA
Rhein-zink



15.78 kg CO2e

Type: titanium zinc sheets
Thickness: 0.7 mm
Density: 5.0 kg/m2
Lifetime: 50 years
Fire rating: Class A1
EPD no: EPD-RHE-20230366-IBA1-EN

FC Facade System
Kalzip



16.20 kg CO2e

Type: aluminium facade panels
Thickness: 1 mm
Density: 4.25 kg/m2
Lifetime: 50 years
Fire rating: Class A1
EPD no: EPD-KAL-20230028-IBC1-EN

Classic Bright Rolled
Rhein-zink



21.60 kg CO2e

Type: electrolytic high-grade fine zinc
Thickness: 1 mm
Density: 7.2 kg/m2
Lifetime: 50 years
Fire rating: Class A1
EPD no: EPD-RHE-20230365-IBA1-EN

4mm Bonded Aluminium
Branch Assoc.



26.70 kg CO2e

Type: aluminum with PU core
Thickness: 4 mm
Density: 7.0 kg/m2
Lifetime: 50 years
Fire rating: B-s1,d0
EPD no: EPD-GDA-2019132-IBG1

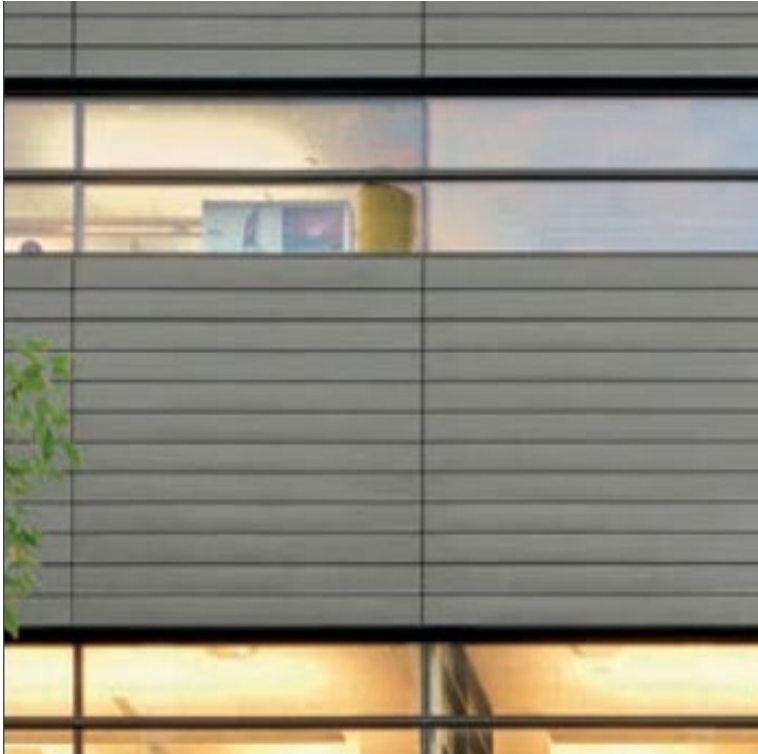
Stainless Steel Cassettes
Ruuki and Vimpeli



38.00 kg CO2e

Type: all side foldes cassettes
Thickness: 1 mm
Density: 9.4 kg/m2
Lifetime: not listed
Fire rating: Class A1
EPD no: EPD RTS_190_22

prePATINA Shipboard Panel
Rhein-zink

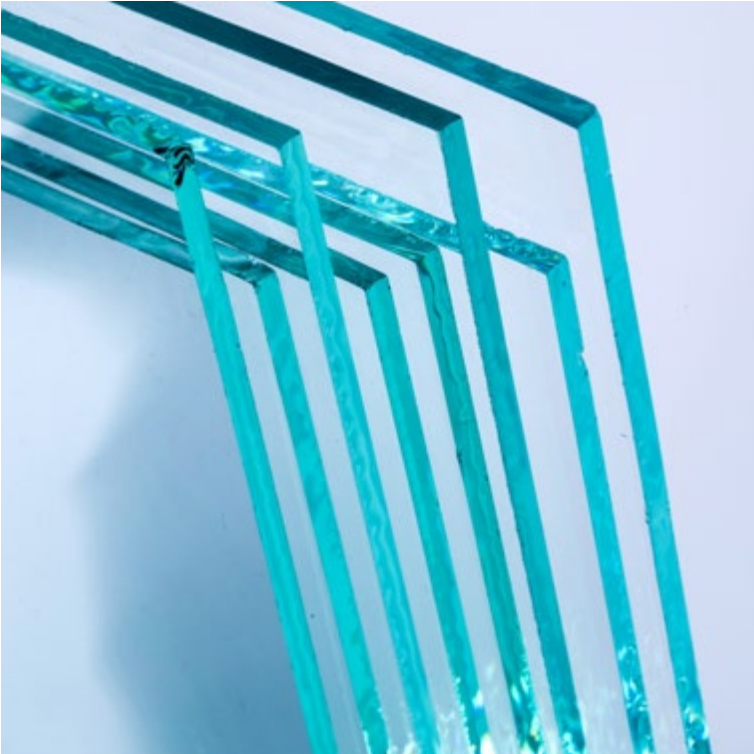
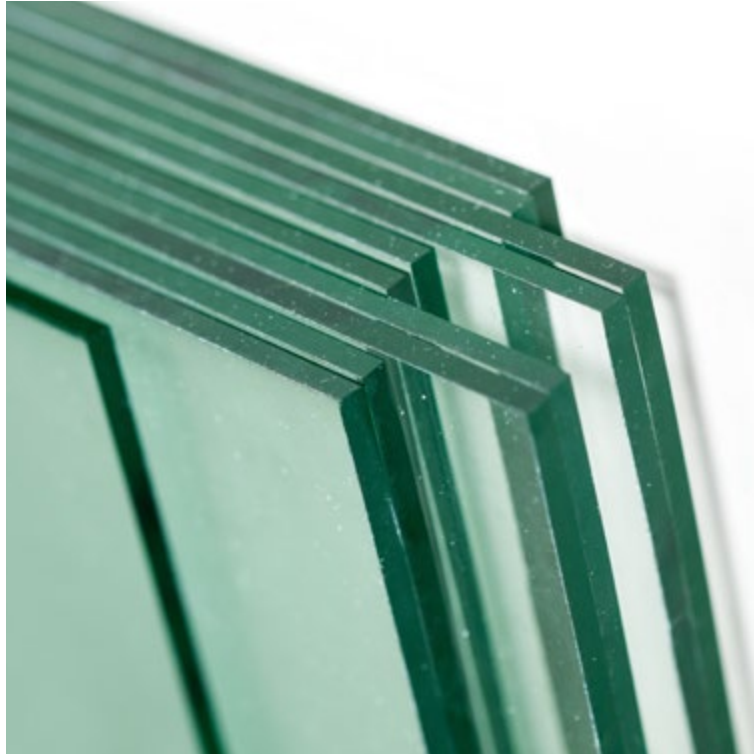


41.50 kg CO2e

Type: titanium zinc sheets
Thickness: 1 mm
Density: 10.4 kg/m2
Lifetime: 50 years
Fire rating: Class A1
EPD no: MD-20035-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

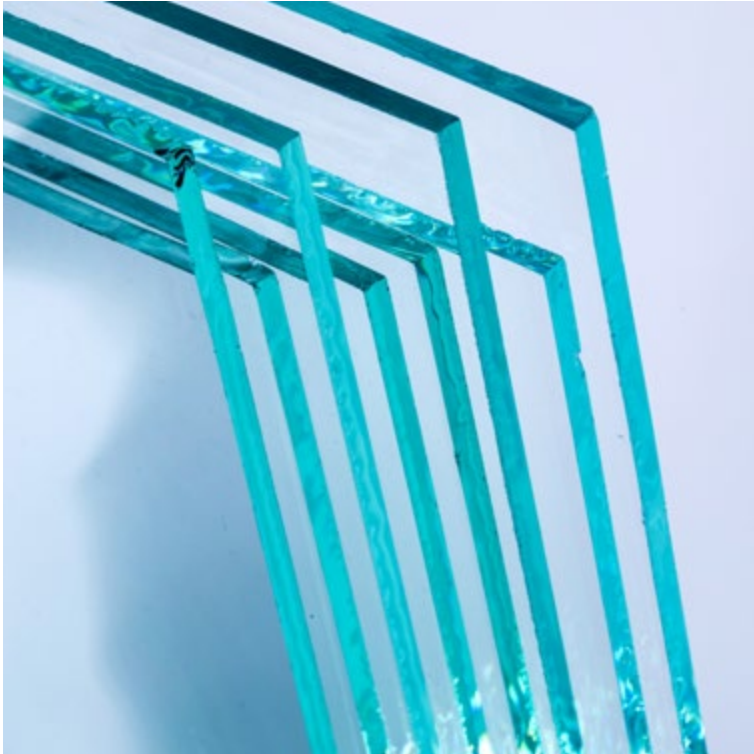
Glass Panels

Uncoated glass Guardian Glass  3.19 kg CO2e Type: uncoated glass Thickness: 2 mm Density: 5 kg/m2 Lifetime: 30 years Fire rating: not listed EPD no: 4791438322.105.1	Laminated glass JSC “Stronglasas”  3.82 kg CO2e Type: laminated glass Thickness: 1 mm Density: 2.5 kg/m2 Lifetime: 30 years Fire rating: not listed EPD no: S-P-10600	Magnetron Saint-Gobain Glass  11.90 kg CO2e Type: coated glass Thickness: 4 mm Density: 10 kg/m2 Lifetime: 30 years Fire rating: not listed EPD no: S-P-00926	Clear Glass Trakya Cam Sanayii  12.20 kg CO2e Type: single float glass Thickness: 4 mm Density: not listed Lifetime: 30 years Fire rating: not listed EPD no: S-P-05129	Securit Saint-Gobain Glass  15.50 kg CO2e Type: thermally toughened safety Thickness: 4 mm Density: 10 kg/m2 Lifetime: 30 years Fire rating: not listed EPD no: S-P-00927	Diamant Saint-Gobain Glass  16.20 kg CO2e Type: thermally toughened Thickness: 4 mm Density: 10 kg/m2 Lifetime: 30 years Fire rating: not listed EPD no: S-P-00927
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Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Glass Panels

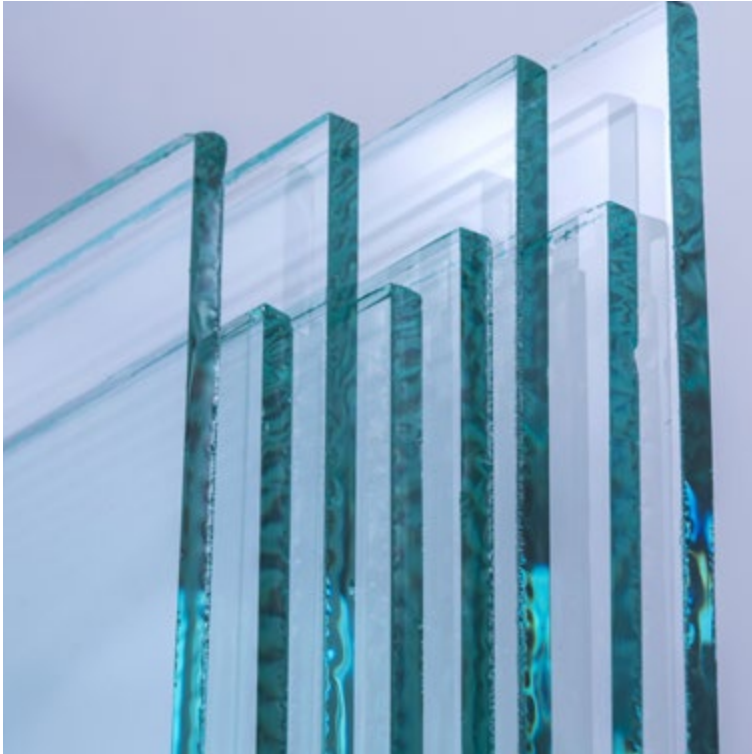
Magneton
Saint-Gobain Glass France



22.8 kg CO2e

Type: coated glass
Thickness: 8 mm
Density: 20 kg/m2
Lifetime: 30 years
Fire rating: not listed
EPD no: S-P-00926

STADIP Protect 33.2
Saint-Gobain Glass



23.1 kg CO2e

Type: laminated safety glass
Thickness: 6.8 mm
Density: not listed
Lifetime: not listed
Fire rating: not listed
EPD no: S-P-00930

Insulating Glass
Cardinal



26.5 kg CO2e

Type: insulating glass
Thickness: 6 mm
Density: 15.6 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: ASTM-EPD149

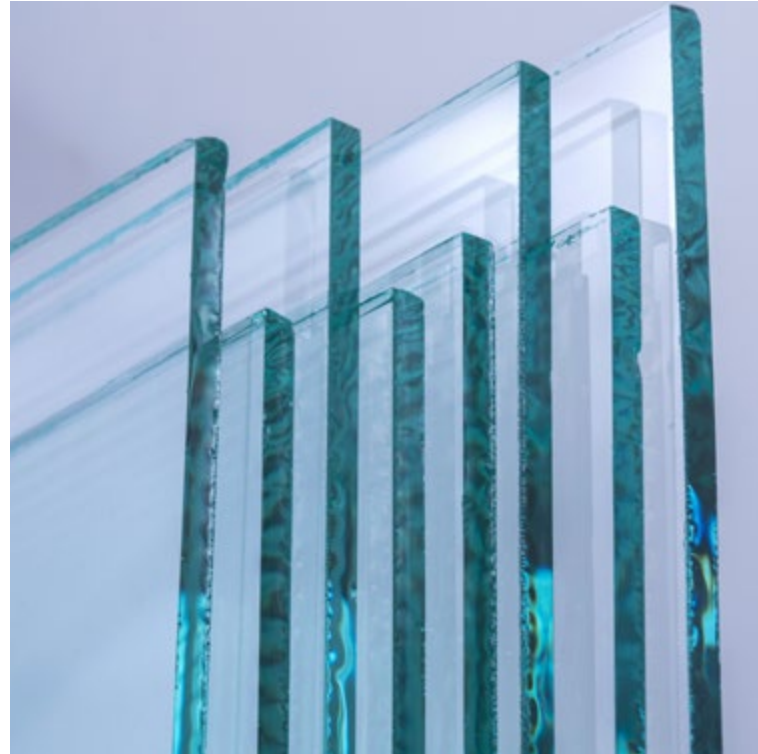
Securit
Saint-Gobain Glass



27.9 kg CO2e

Type: thermally toughened safety
Thickness: 8 mm
Density: 20 kg/m2
Lifetime: 30 years
Fire rating: not listed
EPD no: S-P-00927

STADIP Protect 44,2
Saint-Gobain Glass France



28.6 kg CO2e

Type: laminated safety glass
Thickness: 8.8 mm
Density: not listed
Lifetime: not listed
Fire rating: not listed
EPD no: S-P-00930

Recycled Glass
Magna Glaskeramik



32.9 kg CO2e

Type: recycled translucent glass
Thickness: 21 mm
Density: 52.3 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: EPD-MGK-GB-23.1

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Roofing

Roof Cladding

Danish Reed for Thatched Roof
Thomas Guld



-54.60 kg CO2e

Type: reed for thatched roof (without fastening system)
Thickness: 300 mm
Density: 28.1 kg/m2
Lifetime: 50 years
Fire rating: not listed
EPD no: MD-22113-DA

PTM BituFlex & PTM DuraFlex Kombi
Phønix Tag Materialer



3.48 kg CO2e

Type: 2-layer PTM roofing felt (top- and bottom board)
Thickness: not listed
Density: not listed
Lifetime: 50 years
Fire rating: not listed
EPD no: MD-2009-DA_rev3

Natural Roofing Slate
Average of the Spanish sector



4.01 kg CO2e

Type: natural slate from Spain recommended as roof covering
Thickness: 3-8 mm
Density: 39 kg/m2
Lifetime: 50 years
Fire rating: -
EPD no: dapcons.c-004.105

Double-S
IBF



9.12 kg CO2e

Type: concrete roof tiles laid with lath spacing 340 mm
Thickness: not listed
Density: 41.0 kg/m2
Lifetime: 100 years
Fire rating: not listed
EPD no: MD-22037-DA

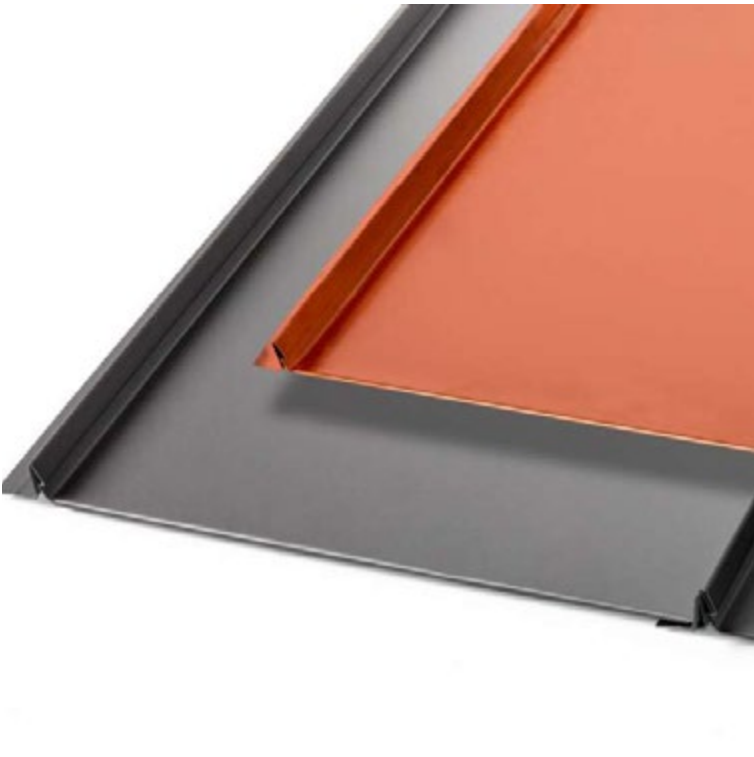
Trapezoidal Sheet
DS Stålprofil



13.59 kg CO2e

Type: trapezoidal sheet 20-115 w polyester surface coating
Thickness: 0.5 mm
Density: 4.7 kg/m2
Lifetime: 25 years
Fire rating: not listed
EPD no: MD-23084-EN

Nordic Click Seam 475
DS Stålprofil



18.72 kg CO2e

Type: nordic click seam sheet w Green-Coat Pro BT Mat surface coating
Thickness: 0.6 mm
Density: 6.5 kg/m2
Lifetime: 25 years
Fire rating: not listed
EPD no: MD-23084-EN

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Insulation

Sandwich Systems

The EcoCocon Panel
EcoCocon



-109.0 kg CO2e

Type: bio-based insulated straw panel
Thickness: 400 mm
U-value: 0.15 W/m2*K
Density: 46.0 kg/m2
Lifetime: 75 years
Fire rating: E
EPD no: EPD-2022-7601

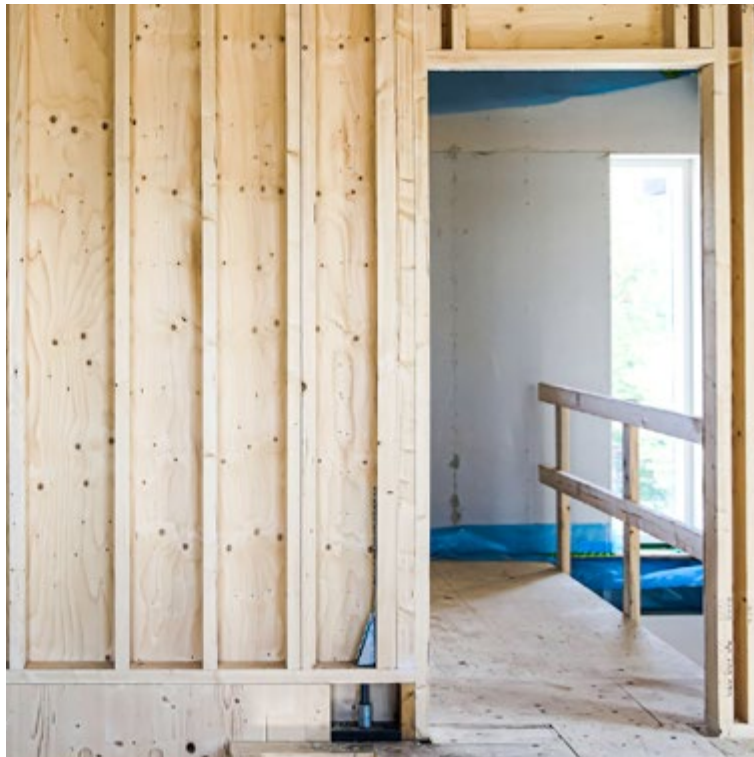
Wooden Facade Element
Leth Beton



-29.6 kg CO2e

Type: wooden panel w fiber gypsum
Thickness: not listed
U-value: not listed
Density: 56.9 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: MD-23085-DA

Prefabricated Facade Element F-2
Taasinge Elements



13.5 kg CO2e

Type: spruce and glass wool panel
Thickness: 323 mm
U-value: not listed
Density: 39.8 kg/m2
Lifetime: not listed
Fire rating: not listed
EPD no: MD-23223-EN_rev1

SPA E Panels
Ruukki



29.5 kg CO2e

Type: steel w mineral wool core
Thickness: 100 mm
U-value: 0.41 W/m2*K
Density: 17.8 kg/m2
Lifetime: 60 years
Fire rating: A2-s1, d0
EPD no: HUB-0519

SPA EE Panels
Ruukki



34.7 kg CO2e

Type: steel w mineral wool core
Thickness: 300 mm
U-value: 0.12 W/m2*K
Density: 30.8 kg/m2
Lifetime: 60 years
Fire rating: A2-s1, d0
EPD no: HUB-0526

SPA E Life Panels
Ruukki



39.9 kg CO2e

Type: steel w mineral wool core
Thickness: 230 mm
U-value: 0.16 W/m2*K
Density: 23.0 kg/m2
Lifetime: 60 years
Fire rating: A2-s1, d0
EPD no: HUB-0492

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Bio-based

R = 8 and U = 0.125

Straw as insulation
UK



-48.20 kg CO2e

Type: straw
Thickness: 416 mm
Density: 41.6 kg/m2
Thermal conductivity: 0.052 W/mK
Lifetime: 75 years
Fire rating: not listed
EPD no: S-P-03854

Gramitherm
Havnens Hænder



-16.30 kg CO2e

Type: grass insulation batts
Thickness: 328 mm
Density: 13.1 kg/m2
Thermal conductivity: 0.041 W/mK
Lifetime: 60 years
Fire rating: Class E
EPD no: MD-24086-DA

Cellulose
THERMOFLOC F



-16.12 kg CO2e

Type: cellulose and wood loose fill
Thickness: 304 mm
Density: 12.2 kg/m2
Thermal conductivity: 0.038 kg/mK
Lifetime: 50 years
Fire rating: B-s2,d0
EPD no: MD-22019-EN

Air-injected insulation
Stecio



-5.47 kg CO2e

Type: wood fibre insulation
Thickness: 304 mm
Density: 13.7 kg/m2
Thermal conductivity: 0.038 W/mK
Lifetime: 50 years
Fire rating: Class E
EPD no: EPD-STE-20200172-IBA1-EN

Cork Panel
L.I.S



-2.10 kg CO2e

Type: cork insulation panels from Italy
Thickness: 344 mm
Density: 56.8 kg/m2
Thermal conductivity: 0.043 kg/mK
Lifetime: not listed
Fire rating: Class B
EPD no: S-P-02315

Flex 036
Stecio



-8.14 kg CO2e

Type: wood fibre cavity insulation
Thickness: 288 mm
Density: 14.4 kg/m2
Thermal conductivity: 0.036 W/mK
Lifetime: 50 years
Fire rating: Class E
EPD no: EPD-STE-20200175-IBA1-EN

Thickness calculations result from defined R- and U-values to allow for comparisons.

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

Mineral-based

R = 8 and U = 0.125

Kretsull
Isover



2.07 kg CO2e

Type: glass wool granulate
Thickness: 296 mm
Density: 11.9 kg/m2
Thermal conductivity: 0.037 W/mK
Lifetime: 60 years
Fire rating: A2-s1-d0
EPD no: NEPD-3287-1931-EN

Stone wool
Rockwool



3.12 kg CO2e

Type: stone wool batts
Thickness: 292 mm
Density: 8.76 kg/m2
Thermal conductivity: 0.037 W/mK
Lifetime: 60 years
Fire rating: A2-s1-d0
EPD no: NEPD-3381-2002-EN

Formstykker
Isover



3.53 kg CO2e

Type: glass wool batts
Thickness: 296 mm
Density: 4.44 kg/m2
Thermal conductivity: 0.037 W/mK
Lifetime: 60 years
Fire rating: A1
EPD no: NEPD-2612-1324-EN

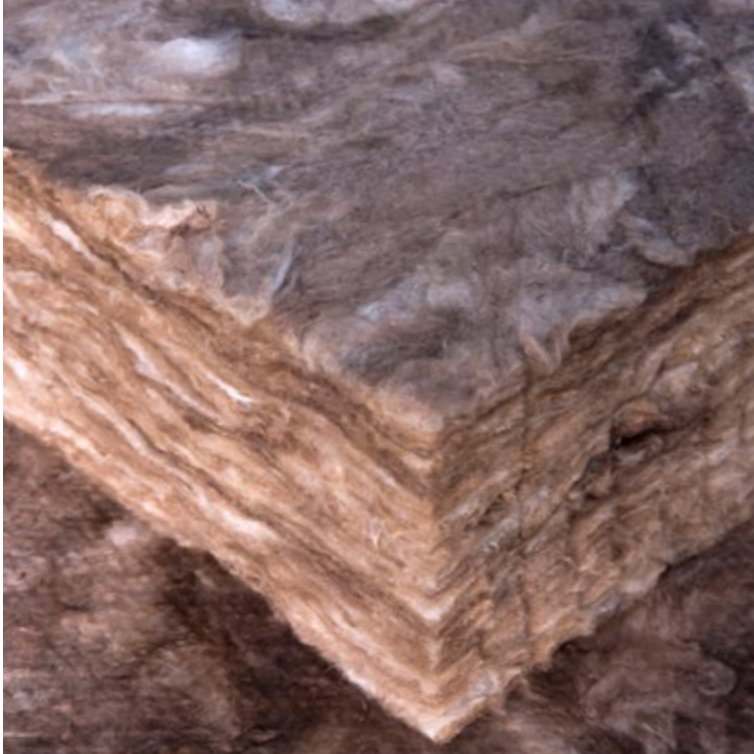
NATURA
Paroc Group



4.74 kg CO2e

Type: stone wool wall insulation
Thickness: 288 mm
Density: 8.0 kg/m2
Thermal conductivity: 0.036 W/mK
Lifetime: 60 years
Fire rating: A1
EPD no: NEPD-2582-1308-EN

Glass wool
Knauf



4.74 kg CO2e

Type: glass wool batts, uncoated
Thickness: 296 mm
Density: 4.4 kg/m2
Thermal conductivity: 0.037 kg/mK
Lifetime: 50 years
Fire rating: A1
EPD no: S-P-01751

Kooltherm K5
Kingspan



12.34 kg CO2e

Type: rigid phenolic foam
Thickness: 160 mm
Density: 5.6 kg/m2
Thermal conductivity: 0.02 kg/mK
Lifetime: not listed
Fire rating: C-s2,d0
EPD no: EPD-KSI-20190072-IBC1-EN

Thickness calculations result from defined R- and U-values to allow for comparisons.

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

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Finishes

Paint

GCS Exterior Premium
Graphenstone



0.22 kg CO2e

Type: non-organic lime binder
Density: 1.40 kg/l
Spreading rate: 6.5 m2/l
Layer(s): 2
EPD no: S-P-01050

Jotashield Ultra Clean
Jotun



0.50 kg CO2e

Type: organic acrylic binder
Density: 1.3 kg/l
Spreading rate: 11 m2/l
Layer(s): 2
EPD no: NEPD-3062-1728

Exterior Silicate Paint
Keim (Market Data)



0.61 kg CO2e

Type: non-organic lime binder
Density: 1.5 kg/l
Spreading rate: 0.38 kg/m2
Layer(s): 2
EPD no: EPD-VDL-KEI-20200170-IBG1

Contour Aqua-PU
Sigma Coatings



0.75 kg CO2e

Type: acrylic polyurethane binder
Density: 1.40 kg/l
Spreading rate: 13 m2/l
Layer(s): 2
EPD no: EPD-PPG-20210123-CBC1

06 Wood Tex Oil Paint W 60
Flügger



0.77 kg CO2e

Type: oil binder
Density: 1.2 kg/l
Spreading rate: 8 m2/l
Layer(s): 2
EPD no: NEPD-2591-1315

Drygolin Nordic Extreme
Jotun



1.49 kg CO2e

Type: binder not listed
Density: 1.23
Spreading rate: 7 m2/l
Layer(s): 2-3
EPD no: NEPD-2405-1208

See also Henning Larsen's [Climate Impacts of Paint Report](#)

Global warming potential of 1 m2
Impacts from production only, A1 - A3
Transport after production and end-of-life not included, C3 - C4
Data from third party verified EPDs valid on July 2024

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Appendix

Unboxing Carbon: The Course



The last decade has seen a wellspring of vocabulary around sustainability emerge and gain prominence. But though we have the language, do we really have the literacy? What exactly is embodied carbon? Do you know your building's carbon footprint? How can you trim that footprint in the design process? And why does it matter in the first place?

Several years ago we launched Unboxing Carbon, a four-hour introductory course providing the knowledge and tools to calculate embodied CO₂ for building materials. The course includes a hands-on "unboxing" of a collection of materials, a tactile workshop to foster discussion about embodied carbon.

The second part focuses on learning to read, understand and work with the data in construction EPDs.

We recommend having both courses combined in a four-hour session. Don't hesitate to reach to us to get a price quote or if you have questions.

We are here to help you at:
carbon@henninglarsen.com

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