

CirCon4Climate



Circular and low-carbon building products

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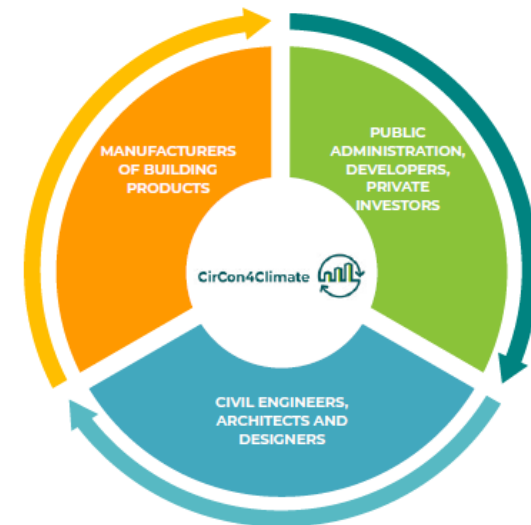
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25 April 2024

The purpose of the Guidelines



- A summary of existing knowledge on low-carbon construction products, and circular economy strategies that can mitigate the environmental impacts of the construction sector,
- We have provided examples of building products that are considered circular and have a relatively low carbon footprint. We have paid particular attention to building products containing recyclates and bio-based building products,
- The guidelines are aimed at architects, manufacturers of construction products, waste managers, regulators and other stakeholders in the construction sector,
- Taking into account the information presented in this guideline, stakeholders can contribute to making the construction sector more environmentally sustainable (meeting climate targets, Paris Agreement).



Definitions



Circular materials

- Designed to be reusable or fully recyclable,
- Additional conditions: recycling must not generate waste or by-products. Circular materials must not contain toxic substances,
- Reuse or recycle locally (circular materials are designed to meet local needs),
- Circular use rate of construction products in the European Union: 12% - 2021 estimate. Great potential for improvement.





Definitions

Low-carbon building products

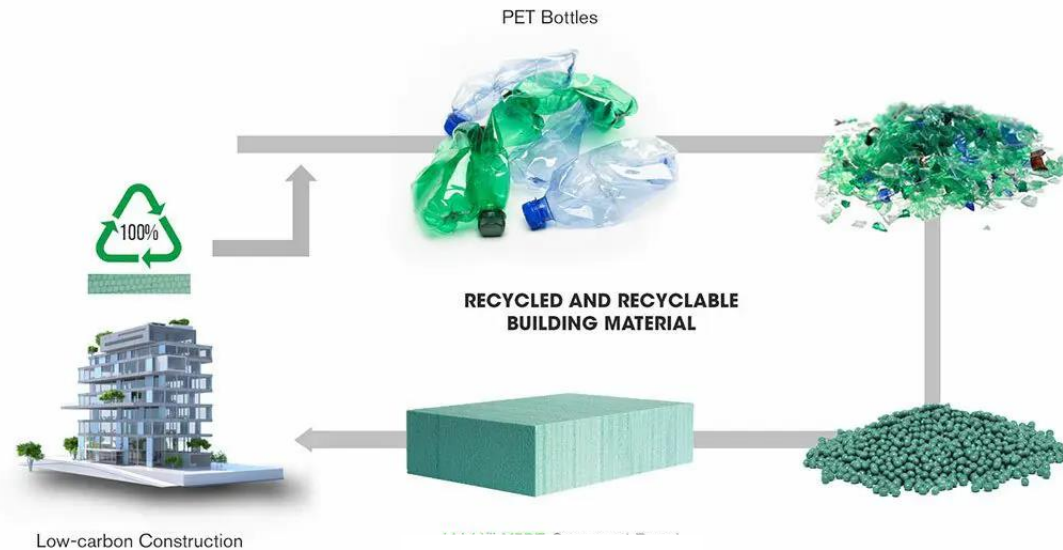
- Produced from feedstocks with low embodied energy (relatively low CO₂ emissions from feedstock mining, transport, production),
- They do not require energy-consuming or otherwise environmentally burdensome processes in the end-of-life management phase (e.g. recycling),
- The global warming potential or carbon footprint is valued in units of kg CO₂ equivalent per quantity/volume/area of the construction product under consideration.



Possible ways to produce low-carbon building products



- Use of alternative materials,
- Use of natural materials,
- Use of secondary raw materials,
- Increasing the use of renewable energy and
- Increase in product capacity/quality.





Use of alternative materials

Greenhouse gas emissions can be reduced by up to 40%.

Production of 1 tonne of cement -> 1 tonne of CO₂ emissions.

The carbon footprint of ready-mixed concrete can be reduced by replacing part of the cement with one of these alternative materials:

- Fly ash (ash from electrostatic or mechanical precipitation of dust particles from the flue gases of a furnace),
- Granulated slag (a by-product of cast iron and steel production, which produces large quantities of slag with pozzolanic properties similar to those of Portland cement),
- Micro-silica (by-product of the production of metallic silicon and iron-silicon alloys in electric arc furnaces).



Use of secondary raw materials (e.g. reused, recycled and waste materials)

Greenhouse gas emissions can be reduced by up to 40%.

- Use of construction and demolition waste - production of ready-mixed concrete using recycled aggregate,
- Using wood from old buildings that are destined for demolition. Raw material for the production of cross-laminated timber,
- Roads built from various recycled materials (asphalt millings, steel slag, etc.).





Use of natural (organic) raw materials

Greenhouse gas emissions can be reduced by up to 90%

- Wood products (structural timber),
- Gypsum/cement particle board,
- Hempcrete.

Use of local raw materials

- Reduced greenhouse gas emissions due to shorter transport distances for raw materials.

Use of renewable energy sources

Greenhouse gas emissions can be reduced by up to 60%.

- Electricity from solar, wind or other renewable energy sources,
- Using waste materials for energy production.

Examples of low-carbon building products



Engineered wood products

- Structural timber
- Chipboard
- Cross-laminated timber
- Glued wood

Use as an alternative to steel structures and concrete floor slabs.

Wood, and many other natural materials, have an inverse carbon footprint, due to the fact that wood contains carbon that is sequestered from the atmosphere by the tree as it grows (known as biomass carbon sequestration).



Health care: attention should be paid to impregnations/coatings and adhesives on wood products



Concrete using secondary materials

- Concrete using recycled aggregate
- Concrete using steel slag
- Concrete using fly ash



Restrictions:

- Recycled aggregate reduces the strength of concrete components, shortening their service life. Use may be limited, depending on quality requirements.
- Leaching of potentially toxic substances (e.g. when using steel slag)

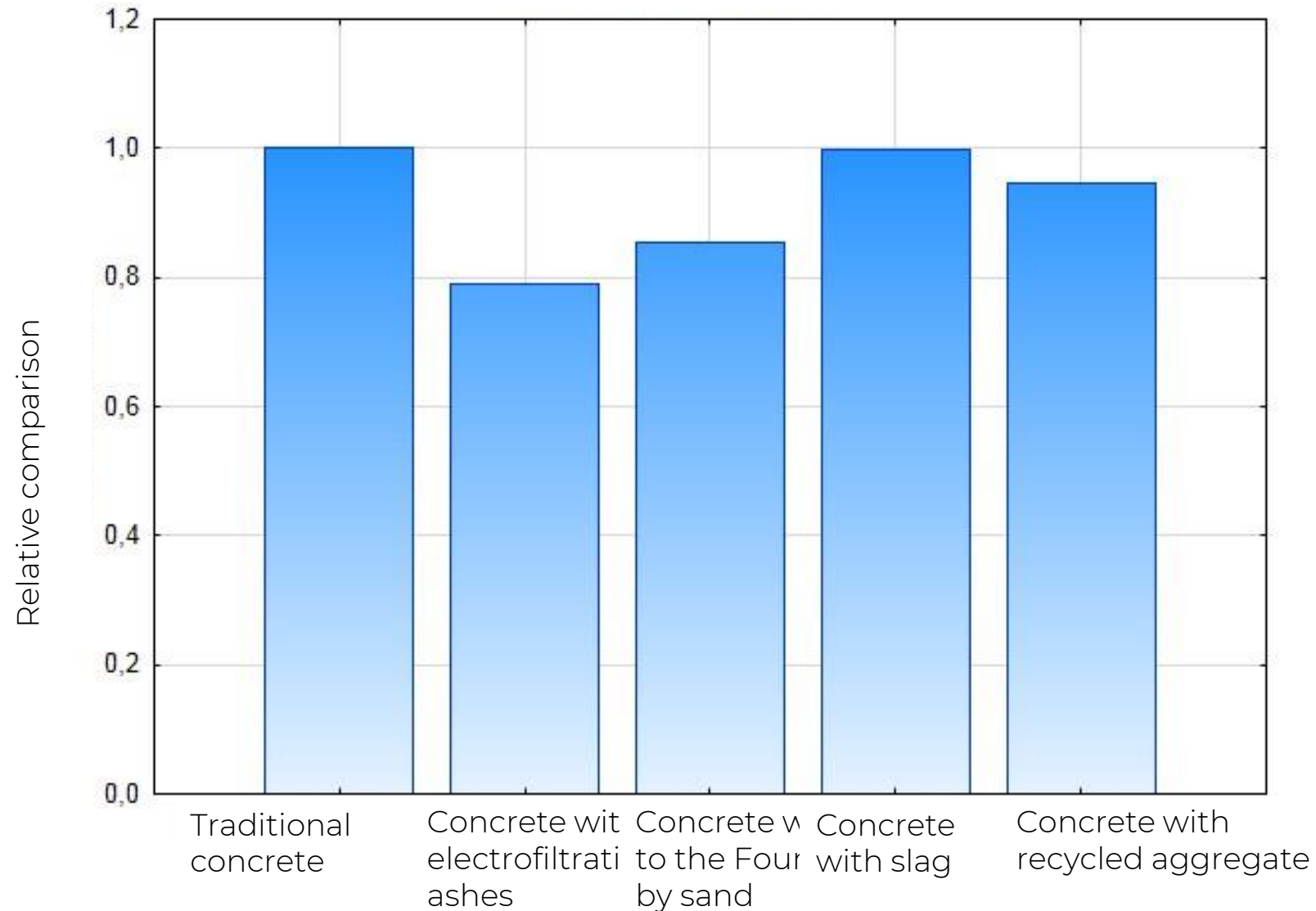
Use

- Concreting foundations, flooring,
- Structural concrete elements,
- Construction of embankments and retaining walls,
- Manufacture of precast concrete products,
- Etc.

- Fly ash concrete:
21% reduction in carbon footprint
- Concrete with foundry sand:
18% reduction in carbon footprint
- Concrete with steel slag:
No reduction in carbon footprint
- Concrete with recycled aggregate:
7% reduction in carbon footprint.



Carbon footprint of 1 m³ of ready-mixed concrete



Source: Environmental evaluation of green concretes versus conventional concrete by means of LCA. *Waste management 2015*.



Bricking using secondary materials

- Brick using river silt,
- Baking using electro-filter ash,
- Brick using calcium carbide sludge,
- Brick using steel slag,
- Reused bricks.



Restrictions:

- Low level of acceptance of the use of secondary materials by the brick industry and the general public.
- Leaching of potentially toxic substances (e.g. when using steel slag, calcium carbide sludge).

Use

- Brick using river silt:

Low-rise buildings, traditional architecture, non-residential buildings, decorative installations.

- Baking using electro-filter ash:

Construction of walls and partitions, construction of commercial and industrial buildings, bridges and culverts, paving (driveways, pavements).

- Brick using calcium carbide sludge:

Use in paving (pavements and landscaping), use in decorative elements, use in low non-residential structures.

- Brick using steel slag:

Use for walls and facades, construction of commercial and industrial buildings, construction of bridges and culverts, construction of retaining walls, paving (driveways, pavements), garden walls and decorative elements, soundproofing walls along motorways, use for interior and partition walls.

- Reused bricks:

Use for building facades, paving paths in gardens and parks, building terraces and courtyards, building or renovating fireplaces and chimneys, building retaining walls, interior flooring, use in various architectural elements, etc.





Steel

Steel is not really a low-carbon product because of the high-energy processes of mining, quenching, enriching and welding. Steel can be recycled again and again into new steel. From this point of view, it is a circular product.

- Application:

reinforcement in concrete construction (reinforcing bars and mesh),

load-bearing structures,

construction and maintenance of railway tracks and bridges,

manufacture of furniture (steel-framed chairs, tables, and other metal furniture products),

etc.





Geopolymers

It is used as a binder for sustainable building products.
Alternative to lime and Portland cement.

- Application:

production of precast concrete products (blocks, slabs and pipes),

Construction of roads for the production of durable and high-strength concrete for paving and other

load-bearing elements,

production of insulation materials

3D printing of building components,

production of architectural elements (decorative panels, sculptures and building facades).



Shop



The building sector contributes about one third of all global greenhouse gas emissions.

As new buildings become more energy efficient, more attention needs to be paid to the materials used. Attention must be paid to the energy and emissions embedded in the building products used.

The construction sector needs to focus on reducing the environmental footprint of construction products at the output of production lines, as well as on reducing the environmental footprint at the end of the lifetime of buildings (proper management of construction waste, with emphasis on reuse and recycling).

The list of circular, low-carbon building products presented here is an example and not an exhaustive list. The decision on which building materials/products to use in specific construction projects depends on a case-by-case basis. It is not the intention of the Guideline to make such recommendations.

**Thank you for your
attention !**



Supported by:



Federal Ministry
for Economic Affairs
and Climate Action



European
Climate Initiative
EUKI

This publication has been developed as one of the activities of CirCon4Climate project. This project is part of the European Climate Initiative (EUKI) of the German Federal Ministry for Economic Affairs and Climate Action (BMWK).

on the basis of a decision
by the German Bundestag

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