Philanthropy Briefs

BUILDINGS

Concrete

a series by Active Philanthropy

WHAT IS IT ABOUT?

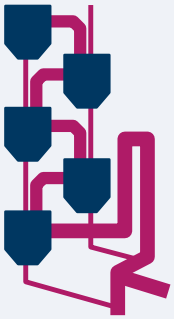
Concrete is a composite material, consisting of cement, water, and aggregates such as gravel and sand. It is the **most widely used construction material in the world** and an integral part of almost any modern building. About half of all the concrete used in the world goes to constructing buildings, while the other half is used for infrastructure development, including roads, railways and energy facilities.[1] As the global demand for buildings and infrastructure is rising, so is the use of concrete – by up to 20 % until 2050.

WHY IS CONCRETE IMPORTANT FOR OUR CLIMATE?

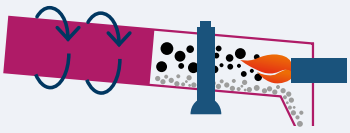
The use of concrete for building construction represents about 4 % of all CO_2 emissions globally. 90 % of these emissions come from cement production, which acts as the binding component in concrete. In comparison to other industries, the cement industry is the third-largest energy consumer and the second-largest CO_2 emitter.[2]

Emissions from cement can be mainly split in two stages[3]:

1 Calciner:
In the calciner, limestone is thermally treated, releasing CO_2 and producing lime, which is a key component of clinker, the essential ingredient in cement.



2 Kiln:
In the kiln, the calcined raw materials are transformed into clinker at high temperatures.



Process-related emissions:
Approximately 2/3 of cement production emissions occur in this stage. When limestone is heated, it releases CO_2 as a by-product. Mitigating these emissions requires strategies like substituting a portion of the clinker with other materials, developing alternative binders,[1] and increasing concrete recycling. However, for most process-related emissions, carbon capture technologies are necessary, though they mainly remain at a pre-commercial stage.

Energy-related emissions:
These emissions, which account for about 1/3 of cement production emissions, result from heating the limestone-clay mixture to around 1,500 °C, primarily through fossil fuel combustion. Reducing these emissions can be achieved by electrifying the kiln heating process.

How cement is made. Own illustration adapted from KEI (undated)

[1] DGNB 2022, [2] IEA 2018, [3] KEI

WHAT FUNDERS CAN DO

Supporting carbon-neutral cement production

The transition to alternative and low-carbon cement has been slow. One important reason is the lack of product standards, such as ceilings on embodied carbon in concrete mixes. Such standards could create a level playing field for producers committed to reducing emissions.[4] Funders could advocate for these standards as much as they could help to create demand by targeting public procurement. The public sector is the greatest buyer of concrete. Green public procurement would thus create a strong business case for producers to invest in the plant upgrades needed to produce low-carbon concrete.[5]

Changing the way concrete is used

A key strategy for funders who seek to tackle carbon emission of the buildings industry is to target construction practices. For example, ensuring that concrete is not used excessively and raising the share of recycled materials in concrete, which at present is below 1%, are important strategies.[6]

If buildings are to become carbon neutral, funders need to engage all practitioners (architects, engineers and builders alike) so that planning and constructing go hand in hand. Funders should support organisations that enhance the know-how of these practitioners to work efficiently with concrete as well as with alternative materials.

One overarching way that funders can push for sustainable building practices is through advocacy for life cycle assessments (LCAs). These assessments deliver emission analysis of an entire building including its use of concrete.[7]

There are many different strategies to engage in climate philanthropy. See our Spotlight on Climate Funding Strategies to learn more.

3 FAST FACTS

400

The percentage that global cement production has increased since 1990, while global fossil energy production has grown by around 60 %.[8]

37%

of emissions can be saved by constructing an apartment building with wood posts and beams instead of reinforced concrete walls.[9]

25%

of emissions from cement and concrete can be saved if building codes are adapted for low-carbon construction and practitioners use the best available technologies.[10]

THINGS TO CONSIDER WHEN FOCUSING ON CONCRETE

Balancing price premiums with efficient design

- Low-carbon concrete comes at a price. But premiums for low-carbon cements can be compensated by efficient use of concrete in building design, planning and construction. Funders can make a difference in stressing the connection between material-conscious designs and building costs, which points to the affordability of sustainable construction in general.

Prioritising concrete demand

- Reducing demand for primary concrete is pivotal for the transition to climate friendly buildings. Without it, other emission-reduction efforts risk falling short of climate targets. This necessitates wholistic funding strategies that change the way that concrete is made and used while simultaneously considering the maintenance and renovation of existing building stock to extend their lifespan and reduce the need for new construction.

Link to bibliography

[4] Frontier Economics 2022, [5] World Economic Forum and Boston Consulting Group 2023, [6] UNEP and Yale Center for Ecosystems + Architecture 2023, [7] DGNB 2022, [8] Andrew 2019, [9] DGNB 2022, [10] UNEP and Yale Center for Ecosystems + Architecture 2023