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Turning concrete recycling plants into Swiss carbon sinks – by mineralizing CO_2 in demolition concrete

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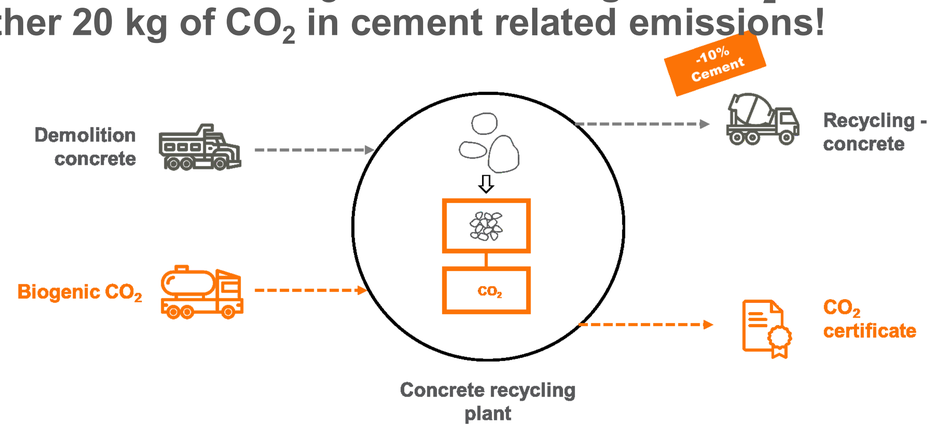
Global Warming

To stop global warming below 2°C, green house gas (GHG) Emissions have to go to net-zero by 2050. The Swiss federal government considers 95% of the emissions as avoidable – the remaining 5% or **2.5Mt CO_2** per year have to be addressed by **carbon sinks**.

Recycling Concrete = fixing CO_2

Today – concrete is recycled by crushing it into concrete aggregate and reusing it afterwards as gravel and sand replacement in fresh concrete. New – a carbonation plant fixes biogenic CO_2 permanently as calcium carbonate rock in the pores of the concrete aggregate. This procedure improves the material properties – which allows to reduce the cement by about 10% in the concrete mix design. Thus: **10 kg of CO_2 stored avoid another 20 kg of CO_2 in cement related emissions!**



Negative Emission Value Chain

In Bern, the current biogenic CO_2 waste stream of Ara Region Bern is liquefied and transported to the concrete plant Kästli. The RECARB technology is installed their – fixing the CO_2 in concrete aggregate. Furthermore, the concrete mix design is optimized to maximize the GHG reduction and the economics of the process.

Similar industrial clusters can be found in all urban areas in Switzerland, and also in Europe. The technology is minimal invasive in current manufacturing practices. Every concrete recycling plant can make use of this value chain to reduce emissions starting now.

The Swiss picture

Today, the 5 Mt of demolition concrete allow to store about **50 000t of CO_2**, which in return can avoid another 100 000t of CO_2 emissions due to cement savings. In addition, it is expected that demolition concrete amounts double every decade. With additional advancements in the storage technologies, about **1 Mt CO_2** can be stored annually in demolition concrete in **2050**.

Results of RECARB Project

1. Proof of concept: concrete fixes CO_2

Fig 1:Concrete, in specific the cement phases of concrete can fixe CO_2 permanently. The smaller the particle, the more CO_2 can be stored.

2. Concrete material tests

Fig 2: The compressive strength (bar) and the E-Module (red dot) for the reference concrete (grey) and the mixture incorporating carbonated concrete aggregate (orange) are plotted over the cement content. It is evident, that carbonation allows to batch concrete at lower cement contents of same or better performance.

3. Pilot plant and pilot tests

Fig 3: Pilot plant, operated at the Kästli concrete plant. It has been shown, that 1) 120-200t of concrete aggregate can be carbonated per day storing 2) 1000-1500 kg CO_2. Furthermore, the material was used for the concrete material tests, as shown in Fig. 2.

Project partners:
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