PERMANENCE OF CO2 STORAGE IN PRODUCTS

CEMBUREAU Position

October 2023

Over the coming months, the European Commission's is expected to publish a Delegated Act setting out the requirements under which greenhouse gases *"are considered to have been captured and utilised in such a way that they have become permanently chemically bound so that they do not enter the atmosphere under normal use, including any normal activity taking place after the end of the life of the product*." (article 12.3b of the revised ETS Directive). This position paper sets out CEMBUREAU's views on how the notions of permanence, normal use and normal activity after end of life need to be interpreted.

Introduction

Carbon Capture, Utilisation and Storage (CCUS) is critical to decarbonise cement production[1] and significant investments are currently ongoing in the sector[2]. Whilst today, the majority of carbon capture projects in the EU cement sector aims at capturing the CO2 and storing it geologically (CCS), the sector is also looking at the utilisation of CO2 in products (CCU). CCU remains indeed vital for many EU cement kilns which are landlocked and not located next to CO2 storage sites. Through CCU, the cement sector can provide a significant stream of concentrated CO2 for use in various sectors of the economy, allowing to decarbonise and cut the EU's reliance on fossil fuels[3].

CEMBUREAU fully agrees that a clear differentiation should be established between CCS and the non-permanent forms of CCU, to preserve the environmental integrity of the ETS and ensure that all CO2 emissions are indeed accounted for.

Mineralisation is a permanent form of CO2 storage

The cement and concrete industry has been looking at the potential of mineralisation for some time. Significant research has gone into the topic[4] and an increasing number of companies – some of them outside the cement sector – are aiming at storing CO2 in concrete or aggregates, sometimes even offering carbon removals through the use of biogenic CO2.

The permanence of CO2 storage through mineralisation is well-established and a non-exhaustive list of references can be detailed as follows:

[1] Please see CEMBUREAU's Carbon Neutrality Roadmap
[2] Based on current investment plans, CEMBUREAU estimates that more than 15 CCS cement projects will be operational by 2030, requiring an annual injection capacity of 12-15 million tons of CO2. The first CCUS project in the cement industry will be operational as early as 2024. In parallel, the sector is also exploring CCU opportunities, with several projects being developed.
[3] Please see study on the need for CO2 in the EU27 society in the timeframe 2035-2050, VITO for CEMBUREAU
[4] Please see EU-funded Fastcarb project

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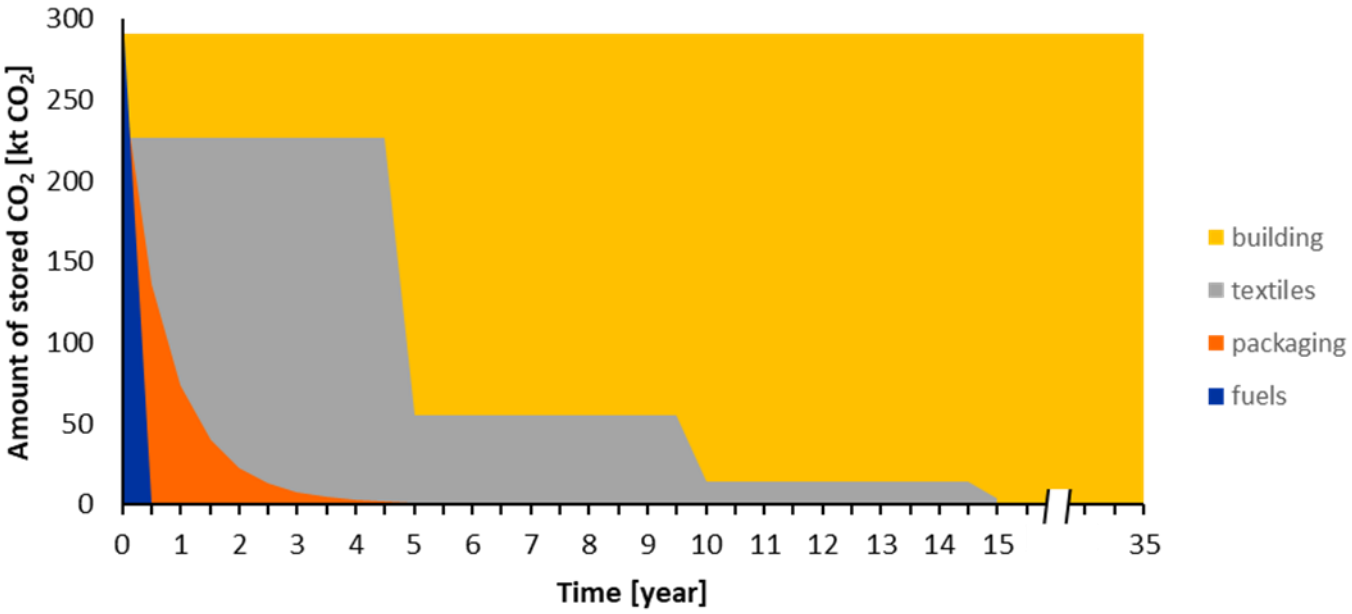
1. The IPPC report"Climate Change 2021 – the Physical Science basis" from August 2021 elaborates on the (re)carbonation of concrete – see full report, pages 687-688.
2. 2018 IVL report. Page 52 says "*However, the carbonated concrete is chemically stable so there is no risk that the CO2 that has been taken up will return to the atmosphere. This can only happen if the concrete is heated to a temperature where calcination can occur, i.e. about > 850 °C*."
3. 2019 Andersson et al wrote in paragraph 3.2 "*When carbonating concrete, the binding of CO2 is essentially permanent, as heating to the calcination temperature (~850 °C) would be required in order for CO2 to re-enter the gas phase"*
4. In 2020 Friedlingstein et.al. reported on the global sink of the carbonation of concrete. Several references have been made in the article. In the abstract mentioned *"For the year 2019 alone, the growth in EFOS was only about 0.1% with fossil emissions increasing to 9.9±0.5 GtC yr excluding the cement carbonation sink (9.7±0.5 GtC yr when cement carbonation sink is included".*
5. In 2020 Cao et.al mentions on page 2 *"Conversely, cement-related materials like mortar and concrete are significant CO2 sinks due to their ability to react with (absorb) atmospheric CO2, which is particularly significant in the use and end-of-life stages of the cement cycle."*

It arises from the above that under "*any normal activity taking place after the end of the life of the product*", mineralisation is a permanent form of CO2 storage.

Using CO2 in chemicals can be a permanent form of CO2 storage, where a recycling loop is in place

CEMBUREAU considers that, provided chemical products are part of a recycling loop, the putting of CO2 in chemicals should be considered as permanent storage.

In a recent study, the Vrije Universiteit Brussel looked at the potential of different CCU uses and their durability (please see graph below). A key finding was that CO2 stored in plastics used in buildings holds both considerable potential for CO2 storage, as well as significant storage times.



Source: Van der Perre & Wyns (Brussels School of Governance, VUB)

For chemical products like plastics, a 'normal activity after the end of life' will increasingly consist in recycling. It is CEMBUREAU's strong view that if plastics are appropriately recycled (with clear obligations for the manufacturer), using captured CO2 to produce them should be considered as permanent chemically bound use.

'Non-permanent' CCU in the revised ETS Directive

Finally, when it comes to non-permanent uses of CCU, we regret that in the revised Directive, co-legislators appear to consider that the capturing installation (rather than the installation/entity actually emitting the CO2) should surrender allowances, even if the capturing installation is not releasing the CO2 in the atmosphere. In our view, CO2 allowances should be surrendered by the 'emitter' of the CO2 contained in a CCU product, and not by the capturing installation. The CO2 accounting needs to be done at the point where CO2 is released into the atmosphere. CEMBUREAU notes that the ETS Directive foresees a review clause to 'assess the accounting' of CO2 used in non-permanent CCU applications[5]. It is in our view very important that this clause is taken up in the future review of the ETS, in light of the expansion of the ETS to other sectors (full aviation coverage, waste incineration, etc.), which should allow to account emissions at the point of release.

[5] Recital 99 : « *In order to regulate the capture of carbon in a way that reduces net emissions and ensures that all emissions are accounted for and that double counting is avoided, while generating economic incentives, the Commission should assess, by July 2026, whether all greenhouse gas emissions covered by Directive 2003/87/EC are effectively accounted for, and whether double counting is effectively avoided. In particular, it should assess the accounting for the greenhouse gas emissions which are considered to have been captured and utilised in a product in a way other than that referred to in Article 12(3b), and take into account the downstream stages, including disposal and waste incineration* »