Global Cement and Concrete Association

Reporting of Carbon Emissions from Waste in Cement Sector

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1.0 Executive Summary

Cement and Concrete CO_2e emissions (GWP) are reported "gross" or "net", with the difference being the emissions from non-biogenic waste combusted in the kiln are included in "gross" but not in "net".

Both "gross" and "net" reporting are part of production level carbon accounting standards and methodologies such as the GHG protocol (developed by WRI and WBCSD), Cement CO_2 and Energy Protocol (developed by GCCA and WBSCD) and ISO 19694-3:2023. These methods recognise the benefit of treating waste in the cement kiln in terms of reducing overall GHG emissions, by including "net" emissions reporting alongside "gross" emissions reporting.

Product level accounting (Environmental Product Declarations (EPDs)) standards from ISO and CEN (EN 15804) are explicit in requiring "net" reporting as long as the waste treated in the kiln has not reached end of waste status. A further provision by CEN (EN 16908:2017+A1:2022) is that in addition to "net", "gross" may be reported to provide transparency. The North American rules for EPDs are set out in Product category Rules (PCR) which require both "gross" and "net" reporting.

2.0 Introduction

The co-processing of waste in cement manufacturing to replace fossil fuels and primary raw materials is a longstanding contribution of the sector towards a circular and lower carbon economy and provides an important service to communities in making beneficial use of a range of society's waste and by-products. By using waste that otherwise will be burned or landfilled without further utilisation the cement industry is contributing to reduce reliance of fossil fuels, reduce waste and reduce CO_2 emissions.

This paper summarises how co-processing is accounted for under different GHG monitoring and reporting schemes.

3.0 What is co-processing?

Co-processing refers to the use of suitable waste materials in cement making for the purpose of energy recovery and simultaneously materials recycling. Thus, the consumption of primary (fossil) fuels and raw materials is reduced.

Cement kilns provide ideal conditions for waste treatment with high temperatures and long retention times. Where wastes cannot be managed technically or economically by prevention, reduction, reuse or recycling, the cement manufacturing process provides a more environmentally sustainable solution compared to incineration or landfilling as fossil fuels use in cement kilns is reduced and the material content is recycled. The same is also true compared with waste to energy because of the significantly higher efficiencies in the cement kiln (70% to 80% depending on raw materials moisture content) compared with waste to energy plants (about 50% as a weighted average of different processes) in utilising the energy in the waste[1]. Furthermore, waste to energy plants generate mineral content waste as bottom ashes which are heavily polluted and of variable quality making them a waste that is quite difficult to handle.[2]

4.0 Purposes of Accounting Methods for Carbon Emissions

Different accounting methods have been developed for different purposes (e.g. ESG disclosure, IPCC reporting, environmental credentials of products etc.) with different scopes and boundaries (Scope 1, 2 and 3, cradle-to-gate, cradle-to-grave etc.) to address different reporting needs. For some purposes scope 1 only is of interest, and for other purposes scopes 1, 2 and 3 are required by stakeholders. Similarly, some purposes require cradle-to-gate reporting, and others cradle-to-grave. And for some purposes and stakeholders multiple reporting is required.

[1] ECRA, Evaluation of the energy performance of cement kilns in the context of co-processing, 2017
[2] Cembureau, Questions and Answers related to co-processing, 2019

In the cement sector, this range of reporting enables both the emissions from waste treated in cement kilns and the benefit to overall CO_2 emissions to be accurately reported.

4.1 Corporate/Industrial Scale Emissions Reporting in Cement/Concrete Sector

For corporate reporting or industrial scale reporting, GHG emissions are aggregated up from plant level emissions to corporate level. Cement companies traditionally have reported direct emissions (Scope 1) and indirect emissions from electricity consumption (Scope 2) and not reported all other indirect emissions (Scope 3) because, in contrast with many sectors, Scope 3 emissions are relatively small in the cement sector. However, as emissions reporting becomes more mature, comprehensive Scope 3 reporting is being introduced by cement companies and the sector more broadly.

Overall emissions, including those from waste co-processing (i.e. "gross"), are reported as well as isolating the emissions from waste treatment enabling calculation and reporting of "net".

One purpose of industrial scale reporting is to enable total scope 1 gross emissions from a sector to be determined. These can then be aggregated across all sectors to obtain overall emissions.

4.2 Product Level Reporting in Cement/Concrete Sector

Environmental Product Declarations (EPDs) are at product level by definition. They are used to compare products – products that should be functionally equivalent – and are also used for marketing purposes. They are scope 1, 2 and 3. CEN standards are cradle-to-gate for cement and cradle-to-grave for concrete. Currently North American standards are cradle-to-gate for both. In contrast to corporate reporting, EPDs which are based on a Lifecycle Assessment (LCA), are more detailed than corporate reporting, not least as they are at product level. EPDs are a type III environmental declaration which means they are third party verified and based on life cycle analysis conducted using established product category rules.

Product level reporting does not enable total emissions to be determined, because there is incomplete EPD coverage of any sector. Even in the future when (if) 100% coverage is obtained, the complexity of aggregating tens of thousands of EPDs, and more critically the total tonnage/volume of each product, renders this impossible. In addition, it would be complex to isolate scope 1, 2 and 3 emissions from every EPD. Far easier to utilise corporate level reporting to determine sector level emissions.

5.0 Overview of Accounting Standards/Methods Relevant to Cement and Concrete sector

It is essential to understand as a pre-requisite, as highlighted in Section 4, that different accounting and reporting standards and schemes have been developed for different purposes. Notwithstanding the different purposes of accounting and reporting standards, the indirect CO_2 emissions reductions delivered by co-processing are widely recognised in the relevant standards and documents.

5.1 GHG Protocol (WRI/ WBCSD)

The GHG protocol (WRI/ WBCSD) clearly states that accounting for indirect emissions can help identify where to allocate limited resources in a way that maximizes GHG emission reduction and return on investment. It highlights that companies may be able to make changes to their own operations that result in GHG emissions changes at sources not included in their own inventory boundary and cites fossil fuels substitution with waste-derived fuel that might otherwise be landfilled or incinerated without energy recovery as an example. The GHG Protocol goes on to specify that these reductions are required to be separately quantified and reported in a company's public GHG report under optional information.

Hence, the GHG Protocol requires reporting as follows:

> Direct CO_2 from combustion of biomass (including biomass fuels, biomass wastes and the biomass fraction of mixed fuels) shall be reported as a memo item but excluded from emissions totals.

> Direct CO_2 from combustion of fossil alternative fuels (AF) and the fossil fraction of mixed fuels shall be calculated and included in the direct CO_2 emissions (gross emissions i.e. total direct CO_2 emissions).

> Indirect GHG savings achieved through the utilisation of fossil AF shall be accounted as net emissions in the Protocol.

5.2 The Cement CO_2 and Energy Protocol version 3, WBCSD/ GCCA [3,4]

The Cement CO_2 and Energy Protocol in line with the guidelines of IPCC[5] as well as WRI / WBCSD GHG protocol, ensures transparent reporting of the direct CO_2 emissions resulting from AF combustion in cement plants whilst defining how to account for co-processing benefits introducing the concept of "net" and "gross" emissions.

The current Version 3 of the Cement CO_2 and Energy Protocol, in line with the guidelines of IPCC[6] as well as WRI / WBCSD GHG protocol, ensures transparent reporting of the direct CO_2 emissions resulting from AF combustion in cement plants by reporting gross (including alternative fossil fuels) emissions. It also offers the possibility of reporting

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[1,4] https://www.cement-co2-protocol.org/en/

[5] IPCC 1996 and 2006 guidelines for national GHG inventories require the following:

> CO_2 from biomass fuels is considered climate- neutral, because emissions can be compensated by re-growth of biomass in the short term. CO_2 from biomass fuels is reported as a "memo item", but excluded from the national emissions totals. The fact that biomass is only really climate-neutral if sustainably harvested, is taken into account in the "Land use change and forestry" sections of the national inventories, where CO_2 emissions due to forest depletion are reported.

> CO_2 from fossil fuel-derived wastes (also called alternative fossil fuels or fossil AF), in contrast, is not a priori climate-neutral. According to IPCC guidelines, GHG emissions from industrial waste-to-energy conversion are reported in the "energy" source category of national inventories, while GHG emissions from conventional waste disposal (landfilling, incineration) are reported in the "waste management" category.

> CO_2 from mixed fuels with biomass and fossil fractions: In the case that biofuels are combusted jointly with fossil fuels (e.g. pre- treated industrial and/or domestic wastes), a split between the fossil and non-fossil fraction of the fuel should be established and the emission factors applied to the appropriate fractions (IPCC 2006, Vol. II, Section 2.3.3.4).

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credits for indirect GHG savings from the use of alternative fuels by reporting net (excluding alternative fossil fuels) emissions.

Industry is currently reviewing the Cement CO_2 and Energy Protocol with the intention of keeping a transparent way of reporting gross emissions whilst recognising indirect GHG savings from alternative fuels along the lines of Version 3. In addition, international convention on a more precise treatment of AF and alternative raw materials (AFR) possibly in scope 3 WRI standards is under discussion.

5.3 ISO/DIS ISO 19694-3:2023 - Stationary source emissions — Determination of greenhouse gas emissions in energy-intensive industries —Part 3: Cement industry

ISO/DIS ISO 19694-3:2023 offers the incentive of taking advantage of indirect GHG savings from the use of AF by reporting gross (including alternative fossil fuels) and net (excluding alternative fossil fuels) emissions.

5.4 EU ETS and SBTi

The EU ETS monitoring and reporting regulation (EU ETS MRR) and the EU's Carbon Border Adjustment Mechanism address direct emissions (gross emissions) only and hence do not account indirect savings. There were marginal differences compared with the Cement CO_2 and Energy Protocol, and then the revision in 2021 added some further differences including in relation to Carbon Capture and Utilization (CCU).

5.5 SBTi

SBTi requires gross reporting but acknowledges that co-processing (combustion of waste derived fuels) leads to savings beyond the value chain.

5.6 Product level reporting: ISO 21930:20177

The relevant parts of ISO 21930:2017 – "Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services" in relation to accounting for emissions from waste are Table 1 and associated clauses.

In Table 1 "waste used in cement kiln" is explicitly given as an example, and the table goes on to explain that for the product system (i.e. cement) that uses the waste "...specific emissions from wastes that can be physically associated with the wastes can be excluded".

Co-processed waste is legally defined as waste and verifiers of EPDs should be provided with paperwork evidence of waste status. The co-processing of waste is permitted and regulated under waste legislation (e.g., co-processing operated in line with BAT/ BEP[8] is recognised by the Basel Convention[9], as an environmentally sound waste treatment option). Almost all of what the cement industry co-processes is waste (in all regions and across borders).

Where waste material has reached end of waste status, it is no longer waste and the emissions from this end of waste status material need to be included in the reported emissions.

[7] International Organization for Standardization. (2017). Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services (ISO Standard No. 21930:2017). https://www.iso.org/standard/61694.html

[8] BAT: Best Available Technology; BEP: Best Environmental Practice

[9] UNEP Basel Convention (2011): Technical guidelines on the environmentally sound co-processing of hazardous wastes in cement kilns: as adopted by the 10th meeting of the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (decision BC-10/8), Cartagena, Colombia.

5.7 Product level reporting: EN 15804[10] –& EN 16908:2017+A1:2022[11]

According to EN 15804, only the impacts from the use of secondary fuels (read "non-waste") need to be considered in a cement EPD. The impacts from the use of waste are considered using the 'polluter pays' principle which means that emissions from processing waste shall be assigned to the product system that generates the waste until the end of waste state is reached. In other words, the EPD should be based on net emissions as long as what is co-processed is waste.

This is further clarified in EN 16908:2017+A1:2022 which is specific to cement and building lime and states that if waste is used for energy or material recovery and does not have the same waste status in all regions, for transparency reasons two figures (net and gross) may be specified in the communication of the LCA results.

This explains why some EPDs report both emissions, for example UK, whilst others only net, for example Germany, France and Switzerland.

As was the case in section 5.6 above, but for clarity and completeness it is repeated here: it is essential to understand that almost all of what the cement industry co-processes is waste (in all regions and across the borders). Co-processed waste is legally defined as waste and the co-processing of waste is permitted and regulated under waste legislation (e.g. co-processing operated in line with BAT/ BEP is recognised by the Basel Convention, as environmentally sound waste treatment option).

5.8 Product Level Reporting: North American PCR

The North American PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements (NSF International)[12] dictates that gross and net are reported. The North American standards for cement and concrete are currently being revised, but there is no change with regards reporting both gross and net anticipated. In Canada and USA, it is custom to use the gross value for GWP reporting.

5.9 IDDI White Paper on Harmonisation of EPD standards, December 2023

The IDDI published a whitepaper prepared by BCG in December 2023 titled: "Driving consistency in the Greenhouse Gas Accounting System: A pathway to harmonized standards for steel, cement, and concrete". This IDDI whitepaper proposes that both gross and net emissions are reported in an EPD which is fully aligned with the above approaches.

6.0 Conclusion

Accounting standards and methodologies have different purposes and therefore have different scopes and cover different lifecycle stages. Therefore, accounting standards and methodologies cannot be identical or result in directly comparable results. However, accounting standards and methodologies, whilst not being identical can be congruent, and in the cement sector, this is the case and has been demonstrated in this paper in the case of reporting of carbon emissions from waste. In the cement sector, the different methodologies of reporting enable both the emissions from waste treated in cement kilns and the benefit to overall CO_2 emissions through co-processing to be accurately and transparently reported.

Accounting standards and methods for the cement and concrete sector accept and recognise the benefits of co-processing (treatment of waste in cement kilns) towards global GHG reductions.

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[10] **EN 15804 +A2** – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

[11] **EN 16908:2017+A1:2022** Cement and building lime - Environmental product declarations - Product category rules complementary to EN 15804

[12] Product Category Rule for Environmental Product Declarations: PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements v3.2, NSF International