Global Cement and Concrete Association

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GCCA Policy Document on Definitions for Low Carbon and Near Zero Cement

Global Cement and Concrete Association (GCCA) is registered in England & Wales, Company No 11191992

Registered office:
Paddington Central, 6th Floor,
2 Kingdom Street, London,
W2 6JP, United Kingdom

T +44 2035 804268

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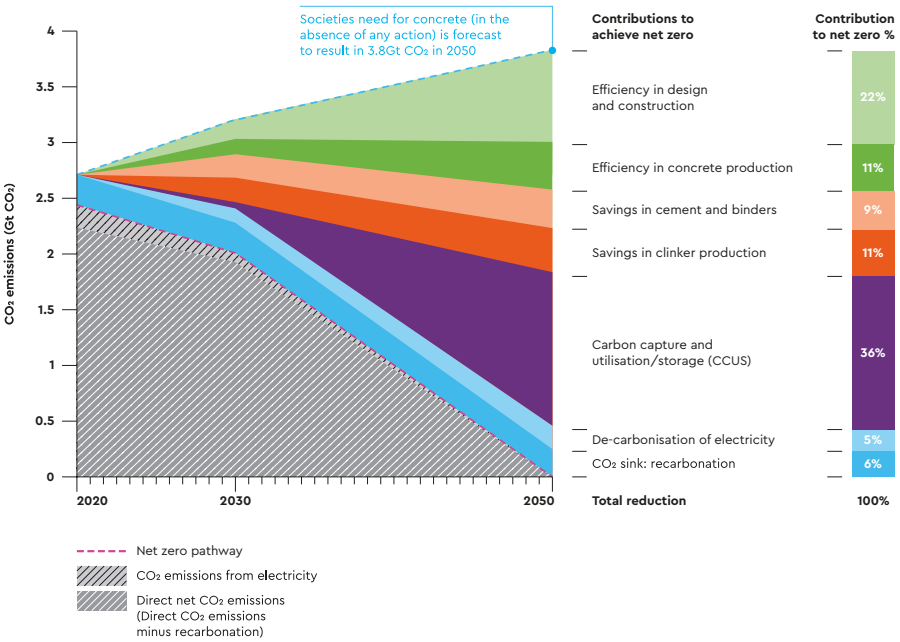

The Net Zero Pathway from the 'GCCA 2050 Cement and Concrete Industry Roadmap for Net Zero Concrete'[1]. Low Carbon Procurement, for which definitions are foundational, will support the decarbonisation achieved along the value chain from manufacturer through to construction.

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1. GCCA Position on Low Carbon and Near Zero Cement Definitions

The GCCA recommends:

1. Adoption of IEA definitions for Low Carbon and Near Zero Cement (Figure 1) and use of static clinker to cement ratio by countries.
2. Environmental Product Declarations (EPDs) to be the basis of carbon footprint reporting with ISO 21930:2017 and EN 15804 treatment of waste CO_2e emissions adopted.

Depending on national averages for clinker to cement ratio, each country can choose the appropriate static clinker to cement ratio, similar to the German example (see Section 5).

EPDs are the method of choice for measuring a product's carbon footprint used as decision criterion in low carbon procurement. EPDs benefit from established standards, widespread infrastructure, inclusion of a Global Warming Potential (GWP) indicator, familiarity among construction professionals, and clear definitions of environmental impacts at each life cycle stage.

"Net" GWP accounting has been chosen to accord with EN 15804 and ISO 21930 and this incentivises a practice that is good for the environment. It also aligns with The GCCA 2050 Cement and Concrete Industry Roadmap for Net Zero Concrete and is included within the Cement CO_2 and Energy Protocol.

The choice of "net" means that:

- The cement banding as described in Section 4 represents "net" values for CO_2e/t cement
- For each cement product being assessed against the banding, the "net" GWP value from the cement product's EPD should be chosen.

2. Background

In 2021, The GCCA published its 2050 Cement and Concrete Industry Roadmap for Net Zero Concrete[1], the collective commitment of the world's leading cement and concrete companies. These companies called for stimulation of demand for low-carbon cement and concrete products through public procurement policy. Part of any such procurement policy is definitions for low carbon and near-zero cement and concrete.

GCCA did not want to create a new set of definitions but has chosen to work with the Clean Energy Ministerial Industrial Deep Decarbonisation Initiative (IDDI).

The IDDI is a global coalition of public and private organisations. One of the key ambitions of IDDI is consistent definitions for low carbon and near-zero cement, concrete and steel. The IDDI employs the IEA definitions[2] for low carbon and near zero cement and crude steel as a robust starting point, and is contributing to processes to develop, refine and extend them as needed.

The key principles that IDDI require for definitions are:

- Same concept of banding as used for cement and steel: i.e., bands E to A with progressively lower carbon footprints down to a near zero emissions band
- A system that can be used in all countries for procurement
- A system that enables all countries to report progress and enables comparison between countries through use of common banding levels.

Low carbon product procurement can be at cement level or concrete level to suit the typical supply and construction practice in a country.

In countries where it is typical for the construction sector to purchase cement and for the concrete to be mixed on project sites, then low carbon procurement should be on the cement level. And for this, IDDI has adopted the IEA methodology as a robust starting point.

3. Introduction

This paper recommends a global cement banding system using the IEA definitions as a robust starting point. The numerical definitions are expressed in units of embodied carbon dioxide equivalent per tonne of cement product (ECO_2e /t) for bands (ranges) including a "near zero" carbon emissions band. The term "carbon footprint" will be used for embodied carbon dioxide equivalent (ECO_2e) for the remainder of this paper.

4. Reporting Method for Product Carbon Footprint: EPDs

EPDs (Environmental Product Declarations) are the method of choice for measuring a product's carbon footprint (GWP) in low-carbon construction procurement for the following reasons:

1. **Established Standards:** Clear rules exist for creating EPDs for all construction materials, making comparisons easier.
2. **Global Infrastructure:** The system for creating and verifying EPDs is already in place or developing worldwide.
3. **Carbon footprint indicator:** Every EPD includes a GWP indicator, simplifying carbon footprint assessment.
4. **Industry Familiarity:** Construction professionals are more familiar with EPDs than other carbon footprinting methods.
5. **Transparency:** EPD standards and Products Category Rules (PCRs) clearly define which environmental impacts are considered at each product life cycle stage.

EPDs aim to provide consistent comparisons of products based on environmental impact, including carbon footprint. Currently this aim is not perfectly achieved but this does not prevent EPDs being able to be used with confidence in the present. There remain inconsistencies in standards, databases, life cycle scopes, and interpretation methods which the IDDI is working to address. In the meantime, any methodology should account for existing variations to enable global comparisons at a local level. The GCCA recommendation contained in this paper achieves this.

5. IDDI definitions for Low Carbon and Near Zero Cement

The IEA proposed a global labelling system for low-emission and near-zero emission cement (kg CO_2e per tonne of cement) in its report "Achieving Net Zero Heavy Industry Sectors in G7 Members". This system differentiates cements according to their clinker/cement ratio and defines six emissions performance labels categories, ranging from near-zero emissions to low emissions A, B, C, D, and E cements (Figure 1).

For the near-zero cement label, the IEA suggests a threshold of 125 kg CO_2e per tonne of cement with 100% clinker content. For 0% clinker IEA recommends a value of a 40 kg CO_2e per tonne of cement, considering calcined clay as the most emissions-intensive, scalable alternative cement constituent in use today. The maximum emission intensity qualifying as "low-emission" cement, labelled as E, is set at 750 kg CO_2e per tonne of cement with 100% clinker content, decreasing to 240 kg CO_2e per tonne of cement with a theoretical clinker factor of 0. This threshold was set approximately 100 kg CO_2e (or 12%) below the IEA's CEM I 100% clinker cement best available technology reference value of 850 kg CO_2e per tonne of cement. The remaining bands A-D are set with equal spacing in between.

The analytical boundary considered by IEA (Figure 2) is not expressed in terms of EPD definitions but it is mainly on EPD life cycle stages "A1-A3", however, it excludes emissions from production of alternative cement constituents such as fly ash and GBBS, which according to EN 15804, should be accounted using economic allocation, and it addresses emissions from waste differently from EPD standards (see Section 6.0).

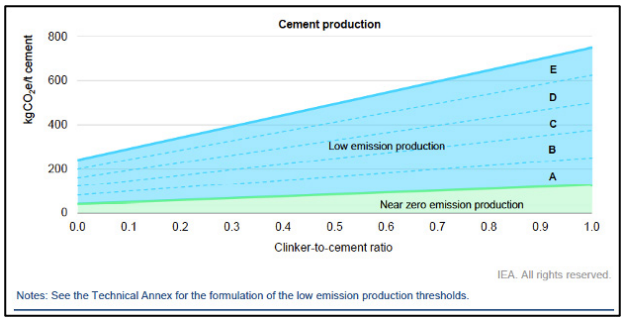

Figure 1[2]: IEA definitions for Low Carbon and Near Zero Cement

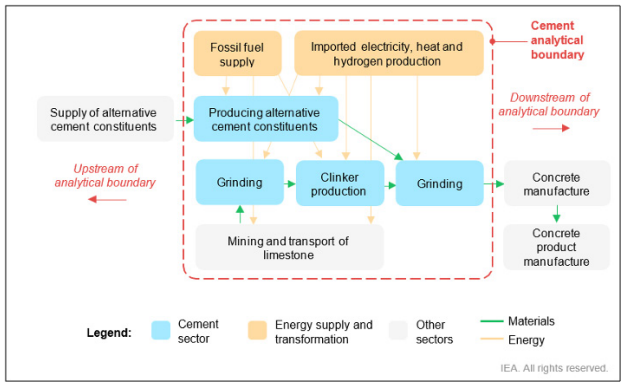

Figure 2[2]: IEA Analytical boundary for defining near zero emission cement production

6. IEA sliding scale for cement thresholds

The IEA proposed "sliding scale" methodology adjusts the cement labelling threshold as a function of the clinker to cement ratio. This approach disincentivises the use of secondary cementitious materials (SCMs) to reduce cement emissions, thereby significantly limiting incentive for a key decarbonisation lever.

IDDI permits countries to adopt a fixed clinker to cement ratio. Germany has exercised this dispensation right and adopted a static clinker to cement ratio of 0.706 (Figure 3). Germany has already executed a decarbonisation lever extensively (alternative fuel) and therefore, exactly as IEA suggested might be done[3], band E is not used in Germany.

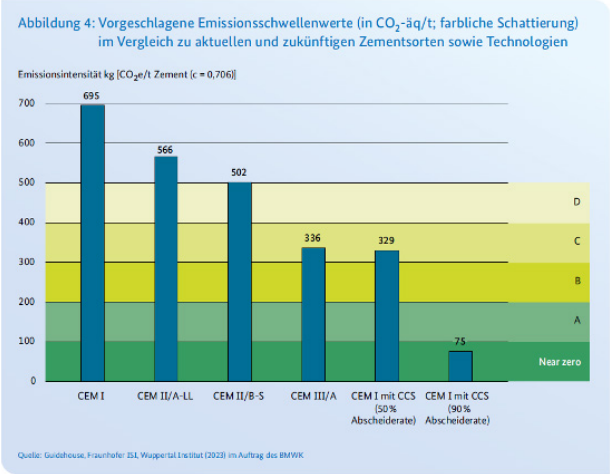

Figure 3[4] : Adoption of a static clinker to cement ratio by the German Economic and Climate Ministry

7. Accounting for emissions from waste

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 net zero economy and provides an important service to communities. By using waste that cannot be reused and recycled in another way, the cement industry is contributing to reduce reliance of fossil fuels, reduce waste and unnecessary CO_2 emissions. This co-processing is common and at scale in some locations such as Europe (in excess of 50% of energy demand)[5] but globally it averages only 6%1 despite being a recognised safe solution to address societal waste, open burning, plastic pollution and methane emissions from landfills.

According to ISO 21930:2017[6] and EN 15804[7], only the impacts from the use of secondary fuels (read "non-waste") need to be considered in a cement Environmental Product Declaration (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[8].

There are further GWP savings relating to methane avoidance. Use of societal waste in cement kilns in some regions of the world avoids, or could help avoid, uncontrolled

dumping and landfill both of which can result in methane emissions. For the method proposed in this paper, the avoidance of these methane emissions is not proposed to be credited to cement (and hence concrete) that has been manufactured using this societal waste as an alternative fuel.

For many years in the cement industry a term "net" GWP has been used to refer to the total emissions excluding biogenic emissions (GWP total) minus the emissions arising from the non-biomass waste used as fuel. (As opposed to "gross" which is the total emissions excluding biogenic emissions (GWP Total)). As seen above, in EPD standard ISO 21930:2017 and EN 15804, the EPD GWP value should be based on "net" emissions as long as what is co-processed is waste. The verifier of the EPD has responsibility to check the waste status of the non-biomass waste used as a fuel.

As an example, Germany, the first country to adopt the IEA numerical definitions for near zero and low carbon cement (Figure 3) uses the EN 15804 accounting rules and the corresponding GWP values in cement EPDs for comparison.

If the established practice in a country for product EPD reporting is other than the "net" approach described above and used in Germany for example, (i.e. on one hand not crediting the cement with avoided CO_2 emissions from waste ("gross"), or on the other hand the avoided methane is credited to the cement), then the normalisation process described in section 7 can be used to amend the numerical values in the country banding, to reflect country practice.

It is to be noted that industrial or production reporting of scope 1 emissions by the cement industry in accordance with the CO_2 Energy and CO_2 Protocol[9] includes "gross" reporting as well as "net" reporting.

8. "Normalisation" of cement definitions if required by a country

EPDs aim to provide consistent comparisons of products based on environmental impact, including carbon footprint. Currently this aim is not perfectly achieved. There remain inconsistencies in standards, databases, life cycle scopes, and interpretation methods which the IDDI is working to address. In the meantime, this methodology accounts for existing variations to enable global comparisons at a local level.

In order to use the cement classifications recommended in this paper, the carbon footprint of the cement product should be calculated according to the EPD methodology, and more specifically:

- Standards: EN 15804+A2, PCR-001 – Cement and building lime (EN 16908)
- Database: Ecoinvent
- Scope: cradle to gate (A1-A3)
- Waste CO_2e accounting: So called "Net" emission accounting adopted but methane avoidance not taken into account. (refer section 6.0).

In countries where practices differ from the above considerations, translation of the cement definition values is permitted so they become consistent with country practice. This mechanism is called "normalisation".

Normalisation will translate the global banding carbon footprint values as calculated with the above four listed global calculation choices, to local banding values that reflect local standards, database, scope and waste emission accounting. For example, if a country

reports "gross" GWP for waste accounting, and typical emissions arising from incineration of waste represent 10% of the gross emissions, the cement bands shall be shifted upwards by 10%.

9. Compatibility of recommended near zero definition with GCCA Global Roadmap

The recommended near zero definition, ranging from 40 to 125 kg CO_2e/t cement for different clinker cement ratios, is compatible with the zero destination in the GCCA decarbonisation roadmap to 2050[1] because the GCCA roadmap also takes into account natural carbon uptake (recarbonation). Carbon uptake is recognised in IPCC AR6[10] and EN 15804[7].

To quantify carbon uptake (recarbonation), the GCCA roadmap adopts the lower bound from the IVL methodology tier 1[11]. This lower bound value for a cement with clinker cement ratio of 1.0 is 105 kg CO_2e/t (20% of the 525 kg CO_2e/t "process" emissions).

This 105 kg CO_2e/t is a lower bound, and hence the small difference to a "near zero" definition value of 125 kg CO_2e/t is compatible.

Finally, it is to be noted that both the GCCA global roadmap and the recommended global definitions are consistent in adopting the same accounting for waste emissions (see Section 6.0).

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10. References

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