Heidelberg Materials

Methodology Documentation for CCS Cement Carbon Reductions Policy

Subject: Project Methodology Description of CCS Cement Carbon Reductions for Heidelberg Materials evoZero and evoBuild Carbon Capture building materials

Owner: GGF Sustainability, Dominik Nied

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Disclaimer / Purpose of this Document

The purpose of this document is to outline how Heidelberg Materials AG will transparently bring to market the world's first Carbon Captured cement. The ideas and concepts are to demonstrate to key stakeholders the challenges and proposed solutions to bringing an innovative product to market outside of ISO & EN standards.

Should this document be updated, Heidelberg Materials AG will engage with the Third-Party Assurance partner to evaluate the need for stakeholder engagement. Revision dates and revised content will be clearly distinguished.

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1 Introduction

The world needs smart, sustainable, and resilient infrastructure, buildings, and public spaces. Challenges like climate change and resource limitations mean that the production and use of heavy building materials must evolve. At Heidelberg Materials AG (HM), we are transforming our business to address these challenges and are placing sustainability at the core of what we do.

The central aim of the Paris Agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise well below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. Cement production accounts for approximately 8% of global CO_2 emissions per year[1], with reductions in the CO_2 intensity of cement production offering a significant lever to limit Global Warming. Cement production involves the transformation of raw materials into cement clinker, which is then ground to produce cement:

1. <u>Clinker Production</u>- Clinker is made in a kiln with gas up to 2000°C, heating raw materials such as limestone (calcium carbonate) with small quantities of other materials (e.g., clay) to 1450°C. The combustion of fossil fuels to heat the cement kilns generates 32% of the CO_2 emissions. The limestone is transformed into calcium oxide (lime – CaO). This so-called calcination reaction is responsible for 68% of the CO_2 emissions during clinker production. It is important to note that this process is an unavoidable emission in cement production. The calcium oxide then reacts with the other constituents from the raw material to form new minerals, collectively called clinker. This near-molten material is rapidly cooled to a temperature of 100- 200°C. Emission reductions can be made at this stage by using alternative fuels such as waste biomass, scrap tires and other waste based alternative fuels.

2. <u>Cement Grinding</u>- Around 4-5% gypsum is added to clinker to control the setting time of the final cement. The cooled clinker and gypsum mixture is ground into a grey powder called Ordinary Portland Cement (OPC) or can be ground with other mineral components to produce, for example, Portland Composite Cements (PCC). The CO_2 intensity of cement can be lowered by reducing the proportion of emission intensive clinker into the cement. Supplementary Cementitious Materials (SCMs) are recognized industry standards and can be sourced from waste streams such as blast furnace slag or fly ash, from naturally occurring materials such as volcanic ash or specially treated calcined clays (Figure 1).

[1] "Data Page: Annual CO_2 emissions from cement", part of the following publication: Hannah Ritchie, Pablo Rosado, and Max Roser (2023)- "CO_2 and Greenhouse Gas Emissions". Data adapted from Global Carbon Project. Retrieved from https://ourworldindata.org/grapher/annual-co2-cement [online resource]

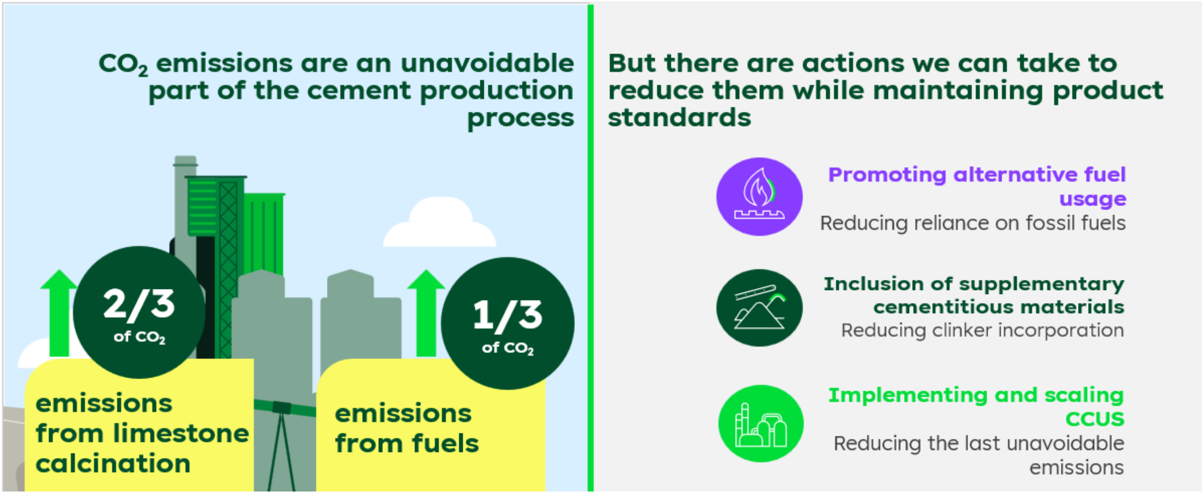

Figure 1 Sources of CO_2 in cement production and different levers available to reduce the CO_2 intensity of cement production (CCUS: Carbon Capture Utilization and Storage)

Heidelberg Materials AG has a good track record of using alternative fuels and developing cements with low clinker content to reduce emission intensity of cement and concrete products. However, those measures can only partly support the industry's transformation to net-zero. Breakthrough technologies such as CCS are a prerequisite to achieve net-zero emissions in our sector.

We aim to achieve net-zero emissions by 2050 at the latest (Figure 2). Our net-zero target was validated by the SBTi in December 2024. To achieve this, we are focusing on three areas: measures at the clinker level, measures at the cement level, and breakthrough technologies (Figure 2 depicts a forecast of the development of the impact achieved by the roll-out of CCUS). Measures at the clinker level refer to all measures to reduce CO_2 emissions associated with clinker production. They include measures to modernize and increase the efficiency of plants, but also those intended to increase the use of alternative fuels, in particular waste-based biomass, to further reduce the proportion of primary fuels used. Measures at the cement level refer to all measures that relate to the use of clinker alternatives, which make it possible to reduce the proportion of traditional cement clinker. These alternatives include supplementary cementitious materials such as blast furnace slag, fly ash, natural pozzolans, limestone, but also new materials such as calcined clays and (carbonated) recycled hardened cement paste. Breakthrough technologies include new, ground-breaking technologies such as carbon capture, utilization, and storage, which help to capture previously unavoidable emissions in cement production before they end up in the atmosphere. The IPCC[2] highlights CCS is critical to achieve the complete decarbonization of the cement industry. The following document focuses solely on carbon capture and storage. Carbon Capture and Utilization projects of Heidelberg Materials are not in focus of this document.

[2] IPCC, 2023: *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 184 pp., doi: 10.59327/IPCC/AR6-9789291691647.

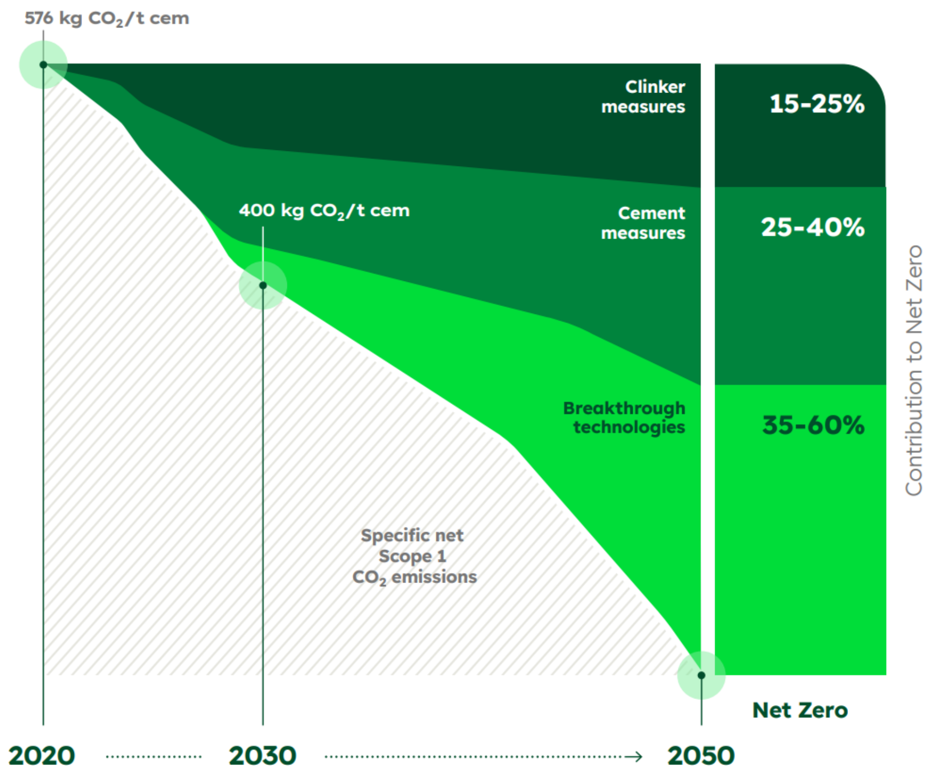

Figure 2 Heidelberg Materials AG Roadmap to Net Zero. It focuses on the development of net Scope 1 CO_2 emissions and underlying decarbonization levers.

Heidelberg Materials AG's Brevik plant in Norway is the first cement plant in the world with an industrial scale Carbon Capture Plant. The facility is operational since May 2025 and in August 2025, the commissioning of the Northern Light Storage Site took place. The Brevik CCS operation is part of the Norwegian Government's "Longship"-program[3]", aimed at demonstrating the capture of CO_2 from industrial sources, as well as transport and safe storage of CO_2. Every tonne of clinker produced at Brevik under CCS-conditions carries 307.3 kg of CCS-related CO_2 reductions and hence defines one unit of environmental attribute certificate (EAC, see chapter 6 for further details). Those certificates are bundled to our products via different attribution models (chapter 3) to support the different product claims (see below).

As part of our lighthouse cement CCS project in Brevik, Heidelberg Materials AG will offer four different products groups or variants to our customers. The variants offered will differ between the local Northern Europe market (e.g., Norway, Sweden, Iceland, Denmark) and the rest of countries covered by the EU Emissions Trading System (EU ETS), UK, Switzerland and are generally subject to customers choice. The products and their Global Warming Potential (GWP) are summarized below and in Table 1.

The three physical product variants based on the main product from Brevik (i.e. CEM II/B-M (V-L) 42,5 R) for the local market are:

- Physical Conventional Brevik Cement (baseline product, "grey cement"): This is the conventional product variant from the Brevik facility with a carbon footprint assuming that CCS is not in

[3] The Longship CCS project in Norway | Learn more about the project

operation. The GWP shall be available through a published EPD.[4] For the main product (Standardsement FA, CEM II/B-M (V-L) 42,5 R) the Global Warming Potential (GWP-total, net) is currently 451 kg CO_2eq./t cement, and it is expected to remain similar.

- Physical Low carbon Cement Brevik (evoBuild Carbon Captured)*:* This product variant is based on the emission reductions from the Carbon Capture unit at Brevik. CO_2 reductions are proportionally distributed across the entire clinker production. As mentioned above and further detailed in chapter 6, every tonne of clinker that is produced under carbon and capture conditions carries 307.3 kg CCS-related CO_2 reductions. For every tonne of clinker used to produce this cement type one EAC-equivalence of 307.3 kg CO_2 reduction is attributed. The GWP-total net for the main product evoBuild Low carbon Standardsement FA, CEM II/B-M (V-L) 42,5 R) is 230 kg CO_2eq./t cement, a reduction of 221 kg CO_2/t cement. The carbon footprint or GWP shall be available through a published prospective EPD[5]. The underlying LCA shall account for emissions related to the capture and storage of CO_2 including transport, operation, commissioning and decommissioning of the storage site as well as any leakages. Throughout this document, references to evoBuild Carbon Captured refer to evoBuild Low carbon Standardsement FA, CEM II/B-M (V-L) 42,5 R[6]. Other evoBuild CC cement types will also be available for sale from Brevik. Customers outside Norway may also choose this product variant.

- Physical evoZero Brevik cement: This is our product where EAC-equivalent CO_2 reductions are non-proportionally attributed to clinker volumes consumed using mass balancing with free attribution within one plant (detailed further in chapter 3.1.). In explicit for every tonne of clinker used to produce this cement type more than one EAC-equivalence of 307.3 kg CO_2 reduction is attributed. The estimated GWP-total net for the main product (CEM II/B-M (V-L) 42,5 R) is 46 kg[7] CO_2eq./t cement, a reduction of 405 kg CO_2eq./t cement or 90% compared to the conventional product. Other evoBuild CC and evoZero CC cement types will also be available for sale from Brevik. The underlying LCA shall account for emissions related to the capture and storage of CO_2 including transport, operation, commissioning and decommissioning of the storage site as well as any leakages. See Chapter 11 for further graphical illustration. Customers outside Norway may also choose this product variant.

It is important to disclose that there will be no physical segregation between those three cement types and that customers may purchase cement which was produced when CCS was operational, but they may choose not to purchase an evo product variant or vice versa. The allocation of CCS-based EACs to products will be based on chain of custody models which will be introduced in chapter 3.

The physical products from Brevik detailed above may also be chosen by customers outside of Norway. In this scenario, the physical cement is sold and transferred from Heidelberg Materials Norway AS to

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[4] https://digi.epd-norge.no/epder/byggevarer/sement-kalk/standardsement-fa-brevik-cem-ii-b-m-v-l-42-5-r

[5] The key purpose for the Prospective EPD is to fill a need and gap for products recently released or not yet released to the market, when the 12 months data quality requirement is not possible to achieve. See https://www.epd-norge.no/nyhetsarkiv/epd-norway-introduce-a-new-epd-type-prospective-epd

[6] EPD ID: NEPD-12342-12398- evoBuild Low carbon Standard cement FA, CEM II/BM (VL) 42.5 R- EPD-Global-Powered by EPD-Norway

[7] 46 kg are from Scope 2 & 3 emissions. It was decided to not balance these in physical products coming from Brevik. Virtual products are balanced to zero to simplify accounting for variability Scope 2+3 emissions across several countries and plants

the destination country's subsidiary of Heidelberg Materials AG (e.g. Heidelberg Materials UK). The customer is then supplied by the Heidelberg Materials AG company local to their market.
In countries not local to the Brevik plant but still covered by EU ETS, UK and Switzerland, we will offer customers the choice of an innovative virtual product to avoid transport emissions that would be incurred by shipping the physical product from Brevik.

- Virtual evoZero cement (evoZero Carbon Captured): Customers that buy virtual evoZero are investing in the production of CCS-based low-carbon clinker produced at Brevik site. A customer sources cement from a Heidelberg Materials AG plant local to them. Verified EACs that carry 307.3 kg CO_2 reductions per tonne of clinker (see chapter 6.1) generated at Brevik and stored in the Carbon Bank are virtually transferred and bundled to the locally sourced product. Due to varied energy mixes and supply chains between plants in Heidelberg Materials AG network, Scope 1, 2 + 3 emissions may vary from that of Brevik. The carbon footprint of the local, non-Brevik product, shall be reduced to zero using EACs from our Carbon Bank. A block chain solution shall support evoZero Declaration traceability back to the Brevik plant (see chapter 6). The Virtual evoZero product will initially be available in countries within the EU ETS[8], UK and Switzerland).

Table 1 List of cement products and their Global Warming Potential (GWP-total net) discussed in this document. Other evoBuild CC and evoZero CC cement types will also be available for sale from Brevik.

	Physical Products from Brevik (e.g. Standardsement FA, CEM II/B-M (V-L) 42,5 R)			Virtual Product
	grey cement	evoBuild CC	evoZero Brevik	evoZero
GWP-total	451 kg CO_2eq./t	230 kg CO_2 eq./t	46 kg CO_2 eq./t	0 kg CO_2/t
Proof of GWP	EPD	Prospective EPD of evoBuild	P-EPD of evoBuild	EPD of local grey cement
			evoZero Declaration	evoZero Declaration balancing GWP from local plant EPD
CCS contribution	-	-221 kg CO_2 eq./t	-405 kg CO_2 eq./t**	As defined on the evoZero Declaration
EACs attributed	-	1*	1.32	

* EACs considered in the evoBuild CC EPD are not defined as an EAC but fully managed via the carbon bank to ensure traceability and to eliminate any double-counting risk.
** Of the 405 kg, 221 kg are part of the underlying evoBuild p-EPD. In addition, the GWP-total of evoZero Brevik is shown in the additional environmental information of the underlying evoBuild p-EPD. The remaining 184 kg of CO_2 reductions are provided to the customer in form of an evoZero Product Declaration issued by the carbon bank. The Residual 46 kg in evoZero Brevik are from Scope 2 & 3 emissions. It was decided to not balance these in physical products coming from Brevik. Virtual products are balanced to zero to simplify accounting for variability Scope 2+3 emissions across several countries and plants.

[8] Germany, Hungary, Spain, Italy, France, Belgium, Netherlands, UK, Sweden, Lithuania, Poland, Romania, Bulgaria, Czech, Estonia, Denmark, Iceland, Greece

2 Scheme description

The key objective of this scheme is to ensure that CO_2 emission reductions achieved by the carbon capture installation in Brevik (chapter 5) are credibly registered in the carbon bank (chapter 6) and attributed at product level (chapter 6.2). Every tonne of clinker produced at Brevik under CCS-conditions carries 307.3 kg of CCS-related CO_2 reductions and hence defines one unit of environmental attribute certificate (EAC, see chapter 6.1 for further details). The attribution model(s) that will be used in this scheme (i.e. mass balancing with free attribution) aims to support our customers and our value chain in meeting their CO_2 emission reduction targets (chapter 3). Heidelberg Materials AG will report environmental benefits from CCS in a transparent and verified manner to ensure stakeholder acceptance. This will be achieved by means of deploying a clear carbon accounting methodology, including third-party verification.

We at Heidelberg Materials AG are fully committed to complete decarbonization of our production processes and to achieve net zero by 2050. However, CCS decarbonization projects are technically complex and capital-intensive investments. It is therefore virtually impossible to decarbonize all facilities at once. Creating market demand, achieving customer confidence as well as building positive business cases for carbon reduced products achieved by CCS, is crucial for triggering further decarbonization investments. Our existing evoBuild line of products offer a reduced CO_2 footprint of at least 30% compared to the GCCA reference CEM I in 2020,[9] whilst our evoZero product line offers the world's first carbon captured cement.

Heidelberg Materials AG's Brevik plant is the first plant in the world to have CCS products at scale. To the best of our knowledge, CCS is currently the only technology that enables a product claim close to zero in which all direct CO_2 emissions are reduced close to zero. In Brevik, this is achieved by utilizing mass balancing as a chain of custody model (chapter 3) to assign CCS related carbon footprint reductions to dedicated product volumes of the Brevik products shipped to customers in Europe.

Supplying customers with the physical product from the Brevik plant over long distances undermines the reason for producing low carbon products as it creates additional transport related CO_2 emissions, disturbs existing supply chains, and triggers multiple challenges resulting in lower acceptance of the product e.g., product approvals, building standards, additional capex from customers, etc. In the absence of a local supply of CCS based products, mass balancing with free attribution chain of custody models serves as an ideal solution in which sustainability credentials of products produced with CCS will be attributed to products produced in a plant, not yet equipped with CCS technology (this is our virtual product as described further in Chapter 3.2 and Chapter 1).

We acknowledge that use of chain of custody models carries an inherent risk of double counting. We mitigate this risk in a transparent and credible manner via third-party verified accounting. CO_2 emission reductions and allocation to each customer will be assured by a third-party verification body and stored on a blockchain (Chapter 6). Blockchain solutions will add an additional level of transparency and security to the carbon reductions transformed into virtual assets. This way HM publicly ensures the "integrity of carbon reductions" utilized and, by immutability of the virtual assets, avoids the risk of double counting.

[9] For products to qualify for evoBuild branding, their gross Scope 1 CO_2 emissions shall be equal or below 552 kg CO_2/t (after mathematical rounding).

evoZero, the Heidelberg Materials brand name for CCS cements that in the Brevik case rely on chain of custody models, stands for the world´s first CCS-based cement at scale. We differentiate our product claim from the recently published CO_2 label called the "Cement Carbon Class" (CCC) by the German VDZ, or the International Energy Agency (IEA) proposal for near zero and low emissions cement labelling. Both rely on EPD values for which the underlying standards do not yet recognize the chain of custody models applied in this document. We see the chain of custody models applied in this document as necessary transitionary tools for the decarbonization of our industry. With increasing deployment and technological developments of CCS, their importance will diminish towards 2050.

We position evoZero as net-zero cement brand. The net-zero claim is achieved by compensating the total GWP value of our **virtual evoZero** product via allocating EACs generated by the CCS facility in Brevik non-proportionally to a cement produced at another Heidelberg Materials plant in Europe or the UK. The amount of via EACs allocated CCS-enabled CO_2 reductions equal the GWP of the underlying physical cement of the non-Brevik plant.

An alternative product offering is the **physical evoZero** cement for which we mass balance the direct emissions (namely process and fuel emissions stemming from the fossil carbon in the fuels) to zero. This is achieved via the allocation of EACs in a non-proportional way to the clinker that is used in the cement. This leads to an emission reduction for the standard product of Brevik of approx. 90%. We will not compensate the remaining emissions from cement production, because, with the exception of applying mass balance of emissions, we decided to be with our physical evoZero offering as close as possible to existing PCF rules as defined in EN15804. Chapter 1 provides more information regarding the GWP of the different product variants on the example of the main product produced in Brevik, i.e. CEM II/B-M (V-L) 42,5 R).

In addition to CCS emission reductions outlined in this document, Heidelberg Materials AG continue to innovate and apply further decarbonisation technologies in our corporate drive to Net Zero by 2050 (Figure 2). Breakthrough technologies such as enforced carbonation and utilization of captured CO_2 will play an increasing role but are not part of this document.

3 Definition of chain of custody models

Several chain-of-custody models exist, and ISO 22095 Chain of Custody – General Terminology and Models classifies them into five models. Among these, the mass balance and book and claim models have gained attention as potential solutions to promote the use and production of more sustainable materials. The five models are:

1. **Identity Preserved Model**: This chain of custody model ensures that materials or products originate from a single source, maintaining their specified characteristics throughout the supply chain.
2. **Segregated Model**: In this model, the specified characteristics of a material or product are preserved from the initial input to the final output.
3. **Controlled Blending Model**: This model involves mixing materials or products with a set of specified characteristics with those without, according to certain criteria, resulting in a known proportion of the specified characteristics in the final output.
4. **Mass Balance Model**: Here, materials or products with a set of specified characteristics are mixed with materials or products without some or all of these characteristics, following defined criteria.
5. **Book and Claim Model**: This model involves an administrative record flow that is not necessarily connected to the physical flow of material or product throughout the supply chain.

In the cement and concrete industry, the chain of custody approaches described in these guidelines cannot fully comply with ISO 22095. This is because ISO 22095 was not originally designed to address GHG emissions. Heidelberg Materials AG acknowledges the definitions in ISO 22095 and places them in a broader context, outlined in this chapter.

Figure 3 describes the two individual chain of custody (CoC) models in use within this document. The mass balance credit method as defined in ISO 22095 serves as the starting point for the two models. However, the terminology is additionally aligned with the latest guidance for chain of custody models developed by ISEAL[10], and free attribution of specified characteristics is used as laid out in the same document. New ISO/DIS 13662 defines new chain of custody models, including Free Mass Balance, referred to as "mass balance credit method". This standard is still under development and shall not be considered in the assurance criteria.

A detailed description is given in the subsequent subchapters 3.1 and 3.2.

To implement CoC models, we utilize the following mechanism for tracking and allocating CO_2 emissions in our value chain:

Environmental Attribute Certificates (EACs) – Environmental Attribute Certificates are instruments used to quantify, verify and track the environmental benefits associated with climate mitigation activities or projects[11]. Heidelberg Materials uses EACs as an instrument to assign, outside current LCA/EPD standards, a particular environmental attribute or benefit to a standard product produced under less

[10] ISEAL Chain of Custody Models and Definitions Guidance v2 (July 25) | ISEAL Alliance
[11] SBTi Call for Evidence on Environmental Attribute Certificates (EACs). ISO 22095 and draft ISO 13662 do refer to them as credit in the mass balance credit method.

favourable conditions. EACs are generated by decoupling environmental benefits, such as emission reductions, from a deeply decarbonized production facility (e.g. a kiln equipped with CCS).

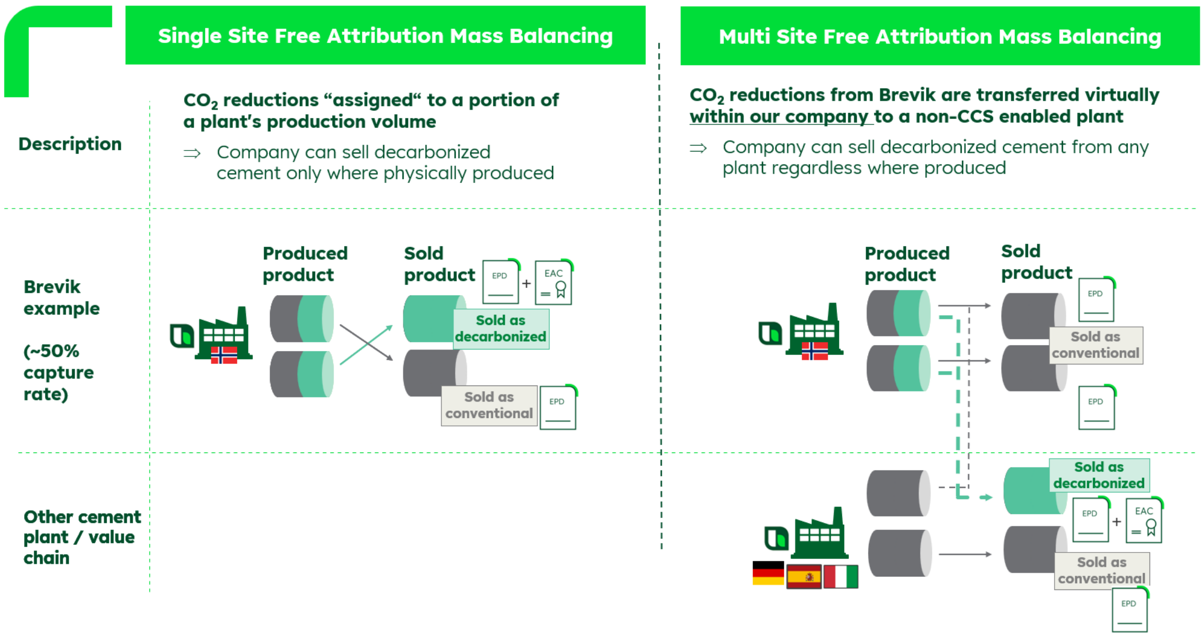

Figure 3 Mass Balancing with free attribution within Heidelberg Materials AG plants.

The CoC models illustrated in Figure 3 apply <u>proper free attribution</u>, i.e. attribution shall be allowed for the emission scope that are addressed by the applied carbon reduction technology solution. Hence, CO_2 reductions achieved by CCS shall be used for balancing fuel and process emissions, i.e. Scope 1 emissions as indicated in Figure 4.

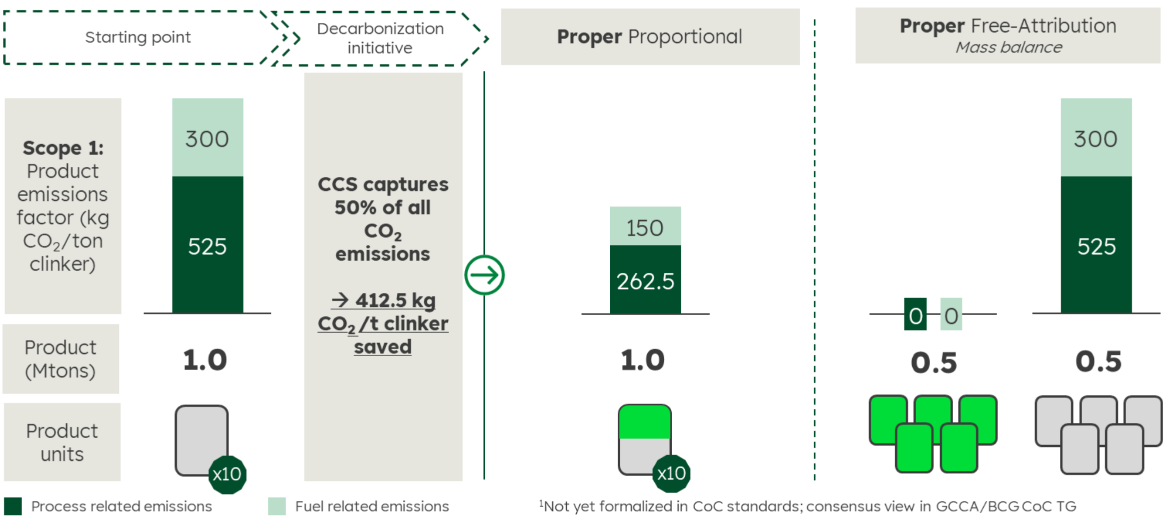

Figure 4 Mass Balance – proper free attribution (proper non-proportional). Free attribution refers assigning emission reductions to a proportion of the product so that it is decarbonized. The remaining product is then sold as "grey" or non-decarbonized cement." The numbers in this figure are purely to demonstrate the difference between Proportional Attribution and Mass Balance with Proper Free Attribution. See Table 1 for the GWP potential for products from the Brevik plant.

CO_2 reductions achieved by CCS may be used to compensate residual Scope 2 or 3 emissions of a product. In such a case, those CO_2 reductions shall not be counted as Scope 1 reductions achieved at the Brevik site and hence shall be added to the plant´s Scope 1 GHG emissions inventory. Purchasing green electricity / RECs may therefore be considered as a valuable alternative for balancing Scope 2 emissions.

3.1 Mass balancing with Free Attribution within one plant

Mass balancing with free attribution (non-proportional) within one plant is a process of assigning, in the case of implementing CCS, achieved carbon reductions of a plant's direct CO_2 emissions (Scope 1) to a share of specific product volumes produced in the respective plant (see Figure 5 "sold as decarbonized"). Consequently, the remaining share of product volumes may be free of assigned Scope 1 emission reductions ("sold as conventional").

In the course of this document, products based on mass balancing with free attribution within one plant shall be called "physical evoZero".

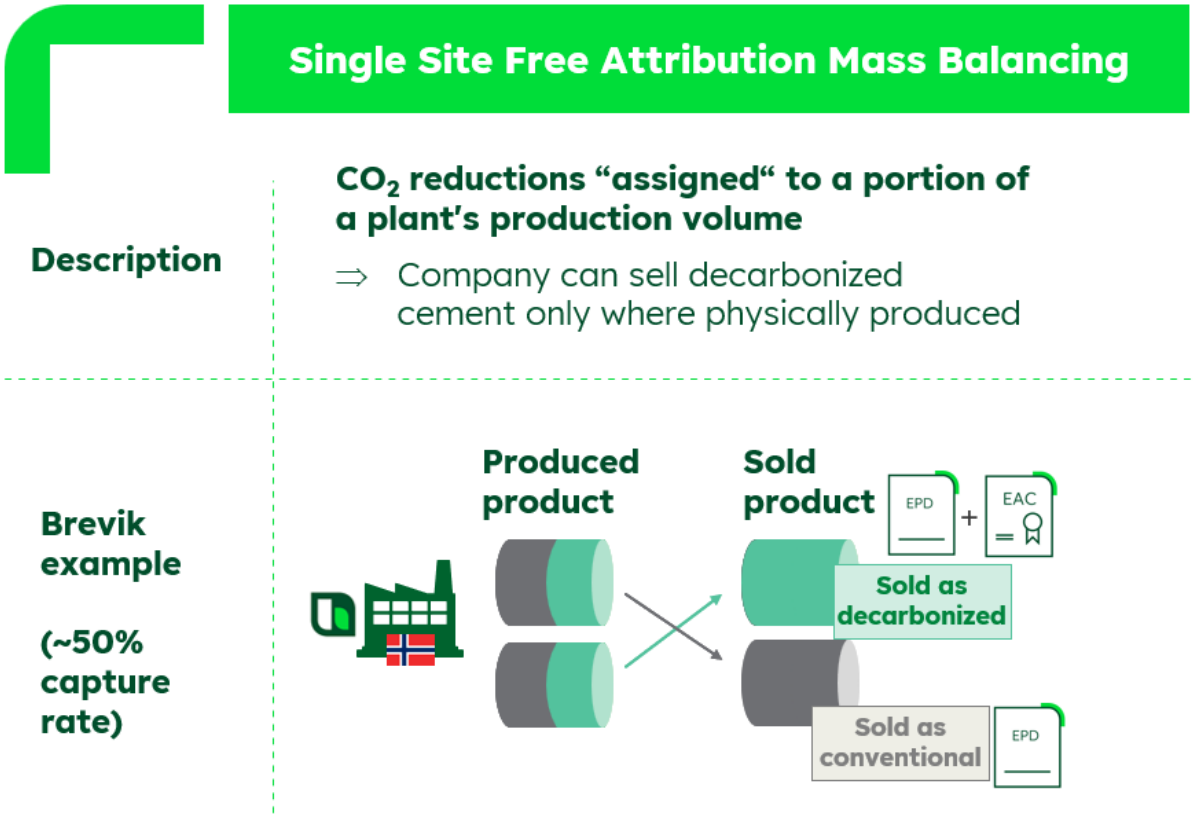

Figure 5 Mass balancing with free attribution within one plant

3.2 Mass balancing with Free Attribution across multiple sites

Multi-site mass balancing with free attribution (non-proportional) is a process applicable in the case of CCS being implemented in a given plant A (here Brevik). Direct emission reductions (Scope 1) realized in plant A are assigned virtually to a share of specific products produced in plant B. Consequently, the share of product volumes in plant B may be free of assigned Scope 1 emissions and may be "sold as decarbonized". Plant A and plant B are part of the same company (Group) but typically located in different places.

In the course of this document products based on mass balancing with free attribution within multiple sites shall be called "virtual evoZero".

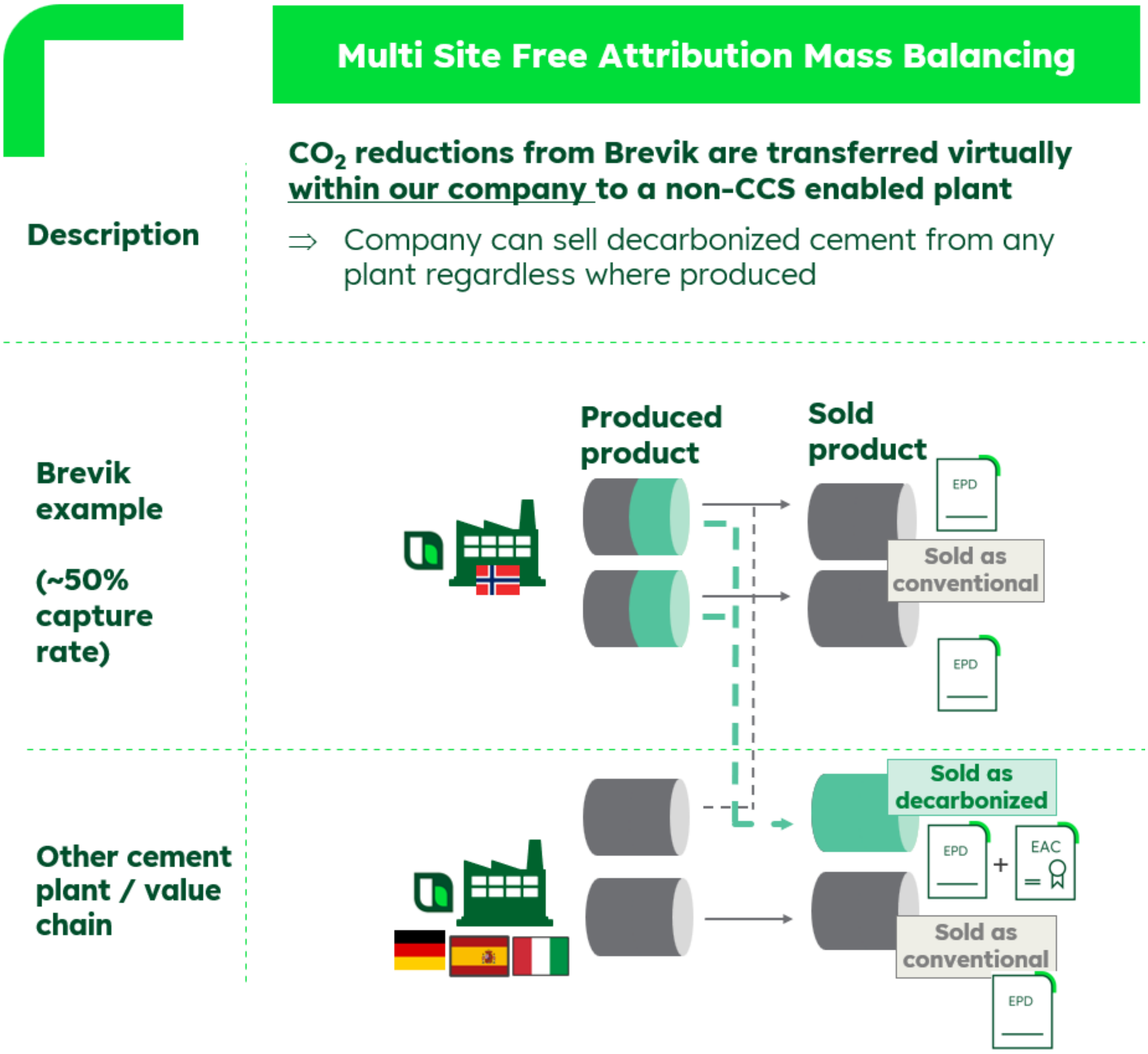

Figure 6 Mass balancing with free attribution within multiple plants belonging to the same company group (organization)

3.3 Book and claim outside company border but within cement value chain

Book and claim is a CoC model specifying how a set of specific environmental attributes of processed inputs can be attributed to products outside the boundary of a specific company through applying a trading mechanism for Environmental Attribute Certificates (EAC).

We will use the term 'book and claim' in the case of direct transfer of EACs to customers. An example would be a project developer in Country A purchasing EACs from HM Norway with the conventional cement coming from another local cement producer that shall not belong to Heidelberg Materials AG.

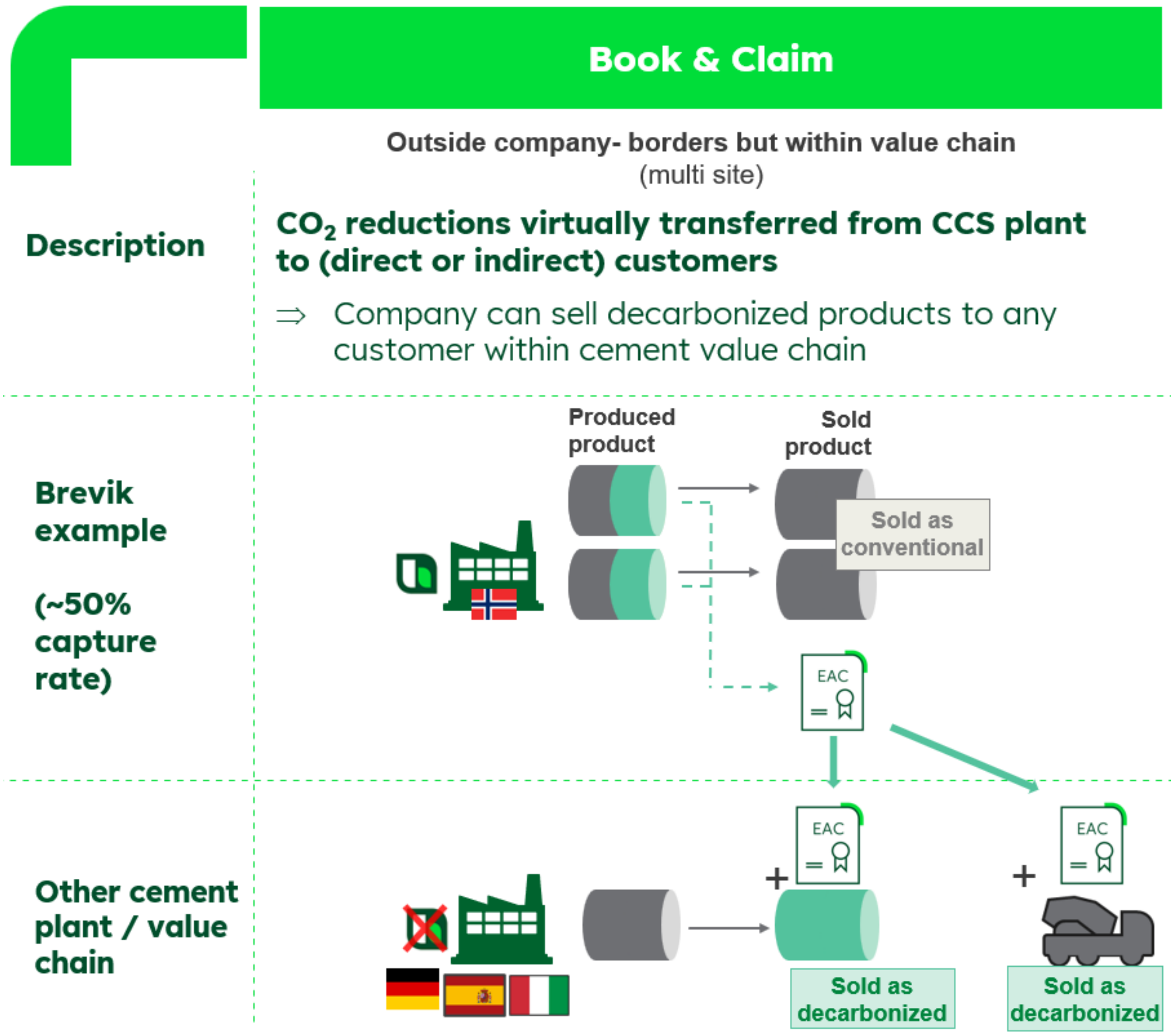

Figure 7 Book and claim CoC model for transferring EACs outside our company boundary (not in scope for this methodology)

The book and claim CoC model as described in this document is not in Scope of this methodology and only presented to highlight ongoing developments within the cement and concrete sector. Heidelberg Materials AG shall update this document should it intend to make use of the Book & Claim CoC model.

4 Calculation of carbon footprint for cement products

4.1 Principles

The accounting methodology shall refer to the carbon footprint (CFP) of the cement product. The CFP shall be communicated as Global Warming Potential (GWP) in the format of an Environmental Product Declaration (EPD). An EPD is an independently verified report, complying with ISO 14025, designed to offer transparency of the environmental performance of the declared product.

The type of EPD shall be a “cradle-to-gate” EPD comprising raw material supply, transport and manufacturing (A1 – A3) in accordance with EN 15804 and EN 16908 and may additionally include the option A4 (downstream transport). The declared unit is 1 tonne of cement. The reference for the CO_2 attribution is the GWP considering A1 to A3. GWP related to the A4 scenario is not balanced by the Carbon Bank.

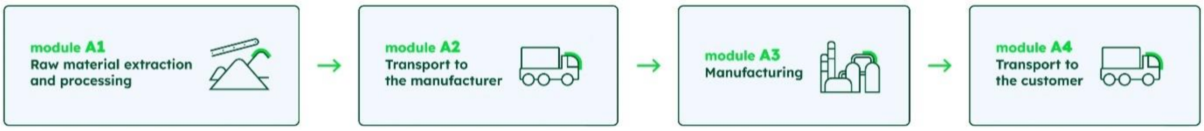

Figure 8 Life cycle stages and modules covered in the cement EPD

4.2 EPD types

The EPDs shall pertain to the actual products manufactured. Therefore, for all plants except Brevik, the EPDs shall refer to conventional cement produced without CCS. EPDs that include CCS in the environmental impact indicators shall only be issued for cement produced at the Brevik plant.

For each cement type produced at Heidelberg Materials AG’s Brevik plant, two EPD shall be issued:

- Conventional cement EPD without carbon capture (“grey cement”), and
- Prospective EPD (P-EPD) with carbon capture (evoBuild Carbon Capture Brevik)

4.2.1 Conventional EPD (“grey cement”)

The EPDs for the cement types produced in Brevik, assuming the carbon capture installation is not operational (conventional cement EPD), shall be based on inventories that exclude CCS.

For all other plants where CCS is not implemented, the EPDs shall reflect conventional cement production. The preferred formats for issuing these EPDs are ranked as follows:

1. Preferred option:
   A cement-type-specific and plant-specific published EPD.
2. Second preferred option:
   A cement-type-specific published EPD based on weighted average data (by production volume) from multiple Heidelberg Materials’ plants within the same country.

3. Third preferred option:
   A cement-type-specific, industry average published EPD, provided this format is commonly used in the respective country.

4.2.2 Prospective EPD (evo Build Carbon Capture Brevik)

Typically, the inventories used for EPD generation refer to one year of production. This is not possible for the evoBuild cement EPD for Brevik production since the go-live of the carbon capture was reached only very recently, i.e. in May 2025. Consequently, the EPDs of evoBuild cements from Brevik shall be generated as "prospective EPDs" (P-EPD) in accordance with EPD Norway's General Programme Instructions including emissions related to CCS (chapter 4.8). These prospective EPDs shall not be valid for longer than one year and shall be reviewed once the first year of validity has expired. It shall be clearly identified in the EPD that it is a prospective EPD and the variability and uncertainty of the limited set of data it is based upon.

The EPDs for evoBuild cement produced at the Brevik plant shall be based on inventories that incorporate CCS. Consequently, the system boundary shall encompass the cement manufacturing process, the capture and liquefaction of CO_2, the transportation of CO_2, and its storage. The burden of CCS will consistently refer to 1 kg of CO_2 stored. In accordance with EN 15804, the effect of permanent biogenic carbon storage shall not be included in the calculation of the GWP.

The P-EPD shall be calculated by supplementing the LCA results of the corresponding grey cement with the life cycle assessment of the CCS activities. The inventories used in the P-EPD published in 2025 are based on a combination of reported and well-justified assumed data. While the LCI for cement production without CCS relies on primary data from 2024, no operational data from the CCS facility were available at the time of the LCA study. Therefore, the CCS-related data are based on design specifications and performance requirements. These include a minimum capture rate of 50 t CO_2/h, which is a key acceptance criterion for the capture plant. This capture rate corresponds to a clinker production rate of 138 t/h. The facility must demonstrate this performance before final approval. As such, the 50 t CO_2/h rate is considered representative for the first year of operation. This capture rate is expected to increase to 54.8 t CO_2/h, reflecting the planned performance ramp-up during the early operational phase.

The prospective EPD shall be developed by an external LCA consultant based on the model used in the LCA.no EPD generator (chapter 4.3) in accordance with EPD Norway's General Programme Instructions[12].

An example of such prospective EPD can be found on the Heidelberg Materials evoZero Assurance Website:

www.evoZero\assurance

as well as under the program operator EPD Global:

EPD ID: NEPD-12342-12398- evoBuild Low carbon Standard cement FA, CEM II/BM (VL) 42.5 R- EPD-Global- Powered by EPD-Norway

[12] The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019. Version 3.0 dated 2019.04.24.

Information on the GWP of Brevik's physical evoZero cement shall be included in the additional environmental information of the evoBuild EPD of the respective cement type.

The P-EPDs serve as a basis for the different evoBuild and evoZero products as outlined in chapter 1 and chapter 7.

As indicated above the capture rate of the plant is expected to be above 50 t CO_2 / h when the capture plant is operational. It is expected that the ramp-up of the capture plant is mainly impacted by downtime periods. The thoroughly implemented accounting and allocation rules laid out in this document will prevent any overselling of EACs which haven´t occurred due to e.g. downtime of the capture plant (see chapter 6 for further details). Consequently, Heidelberg Material shall update the P-EPD as indicated above only once the first year of validity has expired but not because of fluctuations of the capture rate – even if it deviates more than 10% from the estimated value.

4.3 LCA/EPD tools

The EPDs shall be generated either by using a pre-verified LCA or EPD tool, with a locked LCA model and background database that cannot be changed by the user, or by an external LCA consultant in cooperation with a third-party verifier. The pre-verified tool shall comply with EN 15804 and EN 16908. Heidelberg Materials AG has decided to primarily rely on two pre-verified tools:

- EPD generator of LCA.no (LCA.no EPD generator)
- Industry EPD Tool of the Global Cement and Concrete Association (GCCA EPD tool)

LCA.no's EPD generator has been designed to develop EPDs in accordance with EN 15804 and ISO 14025 registered under EPD Norway. The tool can be customized to create EPDs for a variety of products according to different PCRs and for different companies. One application is the cement EPD generator for EPDs in accordance with EN 15804 and EN 16908. The EPD generator is an EPD tool as defined in the ECO Platform Tool Verification Guidelines[13]. The setup for Heidelberg Materials AG enables two modes of use:

- Semi-automated workflow via LCA.no EPD generator web app: locked LCA model and background database, menu and EPD template (EPD tool with individual verification), externally third-party verified
- Fully automated workflow via EPD manager: locked LCA model, background database, data sourcing and mapping, full integration of the tool into Heidelberg Materials AG's management systems (fully integrated EPD tool), externally third-party verified

Whilst in the semi-automated workflow the inventories must be manually entered into the LCA.no EPD generator, in the fully automated workflow the inventories are automatically sourced from Heidelberg Materials AG management systems and processed in the EPD Manager. Both, the LCA.no EPD generator and the EPD manager - Heidelberg Materials' add-on tool to the LCA.no EPD generator - are independently third-party verified. In both workflows, the output is a draft EPD which can directly be sent to verification. The EPDs are published under EPD Norway. The GCCA EPD tool is a web-based LCA tool with a locked LCA model for clinker, cement, aggregates, concrete and precast elements developed by the Global Cement and Concrete Association as an industry tool. The cement LCA model and database have been implemented in accordance with EN 15804 and EN 16908. The GCCA EPD tool

[13] ECO PLATFORM Tool Verification Guidelines Version 1.1, June 2024 (https://www.eco-platform.org/our-documents.html)

generates two outputs: a self-declaration and a background report. The EPD has to be drafted manually and verified in accordance with the respective requirement set by a chosen programme operator.

Heidelberg Materials AG will gradually implement the fully automated LCA.no EPD workflow on a country-by-country basis. Only countries that utilize SAP as their material management system will be included. Countries without SAP should generate their EPDs using the LCA.no EPD generator in the semi-automated workflow, the GCCA EPD tool or external LCA consultants.

4.4 Data

Data quality requirements shall be followed in accordance with the specified methodology.

Background data used in the databases underlying the LCA shall be developed in accordance with the requirements given in ISO 14044, ISO 14025 and EN 15804. The background data shall be implemented directly from the ecoinvent database (version 3.10 or later) or from reliable supplier EPDs which are independently verified. The impact assessment method EF Reference Package 3.1 for EN 15804 shall be used.

LCI data shall be collected from Heidelberg Materials AG's management and reporting systems (e.g. SAP, GCCA reporting, Janus, ESG reporting) by the LCA practitioner or by the fully automated data collection routine.

For electricity consumed in the cement production, Heidelberg Materials AG may apply the location-based approach using the country's average grid mix if no contractual agreements such as guarantees of origin (GOs), being valid for the EPD validity period, are available. Alternatively, the market-based approach may be used, which allows for the inclusion of contractual instruments. Under this approach, if GOs are available, the modelled electricity mix may be customized to the electricity mix purchased. In this case, the portion of electricity not covered by GOs shall be modelled by the country-specific residual electricity mix. Energy attribute certificates are applicable in all Environmental Product Declaration (EPD) creation processes outlined, following ECO Platform calculation rules in combination with Program Operators, General Program instructions. When electricity certificates are no longer valid, the EPD shall be updated. EPDs published under EPD Norge include a transparent reporting on electricity presenting both, the impact of the location-based and the market-based approach in an additional table.

4.5 Time-related coverage

As a minimum requirement, and as per EN 15804 requirements, primary data should be less than 5 years old at the point that the EPD is issued, covering annual production. If less than a 12-months period is covered and if data older than 5 years is used justification shall be provided. Secondary data should be maximum 10 years old. If older data is used, it shall be clearly stated and justified why the data is still considered valid.

The EPD should be recalculated every 5 years as a minimum to reflect ongoing decarbonisation of the cement industry.

The P-EPDs of cements produced at the Brevik plant – reflecting the nature of a prospective EPD –shall be not valid longer than one year and shall be reviewed once the first year of validity has expired.

4.6 Organisational coverage

The term organisation covers the specific production site or a chain of two or more sites where the product is physically transferred from one site to another for further processing (site-to-site).

The EPD shall refer to a specific product, i.e. cement type, preferably of one production site (see chapter 4.2.1). In the case of a physical transfer of the product during processing, the whole chain of production is referred to.

This scheme shall be used to calculate the carbon footprint of cement products produced at all Heidelberg Materials AG production sites within the EU ETS, UK and Switzerland.

In calculating the full impact of the CCS operation, the LCA of the entire CCS operation (both HM + Northern Lights) shall be included. Only net CO_2 stored volumes shall be recorded in the carbon bank (see chapter 6).

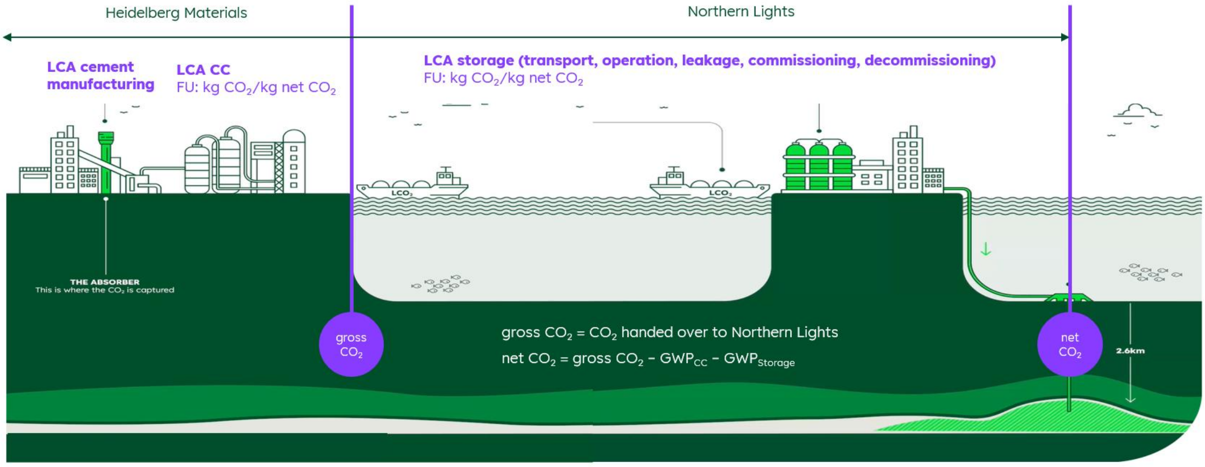

Figure 9 Definition of net CO_2 stored volumes that are the basis for carbon reductions registered in the carbon bank.

4.7 GHG coverage

The Life Cycle Impact Assessment (LCIA) shall be conducted in accordance with ISO 14044 and EN 15804. Following these standards, the GWP shall be calculated in accordance with the Baseline model of 100 years of the IPCC based on IPCC 2013 applying the characterization factors from EC-JRC. The current set of characterization factors given in the Environmental footprint reference package EF 3.1 shall be applied. The characterization factors are available at the following web-link: European Platform on LCA | EPLCA

In the transparent communication of environmental performance through EPDs, two approaches to presenting GWP are currently used across European markets: gross GWP and net GWP.

- Gross GWP Emissions includes fossil and biogenic emissions from the combustion of waste fuels.
- Net GWP Emissions, in contrast, excludes these biogenic emissions. This approach is based on the "polluter pays" principle as outlined in EN 15804.

According to the "polluter pays" principle - one of the two key rules for defining system boundaries in EN 15804 - waste processing emissions are allocated to the product system that generates the waste, up to the point where the waste reaches its end-of-waste status. As a result, emissions from the combustion of waste fuels are attributed to the original waste-generating process, not to the cement production process where the waste is used as fuel.

However, national practices vary. In some countries, such as the United Kingdom, it is common to conservatively report gross GWP in EPDs. Therefore, depending on the market, the EPD will present either gross or net GWP in the main LCA results table. EAC allocation shall follow national practices for GWP reporting. In cases where gross GWP is applied, a proportionally higher number of EACs shall be attributed to support the derivation of individual product claims.

To ensure transparency and comparability, the alternative GWP value (gross or net emissions, depending on which is primary) is typically included elsewhere in the EPD- either in a footnote or in an additional table.

4.8 Tools, verification and certification

The EPD shall be independently verified in accordance with ISO 14025.

For the generation of EPDs with the LCA.no EPD generator, the rules outlined in EPD Norway's General Programme Instructions shall be applied.

It is best practice within EPD Norway to allow for independent internal review in accordance with ISO 14025, provided the EPD tool demonstrates a certain level of reliability due to locked parameters and independent third-party verification. The internal reviewer must prove their competency and independence to the EPD creator, ensuring no conflict of interest.

The LCA.no EPD generator used in the semi-automated workflow is an independently third-party verified "reference flow tool" in accordance with EPD Norway's General Programme Instructions (Annex G) and a "EPD tool with individual verification" in accordance with the ECO Platform Tool Verification Guidelines Version 1.1 (June 2024). The quality of input data is not intrinsically ensured and hence the input data and the output data shall be independently reviewed for each single EPD.

The LCA.no EPD generator, used in the automated workflow through full integration into HM's management systems via the EPD Manager, is a "process certification tool" in accordance with EPD Norway's General Programme Instructions (Annex G) and is referred to as a "fully integrated EPD tool" in the ECO Platform Tool Verification Guidelines Version 1.1 (June 2024). Quality of input data is intrinsically ensured by

- collecting the data from Heidelberg Materials AG's management systems,
- independently third-party verified locked data processing, and
- locked results.

For verification of EPDs generated in the automated workflow, Heidelberg Materials AG has committed to a risk-minimizing approach for 2025, going beyond the requirements stated in the ECO Platform Tool Verification Guidelines, i.e. sample check of input data, consistency of input and output data. In 2025, this verification process shall cover:

- Check of all inputs that may be manually maintained and sent via API, such as texts or manual data capture without the four eyes principle.
- Check of bill of materials and results for plausibility
- Check of relevant balances (sum of weight, kWh, MJ, etc.)

The GCCA EPD tool is an independently third-party pre-verified LCA tool. The International version was verified by Studio Fieschi, Italy, and is recognized by EPD International. The North American version was verified by Athena Sustainable Materials Institute. The results shall be declared through ISO 14025 conformant Type III EPD that is third-party verified..

Table 2: Overview of third-party verification depending on the tool used for EPD creation

EPD tool	Type of tool	Standard/guidelines for verification	Scope of EPD verification	Verifier of EPD
LCA.no EPD generator (semi-automated workflow)	Externally third-party verified reference flow tool / EPD tool with individual verification	- ISO 14025 - GPI of EPD Norway - ECO Platform Verification rules	Independent review of input data & output data (EPD document) of each EPD	Independent internal reviewer with special training (certificate to be maintained)
LCA.no EPD generator (automated workflow)	Externally third-party verified process certification tool / fully integrated EPD tool	- ISO 14025 - GPI of EPD Norway - ECO Platform Verification rules	On every EPD, check of: - inputs that may be manually main-tained and sent via API - plausibility of bill of materials and results - relevant balances (sum of weight, kWh, MJ, etc.)	Independent internal reviewer with special training (certificate to be maintained)
GCCA EPD tool	Externally third-party verified LCA tool	- ISO 14025 - GPI of EPD International - ECO Platform Verification rules	Independent third-party verification of every EPD	Verifier accepted by selected programme operator

5 Carbon emission reductions from Brevik

5.1 Emission Reductions Overview

Greenhouse Gas (GHG) data stands as one of the fundamental key performance indicators (KPIs) within Heidelberg Materials AG's operations, and we diligently allocate substantial resources to ensure accurate and comprehensive data collection in line with the GHG Protocol CO2 and Energy Accounting and Reporting Standard for the Cement Industry.[14] The process of collecting this data encompasses several significant procedures, with a particular focus on scope 1 and 2 emissions, which undergo rigorous scrutiny and are reasonably assured by PwC according to GCCA[15] which is aligned with GHG protocol. However, it is worth emphasizing that we proactively address the assessment of scope 3 emissions on corporate level through a diligent and conscientious limited assurance process.

5.2 Production: Key Steps in Producing Cement/Clinker with CCS

The Brevik plant in Norway, operated by Heidelberg Materials AG, represents a pioneering effort in integrating carbon capture and storage (CCS) into cement production at an industrial scale. This facility is part of Norway's "Longship" project and is designed to demonstrate the end-to-end CCS process, including capture, transport, and safe storage of CO_2. Northern Lights is the transport and storage partner of the Longship Project. The journey of CO_2 from capture to final storage is shown in Figure 10.

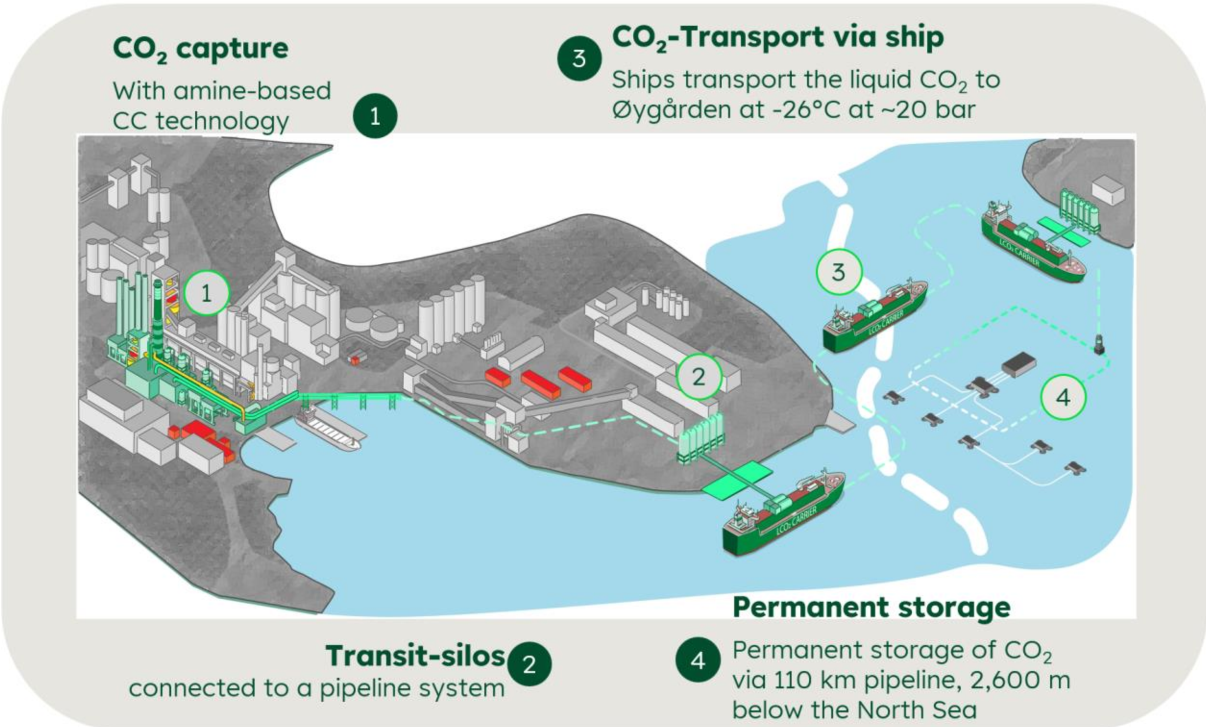

Figure 10 An overview of captured CO2 from Brevik to final storage.

[14] https://ghgprotocol.org/sites/default/files/2023-03/co2_CSI_Cement_Protocol-V2.0_0.pdf
[15] GCCA Sustainability Guidelines for the monitoring and reporting of CO2 emissions from cement manufacturing.

The CCS process at the Brevik plant involves capturing CO_2 from the kiln flue gases during cement production (Figure 11). The plant is equipped with two flue gas strings, with 100% of string 1 and 12% of string 2 being fed into the carbon capture unit—amounting to 56% of the total kiln flue gases. These flue gases are diverted into an amine-based capture unit, operated at a capture rate of 85%. This corresponds to an annual CO_2 capture volume of 400,000 tonnes (approximately 48% of the total CO_2 emissions from clinker production). The main stages of the CO_2 capture process are described in four stages below:

- **Pre-Capture Treatment:** Flue gases are cooled and washed to remove impurities before entering the capture unit.
- **CO_2 Absorption:** An amine-based solvent binds CO_2, separating it from other components in the flue gas.
- **Desorption and Compression:** The CO_2-rich solvent is heated to release pure CO_2 and water, which is subsequently cooled and compressed to a liquid state (-26°C and 16 bar).
- **Storage Preparation:** The liquid CO_2 is temporarily stored on-site in tanks with a capacity of 5,000 m³, sufficient for four days of operation. Waste heat from clinker production is utilized for the desorption process, reducing energy demand from external sources.

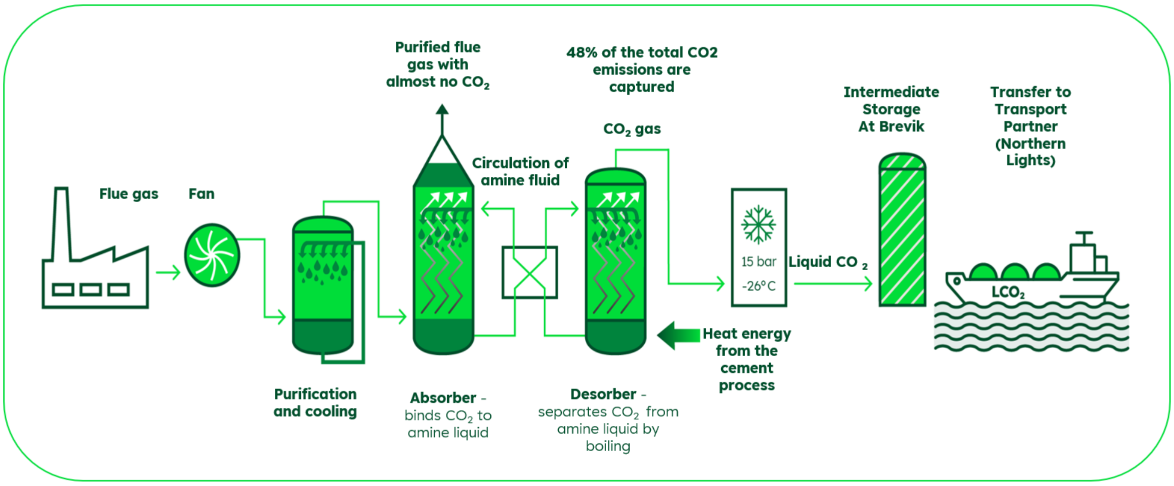

Figure 11 Simplified process diagram of the Carbon Capture process at Brevik. 56% of total kiln flue gasses are fed into capture unit. The absorber captures 85% of CO_2 emissions. Overall, this equals a capture rate of ~48%

The CO_2 emissions resulting from the capture process, including solvent degradation, are minimal due to a closed-loop recycling system. Energy requirements for CCS, including electricity consumption, are accounted for in the plant's Scope 1 and Scope 2 emissions and shall be part of the EPDs of the CCS-based products (chapter 7).

5.2.1 Shipping: Emission Considerations and Logistics Challenges

From the Brevik plant, liquid CO_2 is transported via specialized ships to the Northern Lights facility in Øygarden, Norway. This process involves several logistical and environmental considerations:

- **CO_2 Circulation:** During loading, gaseous CO_2 displaced from the ship's tanks is recirculated back to the plant's compressor for re-liquefication, accounting for approximately 4% of the liquid CO_2 volume transferred. This ensures efficient utilization of storage capacity and minimizes emissions.

- **Ship Transport:** The ships are designed to maintain the CO_2 in liquid form at maximum pressure of 19 bar and minimum temperature of -35°C. Leakages during transport are limited, as the vessel operators ensure proper containment and temperature control.
- **Monitoring:** The volume transferred to final storage is accurately measured onboard the ship for each shipment. Liquid CO_2 is henceforth continuously tracked through sensor measurements from temporary to permanent storage.

The transport stage also considers emissions from fuel use by ships, fugitive emissions, venting and leakages which are included in the life-cycle assessment (LCA) of the CCS system and hence shall be part of the EPDs of the CCS based products (chapter 7). Further information can be found in the "carbon footprint" section of the Northern Lights Homepage under reports.[16]

5.2.2 Storage: Safe and Verifiable Storage of Captured Carbon

The final stage of the CCS process involves the secure storage of CO_2 at the Northern Lights facility (Figure 10). Carbon capture and geological storage is generally considered a secure and effective option for climate change mitigation.[17] The IPCC has also recently reiterated that "if the geological storage site is appropriately selected and managed, it is estimated that the CO_2 can be permanently isolated from the atmosphere."[18] Studies have estimated that even for scenarios that assume pessimistic input parameters and poor management of the storage site, leakage of CO_2 to the atmosphere being small or moderate.[17,19]

The final stage of our CCS process entails:

- **Pipeline Transport:** Upon arrival at Øygarden, the liquid CO_2 is pumped through a 110-km pipeline to the designated storage site.
- **Geological Storage:** The CO_2 is injected 2,600 meters below the seabed into saline aquifers in geological formations proven suitable for long-term containment. Monitoring systems ensure the integrity and safety of the storage.
- **Verification:** The storage process adheres to rigorous standards to ensure the CO_2 remains securely contained. Third-party verification mechanisms confirm the volumes stored and their eligibility for future allocation.

The Brevik plant's CCS-integrated process is a landmark development in reducing emissions from cement production, demonstrating a comprehensive approach to capturing, transporting, and storing CO_2 while addressing logistical and environmental challenges.

The storage stage also considers emissions from operation, construction and decommissioning which are included in the life-cycle assessment (LCA) of the CCS system and hence shall be part of the EPDs of the CCS based products (chapter 7).

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[16] https://norlights.com/what-we-do/reports/

[17] T. Xiao, T. Chen, Z. Ma, et al. A review of risk and uncertainty assessment for geologic carbon storage. Renewable and Sustainable Energy Reviews 189, 2024, p. 113945. doi: 10. 1016/j.rser.2023.113945.

[18] K. Calvin, D. Dasgupta, G. Krinner, et al. Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Tech. rep. Intergovernmental Panel on Climate Change (IPCC), 2023. doi: 10.59327/IPCC/AR6-9789291691647, page 21.

[19] H. Deng, J. M. Bielicki, M. Oppenheimer, et al. Leakage risks of geologic CO2 storage and the impacts on the global energy system and climate change mitigation. Climatic Change 144 (2), 2017, pp. 151–163. doi: 10.1007/s10584-017-2035-8, J. Alcalde, S. Flude, M. Wilkinson, et al. Estimating geological $CO2$ storage security to deliver on climate mitigation.Nature Communications 9 (1), 2201, 2018. doi: 10.1038/s41467- 018-04423-1.

Although long-term storage of CO_2 in geologic reservoirs is a pioneering technology, it is built on a foundation of several decades of oil and gas industry experience injecting CO_2 into oil- and gas-filled formations. This expertise has been enhanced by several decades of R&D and field testing to refine the knowledge and engineering needed for safe and long-term storage of CO_2. The safety of CCS technology is documented in a report by the Norwegian CCS Centre[20], with further peer reviewed scientific research[21] focusing on the specific storage site being used to store Brevik CO_2.

Once transferred to Northern Lights, they bear the legal responsibility to inject CO_2 into their permanent storage site (the "Aurora" complex on Exploration License EL001 in the North Sea). The selection of the permanent storage site is aligned with the EU CCS Directive and has permits to operate from the Norwegian Ministry of Energy, the Ministry of Climate and Environment, the Norwegian Environmental Agency (NEA), and the Norwegian Ocean Industry Authority.

CO_2 will be injected into a saline formation water of the Johannesson Formation at a depth of approximate 2.6 km below the North Sea. Initially, injected CO_2 will sit in the structural trap at the point of injection which has been assessed for integrity by Northern Lights and academic research publications[14]. Over time (100's to 1000's years), injected CO_2 will dissolve in these formation brines and disperse from the point of injection. As the CO_2 rich plume disperses through the porous of the Johannesson Formation, small amounts of the CO_2 rich fluid will be trapped as residual fluid in pores. This residually trapped CO_2 will then later mineralize to permanently stored CO_2[22].

Northern Lights' extensive geological assessment of the Aurora site, exploratory drilling, and ongoing monitoring activities demonstrate their adherence to the principles and recommendations outlined in ISO 27914:2017 for sound site selection and long-term containment of stored CO_2. Additional monitoring of the Aurora site will utilize cutting-edge technology to detect and analyze seismic activity related to CO_2 injection in the Aurora reservoir.

It is important to note that a low overall permanence risk does not imply the absence of risk entirely, but that the low risk estimated rely on the concept of a well selected and managed storage site. Heidelberg Materials AG is confident that the science, permitting and alignment with directives and standards by Northern Lights offers a permanent storage option for CO_2 derived from the Brevik cement plant and that there is no material risk of reversal.

In the very unlikely case of a leakage from the Northern Lights storage site, Heidelberg Materials shall pause its evoZero program and conduct a new risk assessment in tandem with our storage partner (Northern Lights) and relevant stakeholders (e.g. regulators, communities and assurance bodies). In such case, Northern Lights will inform Heidelberg Materials AG about the quantity of lost CO_2 having origin from Heidelberg Materials Brevik site (the total lost will be shared with other partners to the Longship program). Heidelberg Materials AG shall apply the following corrective measures to sales of evoZero Carbon Capture: For leakage within the 10% safety buffer (as per section 6.3), the existing buffer shall be used to compensate for the loss. Customers are not individually informed, as the discrepancy between the claimed stored CO_2 and the leakage is equalized in the Carbon Bank, ensuring the validity of customer claims. This can be achieved and documented by the creation of a designated "leakage" customer account, to which the appropriate amount of EACs are allocated and retired.

[20] https://blog.sintef.com/energy/the-safety-of-co2-storage/
[21] Mulrooney et al. (2020). *Structural analysis of the Smeaheia fault block, a potential CO_2 storage site, northern Horda Platform, North Sea* (https://doi.org/10.1016/j.marpetgeo.2020.104598)
[22] https://doi.org/10.1016/j.heliyon.2023.e23135

If leakage exceeds the 10% buffer, the Carbon Bank is frozen, meaning no new deliveries of evoZero are accepted until sufficient CO_2 has been stored to compensate the leakage. Both the existing buffer and future CO_2 reductions are used to compensate lost CO_2. Customers are not individually notified, as the discrepancy will be equalized to maintain the integrity of their claims.

For purchases of evoBuild Carbon Capture or evoZero Brevik, the amount of CO_2 affected per customer is calculated on a pro-rata basis. Customers shall receive a manual allocation of CO_2 to compensate them accordingly, to the extent such allocation is available. If manual allocations are not available, HM will offer monetary compensation.

5.3 Organizational coverage and ETS

This methodology shall be applicable to all HM production sites that fall under the European Union Emission Trading System (EU ETS).

The Brevik cement and carbon capture plant is part of Heidelberg Materials Sement Norge AS, a subsidiary of the Heidelberg Materials AG Group. Heidelberg Materials AG is one of the world's largest building materials companies, operating in 50 countries. In Norway, we are the market leader in cement and a major player in concrete. Our business consists of four segments: Cement, Ready-Mix Concrete, Precast Concrete, and Aggregates & Asphalt.

All facilities on land in Brevik are owned by Heidelberg Materials AG, including all equipment for the CCS plant. Aker Carbon Capture (ACC) owns the technology rights to the CCS plant and the patented amine solution license. ACC are responsible for the handling of the amine solvent and that it operates at specification.

Under the European Union Emission Trading System (EU ETS), each actor on the CCS value chain has its own responsibility regarding the CO_2 emitted during the actions within its boundaries, meaning that leakages and losses are reported and covered dependent on where along CCS value chain that they occur (i.e. capture, or transport or storage). In this context, the vessel operator has responsibility for the CO_2 cargo after being loaded from the temporary tanks at Brevik.

In terms of regulation for the ETS sectors, HM will not bear a risk for financial loss due to leakage of CO_2 from a ship that HM does not operate itself. It was therefore included in the agreement that Northern Lights and the state will cover the costs in the event of CO_2 leaks from the ship. With the exception of the ship transport, all of Northern Lights' activities (the reception terminal, the pipe trench, injection well and storage area) are subject to the EU's ETS directive. It is clarified that Northern Lights is responsible for any leakages. In the event of leakages, the cost of these will be divided between Northern Lights and the state according to a separate agreement about cost sharing for the volumes in the Longship project. However, HM still has the environmental risk until delivery at Northern Lights, i.e. HM shall only claim net CO_2 stored. Consequently, leakages along the value chain could have an environmental and financial impact to HM due to lower stored CO_2 volumes. Details in this are covered in the agreement between HM and the Norwegian government and further information is available here.[23]

[23] https://ccsnorway.com/responsibility-for-co%E2%82%82-in-the-chain/

In regard to EU ETS, the reduction of emissions at Brevik allows Heidelberg Materials AG the opportunity to limit the impact of CO_2 cost across clinker installations at Brevik.

5.4 Additionality of emission reductions

As outlined in Chapter 1, the CO_2 intensity of cement production can be reduced through three key levers:

1. Increased use of alternative fuels
2. Greater use of supplementary cementitious materials (SCMs)
3. Implementation of carbon capture and storage (CCS) technologies

While the cement industry has broadly adopted alternative fuels and SCMs, CCS has not yet been implemented at scale—until now. The Brevik CCS project marks a significant milestone as the first commercial-scale carbon capture facility in the cement sector, established specifically to reduce greenhouse gas (GHG) emissions from the Brevik cement plant. The project's additionality is demonstrated by the fact that CCS is not common practice in the cement industry.

Moreover, the captured CO_2 will be permanently stored in a geological reservoir beneath the North Sea, a measure that goes beyond regulatory requirements, as permanent CO_2 storage from cement production is not legally mandated in this jurisdiction. This further reinforces the project's additionality relative to the existing regulatory framework.

In a baseline, business-as-usual scenario—i.e., cement production at Brevik without carbon capture—the GWP (net emissions) of the standard fly ash cement (CEM II/B-M (V-L) 42.5 R) is 451 kg CO_2 per tonne of cement, as verified in an EPD. With carbon capture enabled, the same cement yields a GWP (net emissions) of 230 kg CO_2 per tonne, as demonstrated in a P-EPD. This represents a reduction of 221 kg CO_2 per tonne of cement, compared to the baseline, business-as-usual scenario.

The additionality of the carbon capture at Brevik is graphically demonstrated in Figure 12, where we demonstrate that an additional 221 kg CO_2 /t cem are captured than would otherwise have been emitted without having carbon capture in place.

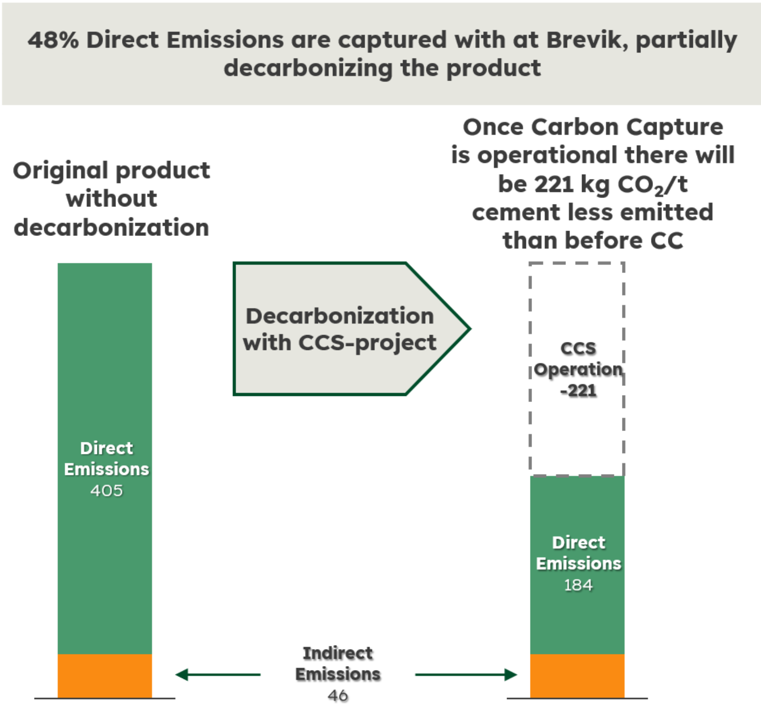


Figure 12 Representation of the additionality of Carbon Capture at Brevik showing an additional 221 kg CO_2 /t cem is captured that would otherwise be emitted.

5.5 Calculation of CO_2 emission reductions

The CCS installation at Brevik entered service in May 2025 with a prognosed targeted annual capture volume of 400,000 tonnes CO_2. Out of which, not all tonnes of CO_2 are handled in the same way:

1. The biogenic part of captured CO_2 is in the range of 12% (i.e., 48.000 t/y) but may increase over time. These biogenic emissions originate from using alternative kiln fuels which contain biogenic carbon. Biogenic carbon content of these fuels will be known (see 5.6) and during the combustion converted to CO_2 based on this content. The current core rules for the product category of construction products, EN 15804, does not accept inclusion of any permanent biogenic carbon storage. Thus, these approximately 48.000 t/y of biogenic permanently stored CO_2 volumes shall not be considered in EPDs; hence these volumes will be reviewed and assured by an independent third party into the Carbon Bank but shall remain separate from product attribution and sales thereof until further update to this document. The process for determining the biogenic content of fuels is detailed further in the next section.

2. Captured fossil CO_2 (i.e. net emissions) at the plant will be around 352.000 t/y. This CO_2 shall be stored below the seabed and corrected for the full impact of the CCS operation to derive to net-stored fossil CO_2 volumes. This ensures that the full life cycle emissions of the CCS value chain (see Figure 9) are accurately reflected. Those net-stored CO_2 volumes shall be used to calculate

the amount of Environmental Attribute Certificates (EACs) eligible for allocation to products (chapter 6.1.3).

Additional emissions from the carbon capture process and the storage process including transportation, operation, and construction shall be reflected directly in the prospective EPD (P-EPD, see section 4.2) and shall also be subtracted from the stored carbon volumes so that only net-stored fossil CO_2 volumes will be registered in the carbon bank as carbon reductions (see Figure 9). While the LCI for cement production without CCS is based on primary production data from 2024, no operational data from the CCS facility were available at the time of the LCA study. As a result, the LCA study, on which the P-EPDs issued in 2025 are based, includes prospective data for the CCS.

To ensure that Heidelberg Materials accounts for the environmental burden associated with CCS operations, the following workflow has been established when calculating the amount of Environmental Attribute Certificates (EACs) available for allocation to products (chapter 6.1.3):

a) Net-stored volumes of CO_2 that are permanently stored shall be registered in the carbon bank.
b) 10 % of this CO_2 shall be retained as a safety and correction buffer and shall not be attributed to products.
c) During the reconciliation period at year-end closing, this buffer shall be used to correct for any discrepancies (e.g. in case that the actual biogenic share in the captured CO_2 varied from the assumed value of 12 %).

Actual CO_2-volumes will be measured at several steps in the chain from capture to permanent storage:

1. Continuous measuring of efficiency in the capturing process (t CO_2/h) (HM)
2. Present volume of liquid CO_2 in temporary storage at Brevik site (HM)
3. Delivered volume of liquid CO_2 to the ship (HM)
4. Received volume into the Northern Lights ship (delivered liquid CO_2 minus displaced gas) (NL)
5. Received volume at Northern Lights terminal (delivered liquid CO_2 minus displaced gas) (NL)
6. Volume pumped into the pipeline and permanent storage (NL)

Until full data integration is achieved Heidelberg Materials will receive manual data via the storage certificate provided by Northern Lights including gross received and net-stored values for the data point mentioned under point 6. The ships that transport CO_2 are designed to receive CO_2 from several CCS facilities. Thus, the CO_2 in the Northern Lights (NL) ship, and storage facilities may be mixed with that of other partners in the Longship Project. Hence, measurement point 4 in this chain, i.e. volume delivered into the NL ship, is the last data point that exclusively describes CO_2 volumes delivered by Heidelberg Materials AG.

5.6 Determination of Fuel Biogenic Content

As detailed above, the biogenic portion of captured CO_2 is approximately 12% (i.e., 48.000 t/y) of overall CO_2 emissions. These biogenic CO_2 emissions originate from using alternative fuels which contain biogenic carbon, which shall not contribute to EAC generation and allocation and hence shall be segregated within the Carbon Bank. All alternative fuels used at Brevik are from waste streams and can be split into two categories 1) Solid and liquid hazardous waste and 2) Refuse Derived Fuel (RDF). The biogenic content of the fuel mix is variable and therefore sampled, calculated and updated according to a detailed monitoring plan[24] (in Norwegian), in line with EU ETS standards and approved by the

[24] Tillatelse til kvotepliktige utslipp av klimagasser for Brevik sementfabrikk

Norwegian Environment Agency (Miljødirektoratet). The amount of fuel used in kilns is tracked on a mass basis. All incoming shipments of RDF are sampled and, on a monthly basis, homogenised and tested at certified laboratories. The biogenic component of hazardous waste streams is updated on a quarterly basis with lab certified values from the supplier (Heidelberg Materials Miljø, a subsidiary of Heidelberg Materials AG).

This fuel biogenic content value of 12% is used in the Carbon Bank to segregate biogenic emissions and prevent allocation to products (see chapter 6). This value is applied prospectively to Carbon Bank inflows. A year end audit shall reconcile with actual fuel biogenic content figures from Brevik, with any deviations accounted for by the Carbon Bank buffer (see chapter 6.1 & 6.6). The segregation of Fossil and Biogenic sourced emissions in the Carbon Bank shall be verified by the independent third-party verifier (as per 6.7).

6 EACs and the Carbon Bank

To ensure the integrity and transparency of carbon accounting, Heidelberg Materials AG has implemented a Monitoring, Reporting and Verification (MRV – called Carbon Bank) system serving as a cornerstone for ensuring the efficacy and integrity of carbon capture and storage (CCS) projects.

The primary purpose of MRV is to:

- **Monitor:** Track the performance of CCS activities, including the capture, storage, and utilization of carbon dioxide emissions.
- **Report:** Provide transparent and accurate data regarding CCS operations.
- **Verify:** Enables third party assurance provider to asses reported data and to confirm its accuracy and legitimacy.

6.1 Creation of Environmental Attribute Certificates

As described in chapter 3 Environmental Attribute Certificates (EACs) are instruments used to quantify, verify and track the environmental benefits associated with climate mitigation activities or projects[25]. Heidelberg Materials uses EACs as an instrument to allocate the environmental benefit generated by the CCS operation in Brevik to different cement products of Heidelberg Materials produced in Brevik and other cement plants within EU-ETS, Switzerland and UK.

6.1.1 EAC Unit and CO_2 Equivalence

The production of CCS enabled clinker at Brevik shall form the basis for our Brevik EACs, specifically the total net stored CO_2 per tonne of clinker produced at Brevik under CCS conditions.

The functional unit of such EACs shall be “kg CO_2 per tonne of clinker.”

➢ **We apply a value of 307.3 kg as the CO_2 equivalence of 1 Carbon Bank EAC (see Table 3)**

As discussed in chapter 4.2.2, a conservative estimate of the capture rate during clinker production is 50 t CO_2/ h with a corresponding clinker production rate of 138 t/h. Based on the underlying LCA for Brevik cement products, a fuel biogenic content of 12% is applied to incoming permanently stored CO_2. The relevant data to derive this value are presented in Table 3 where the biogenic content is calculated as 12% (349.21 * 0.12).

Using this information from the underlying LCA of published and verified P-EPDs[26] for Brevik cement products, clinker production contributes with minus 307.3 kg of net CO_2 stored per tonne of clinker to the overall GWP[27] of the product (see Table 3).

[25] SBTi Call for Evidence on Environmental Attribute Certificates (EACs). ISO 22095 and draft ISO 13662 do refer to them as credit in the mass balance credit method.
[26] For example EPD ID NEPD-12342-12398 evoBuild Low carbon Standard cement FA, CEM II/BM (VL) 42.5 R- EPD-Global- Powered by EPD-Norway
[27] Includes the burden carbon capture operations at Brevik + transport and storage operations of Northern Lights.

Table 3 Calculation of Net captured and stored CO_2 on clinker level (excerpt from the verified LCA underlying P-EPDs for Brevik cement products, CC = carbon capture)

	kg/tonne clinker
Total capture per tonne clinker (gross emissions)	-362,32
CC Brevik Excl infrastructure	3,36
CC at Brevik, infrastructure	1,15
Transport and storage, Northern light	8,6
Stored (incl. Biogenic)	-349,21
Biogenic content	41,91
Total stored per tonne clinker (net emissions)	**-307,3**

The CO_2 equivalence of one Carbon Bank EAC as 307.3 kg CO_2 shall remain a fixture within the Carbon Bank. This value shall only be updated in case that the P-EPD is updated based on new primary production data. If this value is updated, the CO_2 equivalence of one EAC unit will be verified by a third-party assurance partner.

6.1.2 Calculation of EACs generated

EACs shall be generated based on the volume of clinker produced under verified carbon capture conditions during each performance period, provided that Heidelberg Materials has received a valid storage certificate confirming permanent storage of captured CO_2. The following operations shall take place:

- Heidelberg Materials shall report daily clinker production volumes based on process scales, acknowledging that these scales are not calibrated
- In line with Annex IV, Chapter 9, of the EU ETS Monitoring and Reporting (MR) Regulation (EU 2019/331), a correction is applied to the monthly total clinker production. This is based on delivered cement, non-clinker minerals used in cement, sold/bought clinker and stock changes.
- Using this corrected monthly figure as reference, Heidelberg Materials shall provide a correction factor for the daily production volumes based on the monthly back-calculated total clinker production volumes (this KPI is also used for other ESG reporting). The correction factor shall be calculated according to the following equation:

$$Daily\ Clinker\ Correction\ Factor = \frac{Corrected\ month\ end\ clinker\ production}{Sum\ of\ daily\ production\ at\ month\ end}$$

- Heidelberg Materials shall provide proof for each day whether the carbon capture facility was operational for 24 h, less than 24 h or not in operation the whole day.
- Heidelberg Materials shall only account for EAC creation for daily corrected clinker volumes if the carbon capture facility was in operation.
- In cases of partial operation, clinker production volumes will be pro-rated based on sensor data reported at 1-minute intervals, enabling precise and transparent EAC generation.

For every tonne of clinker produced with carbon capture verified by an independent third party, one Environmental Attribute Certificate (EAC) is issued.

6.1.3 Calculation of EACs available for allocation to products

To acknowledge that the expected carbon capture performance (on which the P-EPD is based) may deviate from the actual performance, Heidelberg Materials AG shall only allocate EACs in proportion to measured fossil emissions that have been captured and verified as permanently stored by Northern Lights.

EACs available for allocation to cement products are calculated by converting verified volumes of net permanently stored fossil CO_2 into EAC units. Considerations in calculating the net permanently stored fossil CO_2 are described above in chapter 5.5 and 5.6.

Upon receipt of confirmed storage data from Northern Lights that meet the requirements defined in chapter 6.3 (for example 6000 tonnes net stored), the following operations shall take place in the Carbon Bank, Hedera and Heidelberg Material's Smart Contract residing on the Distributed Ledger Technology:

- This net-stored CO_2 volume is checked by the third-party verifier and a serial number is issued
- A Non-Fungible Token (NFT) with 10% (600 tonnes) of the stored volume is minted. This token is kept active until Year End Closure to facilitate any reconciliations (see chapter 6.6)
- A second NFT with the remaining 90% (5400 tonnes) is minted and immediately burned[28], making the information it contains immutable.
- Of this permanently stored 5400 tonnes, 12% (i.e. 648 tonnes) are of biogenic origin (as per chapter 5.6). These 648 tonnes are segregated in the Carbon Bank and unavailable for allocation to products. This 12% biogenic split is also applied to the buffer NFT that has yet to be burned.
- The Fossil CO_2 available for EACs that are eligible for product allocation is therefore 4752 tonnes (i.e. 5400 – 648)
- The number of EACs available for allocation to cement products is then calculated as 15.463 EACs (4752 / 0.3073)
- This number is checked against the number of EACs generated by clinker production under carbon capture conditions (as described above) to determine number of EACs available for allocation to products.
- Heidelberg Materials AG will only allocate EACs to products in the scenario where sufficient Carbon Reductions are in the Carbon Bank (see 6.2 for how EACs are allocated to products).

Upon invoicing a specific quantity of CO_2-reduced cement, the corresponding EACs shall be withdrawn from the Carbon Bank and reported in units of "kg CO_2eq./t clinker".

As described in Chapter 1, Carbon Bank EACs will be used to reduce the GWP of evoZero products to zero for virtual products and near zero for physical products.

6.1.4 Performance Period for Verification

The performance period for verification of EAC generation and allocation shall be 1 calendar month. This shall be kept flexible and defined iteratively by agreement between Heidelberg Materials and the third-party verifier.

The period of CO_2 production and capture to permanent storage that verification refers shall be clearly defined in the Carbon Bank in addition to the date of verification (as described in 6.5).

[28] While the NFT remains recorded on the blockchain, it is effectively gone from the public supply because there is no way to interact with it or retrieve it.

Once normal operation of the capture, transport and storage elements of the CCS value are established and stable, a defined interval performance period may be defined in agreement with the third-party verifier.

6.2 Allocation of EACs to products

To ensure transparency and accuracy in the allocation of EACs and the underlying carbon reductions, all product variants sold with bundled EACs must be supported by an Environmental Product Declaration (EPD). This EPD is the proof of the GWP of the underlying physical cement without taking the EAC allocation into account. Hence, the EPD serves as the foundation for calculating the carbon footprint of each product variant, ensuring that EACs are properly allocated to. Each product shall be linked to an EPD ID, EPD URL and its global warming potential (GWP) as referenced in the EPD. In addition, each variant will receive an attributed value of EACs and the corresponding carbon emission reductions to derive to the evoZero product claim. These details will be documented in the Bill of Materials (BoM) alongside the raw material specifications for each product variant.

As outlined in Chapter 4.7, the choice between gross or net GWP presented in the main results table of the EPD depends on national practices, with each approach being decisive for its respective market. The carbon reductions shall be calculated based on the GWP type that is representative of the market in which the cement is used and correspondingly withdrawn from the Carbon Bank.

Upon the sale of a physical product variant (see Chapter 7), the carbon footprint and its corresponding carbon reduction potential shall be calculated based on the actual invoiced quantity. The equivalent amount of EACs will then be attributed and the corresponding carbon reductions will then be withdrawn from the Carbon Bank, ensuring that EACs and hence reductions are allocated only in proportion to actual sales. This process prevents discrepancies in emissions reporting and maintains integrity in carbon accounting.

The Carbon Bank will be structured as two distinct accounts: one for fossil CO_2 emission reductions (basis for calculating the available amount of EACs for allocation) and another for permanently stored biogenic CO_2 volumes. While fossil carbon reductions can be allocated to both virtual and physical product variants, permanently stored biogenic CO_2 volumes will remain separate and will for the time being not be withdrawn for allocation to products.

To prevent over-allocation or double counting, every sales order creation and delivery first verifies the availability of sufficient EACS and their equivalent carbon reductions prior to confirmation thereof, ensuring that no customer order shall be promised and fulfilled without sufficient funds. This approach safeguards the integrity of the Carbon Bank, ensuring that EACs and hence emissions reductions are accurately tracked and appropriately assigned.

Below is a summary of how EACs available for allocation and hence emission reductions are assigned to respective products (see also Table 4):

- evoBuild Carbon Captured[29] with a GWP 230 kg CO_2eq./t cement
    - Carbon Bank allocation of 0.72 EACs (equivalent to a carbon reduction of 221 kg CO_2eq./t cement) are assigned via the P-EPD.

[29] evoBuild Low carbon Standardsement FA, CEM II/B-M (V-L) 42,5 R, other cement variants are available from Brevik.

- evoZero Brevik (physical evoZero) with a GWP of 46 kg CO_2eq./t
    - Carbon Bank allocation of 0.72 EACs (equivalent to 221 kg CO_2eq./t cement) are assigned directly via the P-EPD.
    - Plus 0.6 EACs, representing a reduction of 184 kg CO_2eq./t cement assigned via the evoZero declaration

- evoZero ("Virtual" evoZero) with a GWP of 0 kg CO_2eq./t
    - In this scenario, the GWP to be balanced is shown in the relevant EPD of the purchased physical cement. The full GWP from the EPD is reduced to zero by Brevik EACs
    - Below is an example calculation of an Average German CEM II/C-M[30] with a GWP of 510 kg CO_2 eq./t cement:
        - 1.66 EACs, representing a reduction of 510 kg CO_2eq./t cement assigned via the evoZero declaration

Table 4 This table shows the GWP of each product, and how the final GWP is calculated, including attribution of EACs. In the virtual evoZero product, a VDZ national average German CEMII/C-M is used as an example. 1 EAC carries a reduction of 307.3 kg CO_2.

	evoBuild CC	evoZero Brevik	evoZero
	CEM II/B-M (V-L) 42,5 R	CEM II/B-M (V-L) 42,5 R	e.g. average German CEM II/C-M
GWP acc. EPD	230 kg CO_2 eq./t	230 kg CO_2 eq./t	510 kg CO_2 eq./t
P-EPD CCS reduction *("EAC")*	*-221 kg CO_2 eq./t (0.72 EAC)*	*-221 kg CO_2 eq./t (0.72 EAC)*	N/A
Additional EACs from Carbon Bank *(CO_2 Equivalence)*	*0 EACs (0 kg CO2 eq./t)*	0.6 EACs *(-184 kg CO_2 eq./t)*	1.66 EACs *(510 kg CO_2 eq./t)*
Total EAC reductions *(Total CO_2 Equivalence)*	*0.72 EACs (-221 kg CO_2 eq./t)*	1.32 EACs *(405 kg CO_2 eq./t)*	1.66 EACs *(510 kg CO_2 eq./t)*
Final GWP	230 kg CO_2 eq./t	46 kg CO_2 eq./t	0 kg CO_2 eq./t

The evoZero Declaration will accompany deliveries of evoZero cement product variants as outlined above. A draft of this product declaration is available on the evoZero Website (www.evozero.com/assurance). Upon withdrawal of EACs and the underlying CO_2 reductions from the Carbon Bank, an evoZero Declaration shall be issued, containing the following information:

- Certificate Holder details

[30] EPD_CEM_II_C-M.pdf from the VDZ

- Project utilization reference
- Physical material, volume, and source plant
- Amount of EACs and associated CO_2 emission reductions and source plant
- Global Warming Potential of the physical product

This declaration shall serve as proof of authenticity and ownership, explicitly identifying the holder. Each certificate shall be issued once, remains unalterable post-issuance, and is securely stored on distributed ledger technology for supply chain traceability.

6.3 Eligibility criteria for registering permanently stored CO_2

Permanently stored net-injected CO_2 volumes shall be registered in the Carbon Bank only after meeting all prerequisites to ensure accuracy, integrity, and compliance with verification standards.

Only CO_2 permanently stored in geological reservoirs, as measured by the reservoir operator, shall qualify for registering in the Carbon Bank. The storage operator shall provide data in form of a storage certificate or similar, which shall be assured by a third party or in the absence of a third-party assurance shall provide as minimum the following information. This minimum information shall also be provided in case of a third-party assurance:

- Shipment ID
- Transfer via ship
  - Received volume into the Northern Lights ship (delivered liquid CO_2 minus displaced gas)
  - Date & Time Start and End time
- Received at Terminal Øygarden
  - CO_2 received at Øygarden (unloaded liquid CO_2 minus direct transportation losses and minus associated amortized emissions and minus associated operational emission sources due to electricity used at Brevik port)
  - Date & Time Start and End time
  - Confirmation of CO_2 purity as measured at Øygarden
- Transfer and injection to permanent storage
  - Net-stored CO_2 (Received volumes of liquid CO_2 at Terminal Øygarden minus direct terminal & injection CO_2 losses minus associated emissions, amortized, per tonne of cargo minus associated operational emission sources due to electricity used at Øygarden)
  - Date & Time Start and End time
  - Supporting documentation

This reported net-stored CO_2 will be eligible for registering in the carbon bank only after a comprehensive third-party review and limited assurance by an independent third party, accounting for both fossil and biogenic emissions before deposit.

For each volume of reviewed, assured, and banked carbon emission reductions, 10% shall be withheld as a safety buffer. This withheld amount will remain unavailable for commercial use until an annual assurance verifies the accuracy of carbon accounting, at which point it will be released back into the carbon bank for sale (see chapter 6.6).

To ensure transparency and prevent double counting, CO_2 reductions allocated to cement through EACs or P-EPDs shall be recorded separately and cannot be reassigned.

6.4 Expiration of EACs

The expiration date for generated EACs and its underlying emission reductions must be clearly defined and effectively managed. They shall remain valid for a maximum of **five** years from the date of banking and shall automatically expire thereafter. Emission reductions of registered permanently stored biogenic CO_2 shall be exempted from expiration until further use has been defined.

EACs from carbon capture and storage (CCS) projects and its underlying emission reductions, like other forms of emission reductions, require ongoing verification to ensure their permanence. Over time, new scientific insights, monitoring data, and policy updates may affect the validity of previously banked reductions. The five-year limit shall account for these uncertainties and help in maintaining the integrity of product claims.

Additionally, Environmental Product Declarations (EPDs) are periodically updated to reflect the latest data and methodologies. As a result, there may be a transitional period where an updated EPD has been issued, but registered EACs and its underlying emission reductions from a project included in the previous version are still available. The five-year expiration period shall ensure that EACs remain relevant within this evolving framework. Furthermore, imposing a time limit incentivizes continuous emission reduction efforts, preventing indefinite reliance on past achievements.

6.5 Information to be recorded when registering emission reductions

To ensure transparency, traceability, and accountability in the banking of EACs and the underlying emission reductions, all relevant metadata associated with each step in the CCS production chain shall be systematically recorded in the MRV system. This metadata must include:

1. **Time Period** – The specific time period over which the emission reductions have occurred, ensuring alignment with reporting and verification requirements.
2. **Emission Reduction Tracking** – The amount of emission reductions recorded at each transfer step in the carbon capture, transportation, and storage process. These steps shall include:
    i. **CO_2 captured from cement plant**– The quantity of CO_2 captured at the source facility.
    ii. **CO_2 in temporary storage** – The interim storage amount before transportation.
    iii. **CO_2 delivered to ship**– The amount of CO_2 transferred from storage to transport vessels.
    iv. **CO_2 received in Ship** – The amount of CO_2 confirmed onboard the transport vessel.
    v. **CO_2 received at Terminal** – The amount of CO_2 received at the designated terminal or intermediary storage facility.
    vi. **CO_2 received in Permanent Storage** – The final amount of CO_2 successfully injected into permanent storage.

The MRV system shall store and manage this data in a structured format, including the following fields:

- **Transfer Type** – Classification of the transfer event (e.g., CO_2 Carbon permanently stored).
- **Timestamp and Transfer Period** – Capture, transfer, and storage timestamps to track the movement and validation of emissions reductions.
- **Sender and Receiver Details** – Unique identifiers, names, and relevant metadata of entities involved in the transfer.

- **Quantity and Composition** – Total amount of CO_2 transferred, specifying biogenic and fossil fractions, recorded in kilograms.
- **Operator Information** – Name, contact details, and website of the operator responsible for the transaction.
- **Geolocation Data** – Latitude and longitude coordinates of key transfer and storage points.
- **Statement of Storage** – A unique digital reference confirming the recorded storage provided by the storage operator.
- **Immutable Recordkeeping** – A reference to decentralized storage (i.e. TransactionID) as tamper-proof documentation.
- **Additional Comments** – Any relevant remarks or annotations related to the transaction.

All recorded data shall be maintained in compliance with applicable regulations, ensuring alignment with best practices in carbon accounting and environmental reporting. The MRV system shall also provide mechanisms for auditability, verification, and periodic updates as required by regulatory and industry standards.

6.6 Year-Ends Closing of Carbon Accounting

The annual EU ETS audit requires data on both fossil and biogenic emissions. HM shall verify the total CO_2 saved for the annual reconciliation of the carbon bank using this report. Potential additional information on unaccounted leakages and losses by Northern Lights shall also be adjusted based on annual specific data from NL reports.

A 10% safety buffer shall be maintained to mitigate potential accounting discrepancies and ensure the accuracy of carbon reduction allocations. This buffer is intended to:

- Safeguard against overselling of EACs and hence carbon reductions during the year
- Enable corrections to the origin and classification of carbon (biogenic vs. fossil)
- Adjust permanent storage volumes for any leakages or losses, as reported and confirmed by the storage operator
- Address any other errors identified in carbon accounting

We retain the right to adjust the buffer volume if correctional requirements are expected to exceed the allocated 10% margin. Conversely, the buffer may be reduced if the actual correctional volumes fall significantly below the anticipated safety threshold.

In the unlikely event that this safety buffer is exceeded *in the yearly reconciliation process (e.g. due to significantly underestimated share of biogenic CO_2 in the flue gas*), Heidelberg Materials shall produce CCS cement but sell it without CO_2 reductions until the error is reconciled.

The release of the safety buffer shall only occur after the annual review and assurance process, which confirms the accuracy of the yearly accounting and the effectiveness of corrective measures. Any remaining buffer amount will then be made available as carbon emission reductions in the Carbon Bank for calculating of the available EACs for product allocation according to chapter 6.1.3.

By implementing these safeguards, the Carbon Bank will maintain a robust, transparent, and verifiable system for managing EACs and the underlying emissions reductions, supporting more sustainable product offerings while adhering to recognized environmental standards.

6.7 Third-party verification and certification

The Carbon Bank shall ensure full traceability of carbon accounting, maintaining transparency in emissions accounting. All allocated EACs and the underlying carbon reductions shall be clearly documented, supporting robust carbon accounting practices and verification by an independent third-party party under a limited assurance program.

To uphold credibility, accuracy, and compliance with recognized standards, the Carbon Bank shall undergo periodic verification by an independent third-party verifier. This process shall validate the integrity, transparency, and reliability of recorded emission reductions, aligning with evolving regulatory and industry requirements. The third-party assurance body will design and implement a suitable assurance plan to deliver limited assurance. The boundary of Independent third-party verification ends with allocation of EACs to Heidelberg Materials Tier-1 customers or P-EPD (as detailed in section 6.2).

7 Supply of cement products with EACs

CO_2 emission reductions stored in the Carbon Bank (as detailed Chapter 6) may be sold alongside cement products (evoBuild products) or assigned via EACs to specific products using the chain of custody models outlined in Chapter 3 (evoZero products). These Carbon Bank EACs are assigned to products via the evoZero Product Declaration. The issuer of the evoZero Product Declaration stating emission reductions shall be Heidelberg Materials AG and will utilize the third party assured Carbon Bank and MRV process outlined in Chapter 6.

Environmental attribute certificates shall not be included as part of the EPD-GWP of the product sold to customers but declared to the customers separately. Products shall be supplied with a declaration stating the CCS emission reductions (evoZero Declaration) and an EPD or P-EPD stating the GHG emission intensity of the underlying physical cement product as detailed in Chapters 6 and 4, respectively.

Once sold, the EACs and the underlying CO_2 emission reductions shall be withdrawn from the carbon bank and the following shall be ensured (see chapter 6 for details):

- No more EACs (and hence CO_2 reductions) shall be sold than are available for allocation to products (see chapter 6.1.3)
- No more EACs (and hence CO_2 reductions) shall be sold with the cement products than the total GWP of the purchased tonnage of the cement product.
- The evoZero Declaration by itself shall not be freely distributed in the market but shall only be sold down the value chain alongside cement products.

Heidelberg Materials AG will offer four different product variants to our customers, based on the CCS-project in Brevik (see Table 1 on page 9). The product types offered will differ between the local market (e.g., Norway, Sweden, Iceland, Denmark) and the rest of Europe, and are generally subject to customers choice.

A Description of the four product variants can be found in the introduction and an overview in Table 1 on page 9.

7.1 Information supplied to customers regarding product and related GHG information

To ensure transparency towards our customers, the following information related to the product and related GHG shall be provided dependent on the chosen product as defined in chapter 6.2 :

a) Environmental Product Declaration (EPD) or Prospective EPD
b) For orders of evoZero product variants, an evoZero Declaration shall be issued, containing:
    - Declaration Holder details
    - Project utilization reference
    - Physical material, volume, and source plant
    - EAC and underlying carbon emission reductions and source plant
    - Global Warming Potential of physical product (acc. to EPD mentioned under point a)
    - Chain of custody model followed, and the system boundary applied

- A statement specifying that with the purchase of your evoZero volume you have invested in the production of a specified volume of carbon captured clinker in Brevik.

This declaration shall serve as proof of authenticity and ownership, explicitly identifying the holder. Each declaration shall be issued once, remains unalterable post-issuance, and is securely stored on distributed ledger technology for supply chain traceability.

A draft version of the evoZero Declaration containing this information is available on the evoZero website (www.evozero.com/assurance) .

7.2 Info supplied to customers regarding scheme

evoZero customers will receive the following relevant information regarding the scheme outlined in this document:

- The owner of the scheme, i.e. Heidelberg Materials AG
- Details about how the scheme operates, in particular:
  - methodology used
  - relevant international standards
  - data quality
  - organizational coverage
- Details about the emission reduction project associated with the scheme and how the reductions meet additionality requirements
- Verification and/or certification details
- Details about the verifier

7.3 Use of the evoZero Declaration by customers

The transactional data of the carbon reduction certificates will be stored on the distributed ledger technology, allowing certificates to be traced (blockchain-like powered certificates). This process ensures holders, auditors as well as the public that each reduction issued once will only be utilized a single time for sale. HM's customers will be granted access to their blockchain-powered certificates via an easy-to-use interface. HM holds all tokenized carbon emission reductions in a fiduciary wallet on behalf of the client until they are withdrawn at the point of material invoicing. At this point, tokenized EACs and hence carbon emission reductions shall be retired and claimed through the creation of evoZero Product Declaration. This ensures that reductions belong to a concrete good produced with evoZero / evoBuild cement and prevents unbundling of CO_2 reductions from the product for onward sale to the voluntary carbon markets.

The blockchain-powered certificates contain all relevant information from the third-party assurance of production, transfer and storage steps to the customer getting access to the blockchain-powered certificate in a downloadable PDF format.

There will be different interactions between the end-customers and the public to ensure data privacy and confidentiality but also ensure that the public is able to track carbon reductions. The public shall only get access to uncritical, anonymized data e.g., dates and volumes.

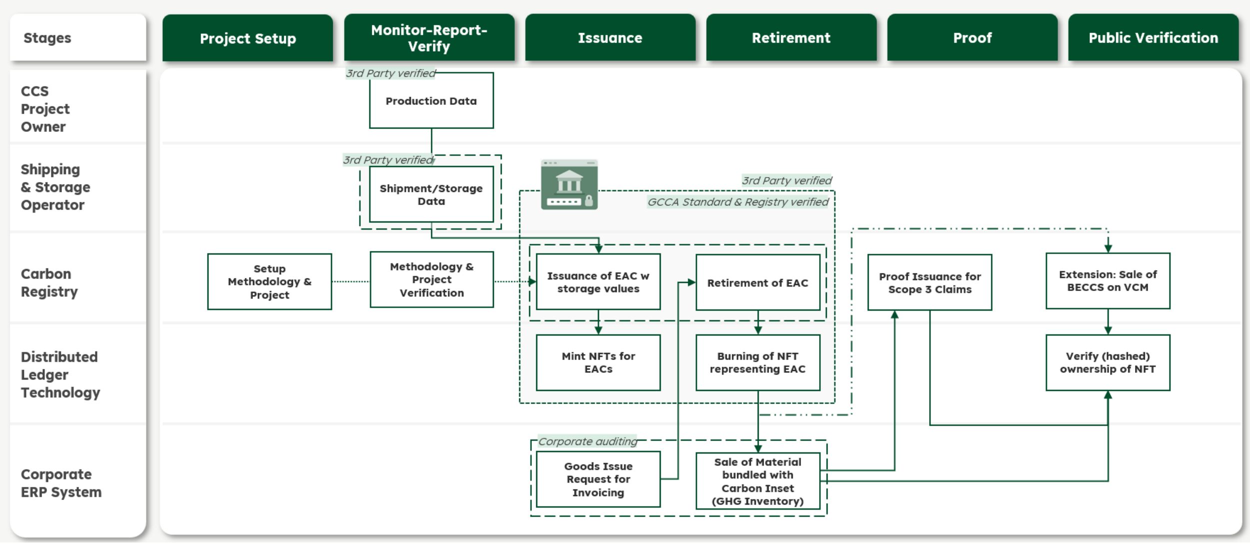


Figure 13: Data flows of distributed ledger powered declarations

In contrary to this, the end-customer as the user or the owner of the CCS-based cements and respective blockchain-powered certificate will have full access to all information stored on the blockchain linked to the respective certificate, e.g., product type, volume consumed, number of certificates, project reference, building address as well as the name of the end-customer.

Customers who purchase CCS-cement with evoZero Product Declarations following the GHG chain of custody approaches described in this methodology can use them to claim a reduction in their upstream emissions on, for example an organizational, project or product level, equivalent to the amount of the reductions supplied with the chosen cement. This means that, in the context of the GHG Protocol, customers and end users can use them to reduce their scope 3 emissions. The evoZero Product Declaration can only pass once through the value chain. The declaration by itself shall not be distributed in the market. Use of the product declaration by the customer should be done based on the relevant standards or regulations. For example, ISO 14068-1 provides guidance on how customers can claim CO_2 reductions using such types of certificates.

8 List of Abbreviations

ACC – Aker Carbon Capture

EAC – Environmental Attribute Certificate

CCS – Carbon Capture and Storage

CCUS – Carbon Capture Utilization and Storage

CFP – Carbon Footprint

CoC – Chain of Custody

EC-JRC – European Commission's Joint Research Centre

EPD – Environmental Product Description

ETS – Emission Trading System

GCCA – Global Cement and Concrete Association

GHG – Greenhouse Gases

GWP – Global Warming Potential

HM – Heidelberg Materials AG

IPCC – Intergovernmental Panel on Climate Change

LCA – Lifecycle Assessment

LCI – Lifecycle Inventory

LCIA – Life Cycle Impact Assessment

MRV – Monitor Report Verify

NFT – Non-Fungible Token

NL – Northern Lights

REC – Renewable Energy Certificate

RMC – Ready Mix Concrete

SCMs – Supplementary Cementitious Materials

9 Definitions

Company - „Company" also means a Group of companies under the same control.

Environmental Attribute Certificate – Environmental Attribute Certificates are instruments used to quantify, verify and track the environmental benefits associated with climate mitigation activities or projects.[31]

Heidelberg Materials AG uses EACs as an instrument to assign, outside current LCA/EPD standards, the CCS-based CO_2 reductions that are generated by producing 1 tonne of clinker at Brevik via mass balance with free attribution in a non-proportional way to products. EACs are generated by decoupling the CCS-based CO_2 benefit from the physical product and hence, when allocated to other products this share of physical product shall be sold without the CCS-based benefits.

CO_2 reductions used to compensate Scope 2 and 3 of a product shall not be counted as Scope 1 reductions achieved at the Brevik site anymore and hence shall be added to the plant´s Scope 1 GHG emissions inventory.

Gross GWP Emissions- includes fossil emissions from the combustion of waste fuels (biogenic emissions are counted as zero).

Gross transferred CO_2 - refers to volumes of liquid CO_2 transferred from Brevik to CO_2 transport ships. This is uncorrected for any losses or LCA based amortization.

Mass balance with free attribution - Equivalent to the mass balance credit method applying non-proportional attribution (ISO/DIS 13662).

Net Emissions – excludes fossil and biogenic emissions of waste fuels. This approach is based on the "polluter pays" principle as outlined in EN 15804.

Net Stored CO_2 –Refers to Gross transferred CO_2 that have reached permanent storage minus associate emissions, direct losses, leakages, venting, fugitive emissions and LCA based amortization of Northern Lights' transport and storage operations. This term includes both fossil and biogenic emissions.

Net Stored Fossil CO_2 – The portion of Net Stored CO_2 attributable to fossil sources.

Offsetting – The term 'offsetting' refers to projects or interventions that reduce emissions or increase GHG removals outside of the reporting group of company's value chain.

While there is no full consent on a single definition of offsetting, our preferred understanding is that offsetting is an activity performed by a company that purchases carbon credits from activities outside of the value chain of its group as a substitute for abating CO_2 emissions within its value chain. The GHG Protocol recognize the possibility to use offsets, if a company cannot fulfill its commitments and it may be appropriate when the cost of internal reductions is high, opportunities for reductions limited, or the company is unable to meet its target because of unexpected circumstances. SBTi does not recognize its usage towards target achievement. EU legislation understands "offsetting" to mean claims that are not

[31] https://files.sciencebasedtargets.org/production/files/call-for-evidence-environmental-attribute-certificates.pdf

based on the actual lifecycle impact of the product in question but rather based on the reduction of greenhouse gas emissions outside the product's value chain.

We do not consider the sale of an EAC from Heidelberg Materials AG into the value chain of another Heidelberg Materials AG entity to be offsetting, provided they are also a cement producer with a corresponding cement value chain within the same group. We would only speak of offsetting were we to sell EACs to a player outside the group of companies.

Physical evoZero Product – Physical evoZero refers to the cement product produced and delivered according to the chain of custody model "mass balancing with free attribution within one plant" as outlined in Chapter 3.1.

Virtual evoZero Product - Virtual evoZero refers to the cement product produced and delivered according to the chain of custody model "mass balancing with free attribution within multiple sites" as outlined in Chapter 3.2

10 Bibliography

EN 15804:2012+A2:2020 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

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

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14025:2010 Environmental labels and declarations - Type III environmental declarations - Principles and procedures

ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines

ISO 14068-1: 2023 Climate change management — Transition to net zero. Part 1: Carbon neutrality

ISO 21930:2006 Sustainability in building construction — Environmental declaration of building products

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

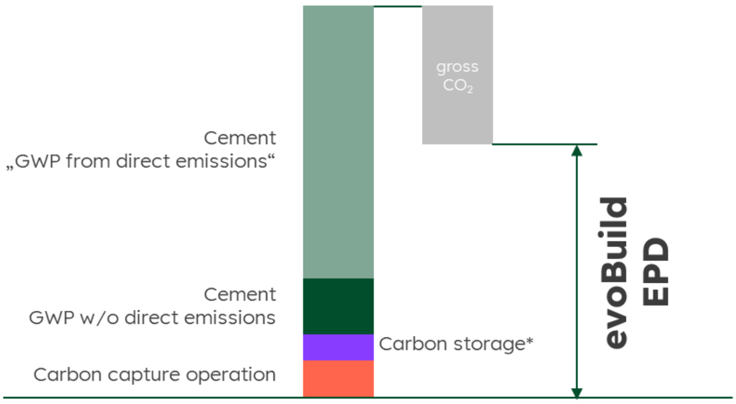
ISO 22095:2020 Chain of custody — General terminology and models

ISO/DIS 13662, Chain of custody - Mass balance - Requirements and guidelines The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019. Version 3.0 dated 2019.04.24.

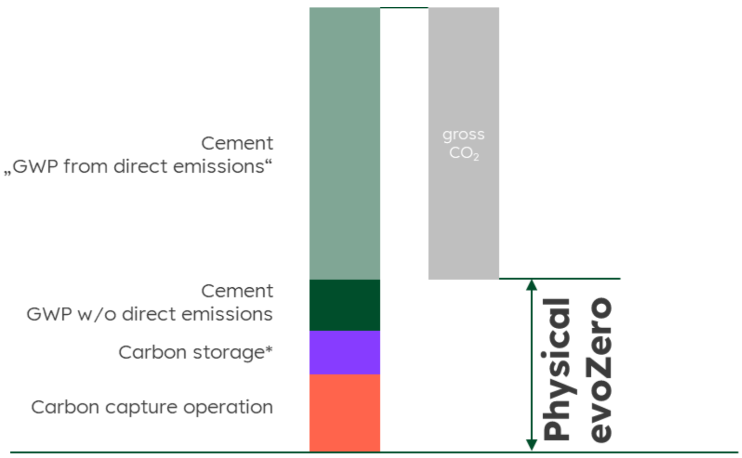
Science Based Targets initiative (SBTi), CALL FOR EVIDENCE ON THE EFFECTIVENESS OF THE USE OF ENVIRONMENTAL ATTRIBUTE CERTIFICATES IN CORPORATE CLIMATE TARGETS" September 2023.

11 Annex 1 – Graphical Illustration of Product Claims

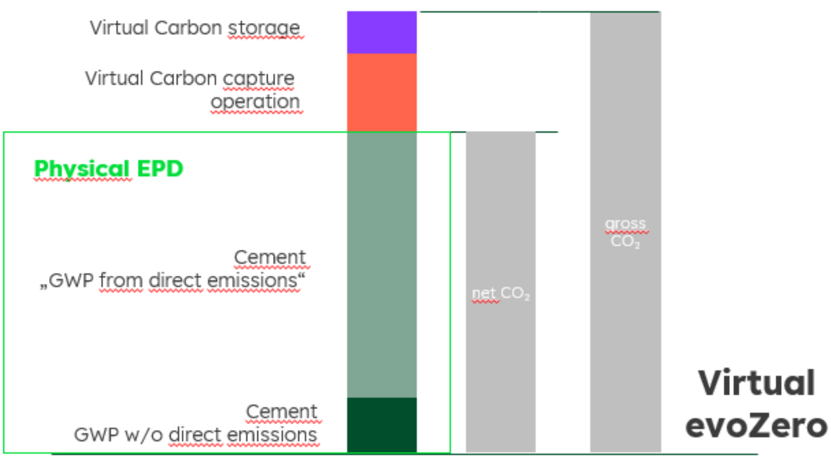
Please note that the illustration of the GWP does not represent the actual contribution but should rather illustrate how each product claim will be achieved. For the definition of gross and net CO_2 see Figure 8.



* Includes transport, leakages, operational emissions and emissions from construction an decommisioning



* Includes transport, leakages, operational emissions and emissions from construction an decommisioning



* Includes transport, leakages, operational emissions and emissions from construction and decommissioning

12 Annex 2 – Stakeholder Engagement

To build further trust and transparency in our methodology and product claims, Heidelberg Materials AG engaged in a Stakeholder Engagement. This engagement was facilitated by DNV Business Assurance Germany GmbH (DNV). DNV's scope of work included facilitating a stakeholder consultation and compiling feedback on the evoZero product claim. The participants were potential customers, LCA experts, cement industry experts and sustainability experts from not-for-profit organizations.

Stakeholders were provided with a draft of this Methodology document for review. Three online hosted Stakeholder Engagement sessions occurred in March, April and May 2025. At the start of the meeting, Heidelberg Materials AG provided a live presentation of the concept defined in this document and, where requested, answered questions up front. Heidelberg Materials then left the call. DNV then collected anonymized feedback from stakeholders. Chatham House rules applied, and no comment or question was attributed to the stakeholder raising it.

This feedback was shared in an anonymized format with Heidelberg Materials AG. Representatives of Heidelberg Materials AG then re-entered the call and responded to anonymized feedback.

Feedback from stakeholders helped to refine the evoZero product claim and communication thereof. Stakeholders are thanked for their participation.