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The EU ETS and cement: How did we get here?

This article offers a data-backed review of the EU Emissions Trading Scheme (EU ETS) and its impact on the cement industry in Europe, based on a recently-published report by CemBR. The report examines all countries and integrated cement plants within the EU ETS. The analysis was carried out with reference to detailed data since the onset of the EU ETS back in 2005.



Above: Claudia Stefanoiu, Head of Research at CemBR, a data, research and intelligence provider in the global cement sector. CemBR's team consists of several cement-related professionals with a wide range of expertise. Its mission is to provide the most accurate, insightful and data-driven cement related intelligence in the market.

The EU ETS has been operational for almost 15 years. In the early years of its application, carbon pricing was high, but the cement sector had more than enough free allowances to cover its operations. Later, the situation became even more comfortable for the sector. CO₂ prices were low and the sector retained a significant surplus of free allowances. However, in the last years things have become more interesting.

CO₂ emissions permit prices began to rise in early 2018, reaching Euro28.57/t in August 2019. At the same time, as cement demand had recovered in certain parts of Europe, an increasing number of cement plants were confronted with the need to purchase CO₂ credits at the increased pricing levels (many expect prices to keep increasing) or to consume stocks of accumulated credits held by the company. In addition, Phase IV of the EU ETS is now being developed, with future allowances (beyond 2020) expected to be based on lower production activity levels for most of the countries and their respective cement plants.

To make things even more complicated, it is now generally accepted that the cement sector has not met the targets set out by the EU ETS. An increasing number of large cement companies are raising the climate change issues to the top of their corporate agenda.

Below - Table 1: The largest variance in CO₂ emissions of cement plants in the EU ETS is due to the fuel requirements of different process technologies.
Source: CemBR.

Process	Capacity (t/day)	Dimensions (m)	Feed H ₂ O (%)	Energy Consumption (MJ/t clinker)	Energy Consumption (KCal/kg clinker)
Wet	200 - 3000	Ø = 3.0 - 7.0 L = 100 - 220	25 - 45	4500 - 7500	1080 - 1800
Semi-dry	500 - 2000	Ø = 3.5 - 5.0 L = 55 - 75	12 - 17	3300 - 4200	800 - 1000
Dry (4/5 stage Preheater)	500 - 4500	Ø = 3.0 - 6.0 L = 40 - 105	0.5	3000 - 4200	710 - 1000
Dry (4/5 stage Precalciner)	1500 - 13,000	Ø = 3.5 - 6.0 L = 60 - 105	0.5	2900 - 4000	690 - 950

Cement process and CO₂ emissions

Around 60% of CO₂ emissions from the cement sector emanate from the decarbonation step when making clinker. The remaining 40% of emissions are due to burning the fuels needed to heat the kiln up to 1400°C to achieve clinkerisation. While the decarbonation component of the emissions is quite stable across plants at around 520-550kg of CO₂ per tonne of clinker, the fuel component varies significantly depending on the type of fossil fuel, the use of alternative fuels and their biomass content.

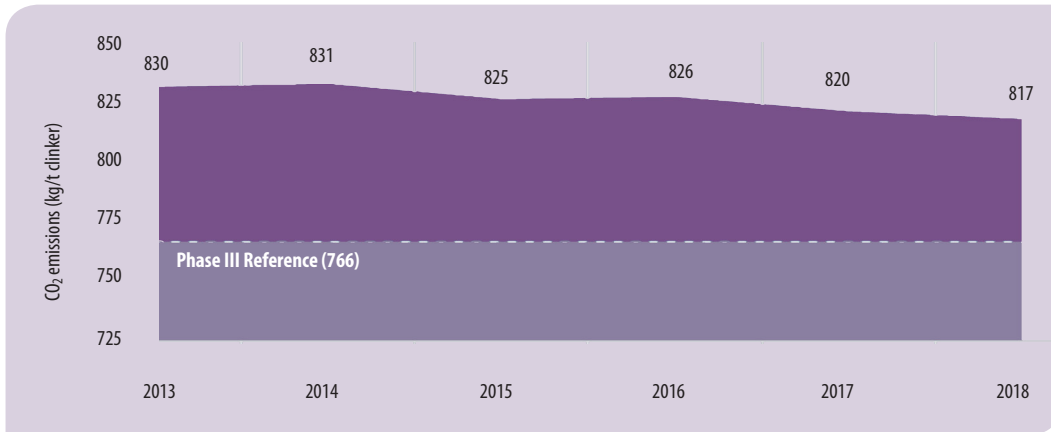
The various plant technologies currently operating in Europe significantly impact the fuel requirements and thus the CO₂ emissions due to combustion.

Working the system?

All the phases of the EU ETS have so far been characterised by what many would describe as over-generous allowances of CO₂ emissions credits for the cement industry, especially in the first two phases. The carbon pricing history, coupled with the more than adequate allowances (with the gap between free allowances and verified emissions increasing significantly after the financial crisis and the resultant decimation of cement production in most of Europe), may have led producers to actions that were not always supportive of lowering CO₂ emissions per tonne of clinker. Even in Phase III, when the benchmark of 766kg of CO₂ per tonne of clinker

was adopted, the allowances were broadly adequate to keep the cement players producing at no additional cost. CemBR estimates that, as a result of this, CO₂ emissions per tonne of clinker fell by just 0.4%/yr between 2005 and 2018. This rate was consistent across all phases of the EU ETS.

Some suggest that the above factors have also conspired to induce a financial bonanza for



Left - Figure 1: EU ETS CO₂ emissions per tonne of clinker (2013 - 2018).

Source: CemBR.

various cement producers, who have either sold surplus credits for cash or banked them (after Phase II) for future use.

As CO₂ credit prices began to increase from 2017, they became more of a financial consideration for cement producers than an incentive to reduce CO₂ emissions. The abundance of credits coupled with the high prices have allowed many cement producers to keep uneconomical plants open by way of exporting, thus edging production just above the 50% threshold whereupon they retained full allowances. One might argue that the EU ETS had the exact opposite effect on cement producers than the one envisaged by its advocates.

The alternative fuels conundrum

A proud achievement of the European cement industry during the period of the EU ETS (and even before its introduction) has been the increasing replacement rate of alternative fuels. By 2018, it is reported that the industry has reached an overall substitution rate of 44%, up from 5% back in 1990.

Indeed, this is an achievement not seen anywhere else in the world. However, as alternative fuels were on the rise the per tonne of clinker carbon emissions have made only minimum advancements. The CemBR report identifies two factors that contribute to this paradox. The first refers to the 'accounting' of CO₂ emissions under the EU ETS. It is only the biomass content of alternative fuels that is not taken in the tally of verified emissions. Of course, not all alternative fuels have high levels of biomass. So, if a cement plant increases its alternative fuels usage by, for example, burning oil sludge, it gets no recognition from the EU ETS. However, it does improve its cost structure significantly.

The second factor refers to the inevitable (as shown by real life data) increase in the fuel consumption per tonne of clinker produced as alternative fuels are introduced on a cost-driven basis and not on a CO₂ reduction basis. The high moisture content of RDF for example, unless removed prior to entering the kiln, increases fuel consumption.

Alternative fuel	Calorific Value (GJ/t)	Biomass content (%)
Used tyres	28	30
Waste oil	30	0
Paper	5	100
Plastic	23	0
Animal meal	18	100
RDF	18	50
Solvents	25	0
Sewage sludge (wet)	3	10
Oil sludge	5	0
Others	18	50

Left - Table 2: Common alternative fuel calorific values and their average biomass content.

Source: CemBR.

Consequently, the alternative fuels success story is true in financial and environmental / waste management contexts, but not so much in terms of reducing CO₂ emissions.

Leaders and laggards

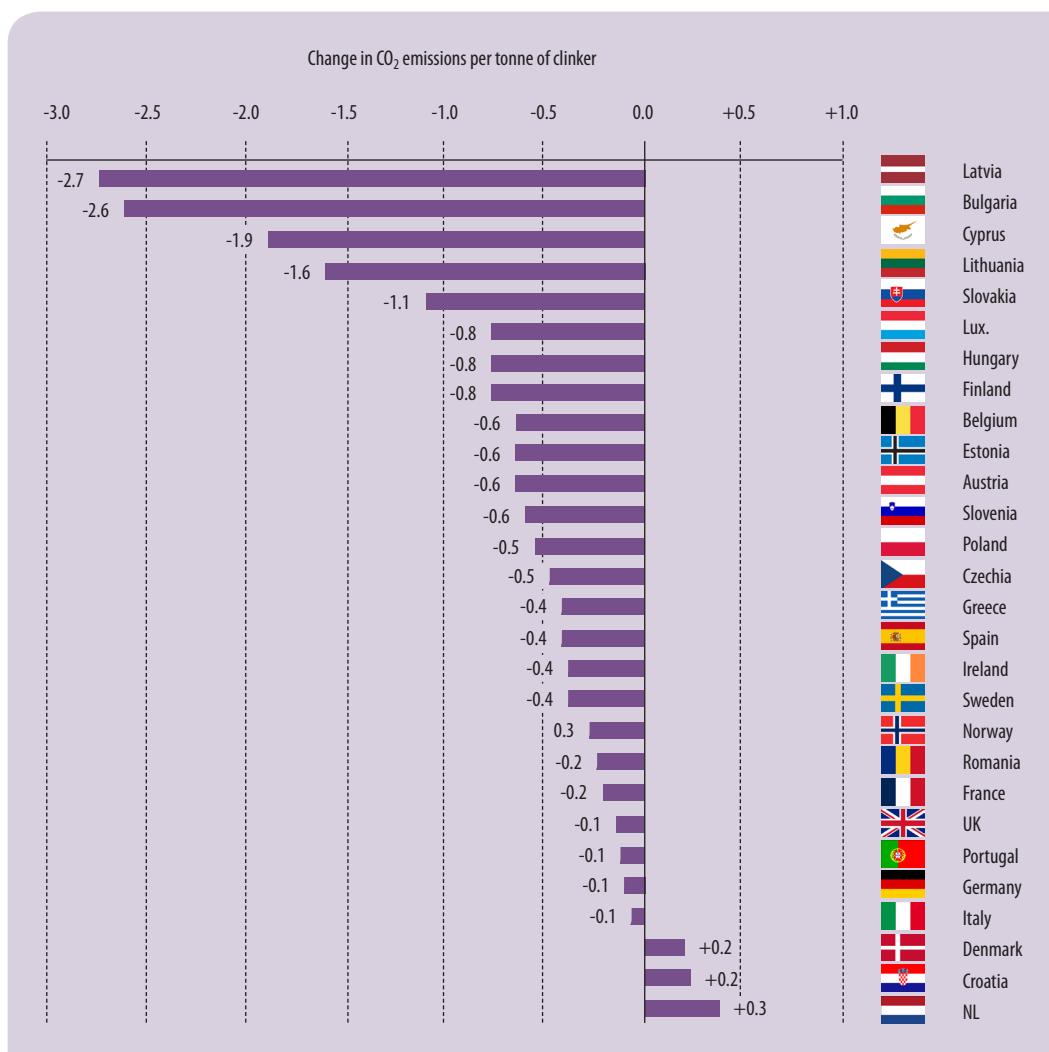
CemBR identified that the variability between all 28 EU ETS member states in terms of CO₂/t of clinker is substantial. Three of the 31 EU ETS member states have no integrated cement plants and thus are not relevant here. The myriad reasons behind this divergence are explained in detail in the CemBR report but suffice to say that one of the main reasons for the discrepancy in performance is wet to dry process upgrades. This results in significant overall reduction in CO₂ emissions. Smaller countries with a few plants (or even just one plant) tended to be affected by this disproportionately. It is not possible to pinpoint accurately the impact on CO₂ emissions from these upgrades. However, CemBR estimates that a large proportion of CO₂ emission reduction comes from step technological changes, not micro-process improvements.



Right - Figure 2: Rounded long term compound annual growth rates (CAGR) of CO₂ emissions (kg/t of clinker) by country in the EU ETS.
Lux = Luxembourg.
NL = Netherlands.
Source: CemBR.

Note: For all countries, the CAGR reflects the period 2005 - 2018 except for those countries that joined the EU ETS later or had inconsistent reporting in the early years.

Bulgaria = 2007 - 2018
Romania = 2007 - 2018
UK = 2008 - 2018
Norway = 2008 - 2018
Croatia = 2013 - 2018



Other key findings from the CemBR report

The data- and analysis-driven insights from the report cannot be included in this short article but as an indication some further key findings include:

- The CO₂ intensity variation between the 28 EU ETS member states is significant, ranging from 750kg/t of clinker to 1085kg/t of clinker;
- A total of 52 integrated cement plants in the EU ETS closed between 2005 and 2018;
- The 2018 activity level of each remaining plant shows that several are producing at a rate close to or above their Historical Activity Level (HAL), the median clinker production rate between 2005-2008. This means they are now in a CO₂ permit deficit. Others still operate at very low levels but secure free allowances;
- 2018 was the first year that the industry presented a deficit of CO₂ credits. This is expected to widen further in 2019 and 2020;
- EU ETS has been generous with CO₂ allocations for the cement industry, resulting in inconsistent behaviours between the various cement producers. Reducing CO₂ emissions per tonne of clinker has not been at the top of corporate agendas;
- The variation between northern and southern Europe is significant, with the so-called 'olive line' separating two very different CO₂ outcomes;
- There are eight types of country profiles regarding the CO₂ impact depending on the combination of domestic sales, regional sales, imports, exports (and their destination or source);
- The financial impact of carbon credits is significant in the industry. Simulations suggest that earnings before interest, tax, depreciation and amortisation (EBITDA) margins vary from 50% to -16% depending on the combination of sales, imports, exports, alternative fuels and the plant's actual capacity utilisation rate.




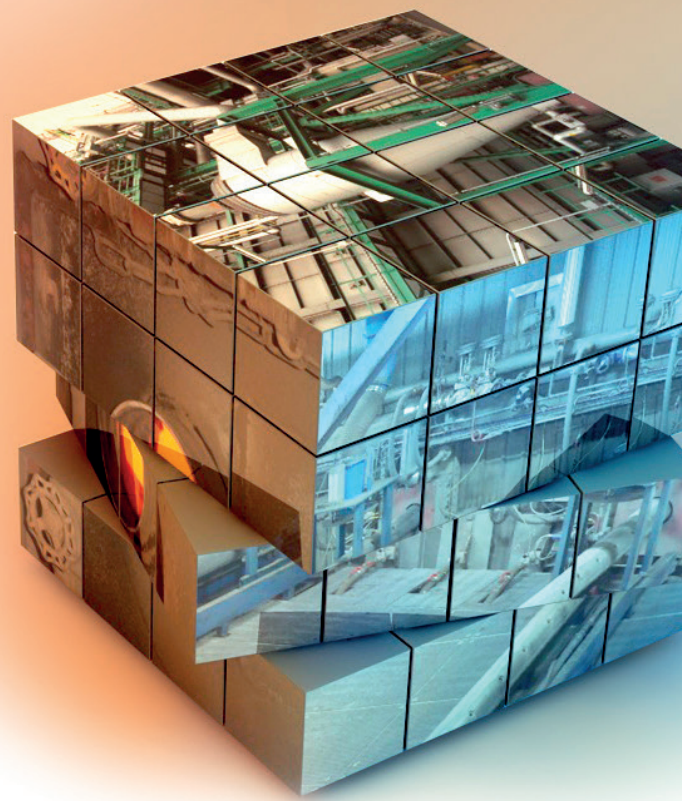
Looking forward to Phase IV

CemBR understands that, at the time of writing, the EU ETS Phase IV implementation details are still being refined. However, the findings from this report lead us to pose some questions for Phase IV to which cement producers will want answers:

- What will the new benchmark for CO₂ be per tonne of clinker?
- Will there be 'carbon leakage' protection in Phase IV? (not available for previous phases)
- If there is a 'carbon leakage' protection mechanism, how will it be implemented? A blanket CO₂ import tax or a more sophisticated remedy that considers the importing source's emissions?
- How could answers to the above influence potential non-scheme exporters to Europe?
- What will cement companies decide to do in the face of significantly reducing allowances and increasing CO₂ emission permit prices?
- Will there be different strategies between the various plants in the scheme? And why?
- Will there be closures of hitherto 'surviving' plants?
- How would exports from scheme members to outside the scheme members develop?

An additional complication for the UK is, of course, Brexit, despite three 'departure deadlines' now having been missed. Will cement plants in that country still be included in the EU ETS?

CemBR together with its advisory arm (CBA) is working on answers to all of these questions and more, as well as the various scenarios that might materialise in Phase IV. Stay tuned for more in 2020. 



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