Accelerating cement decarbonisation through better standards

Joren Verschaeve | Programme Manager | 30.01.2024

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Environmental Coalition on Standards

is an international NGO with a network of members and experts advocating for environmentally friendly technical standards, policies, and laws.

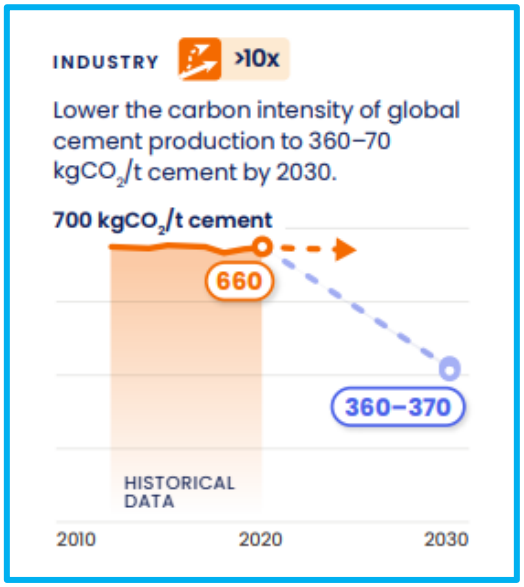


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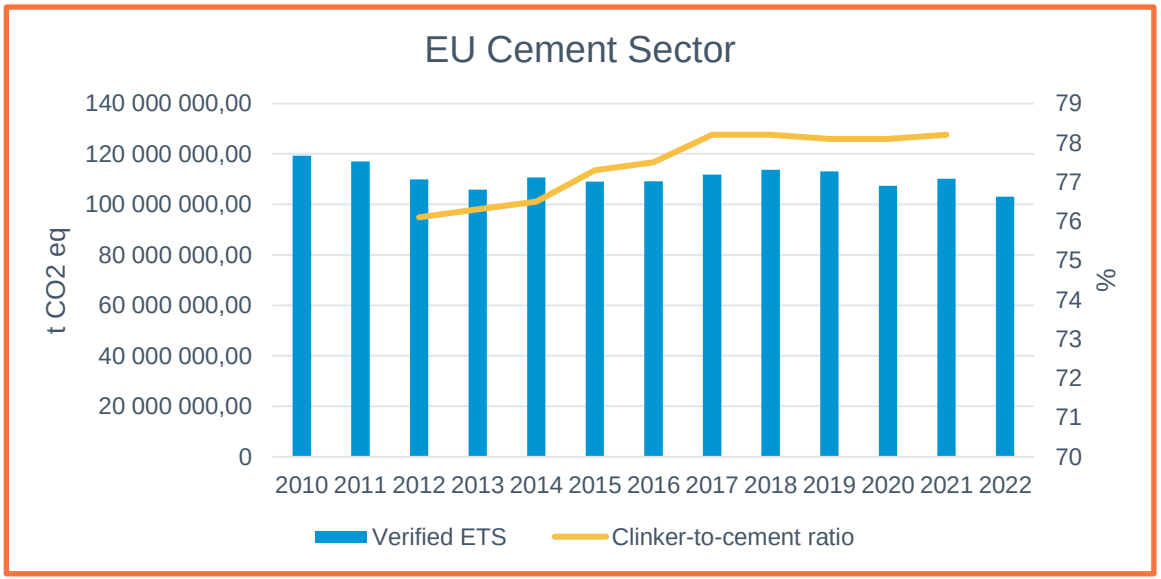
Cement is omnipresent and indespensible



Time to act is now !



« Well off track »
(State of climate action 2023)



Verified ETS emissions = stable and high last 12 years
Clinker-to-cement ratio increasing

(European Environmental Agency, 2024 ; ALCCC, 2023)

Challenge ahead is a political one



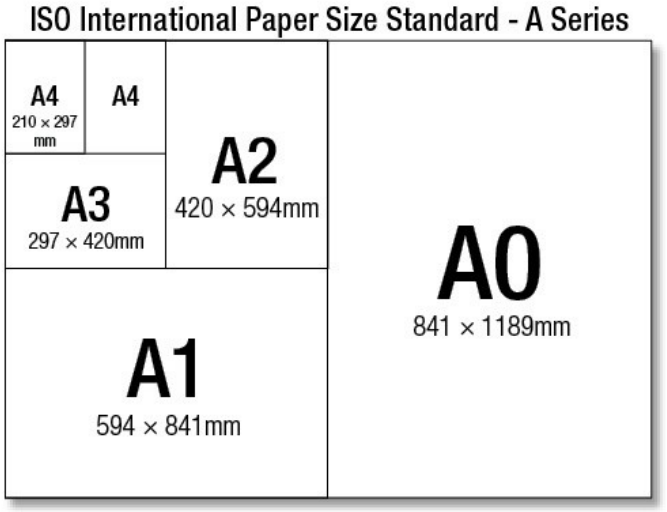
Bringing solutions to the market

Regulatory framework presenting key barriers for decarbonsation

- ETS framework underperforming
- GPP underappreciated
- Overreliance on expensive technologies (CCS)
- Standards serving as bottleneck for market entrance

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What are standards?

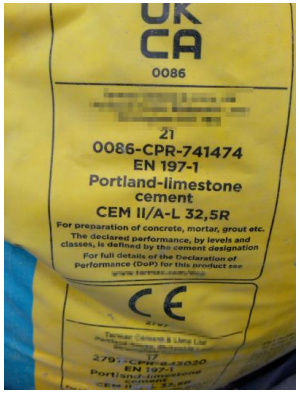









EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM
EN 197-1
June 2000
English version
Cement - Part 1: Composition, specifications and conformity criteria for common cements




EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG
Central Secretariat: rue de Stassart, 36 B-1050 Brussels
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Ref. No. EN 197-1:2000 E

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EN Standards hamper clinker substitution…



*Only ready available and scalable solution at **near zero costs**. Potential for reduction **up to 50%** (IPCC, 2022)*

EN standards hamper innovation…

Sublime Systems

BIOMASON

BRIMSTONE

SOLIDIA®

Electrochemical production, bacteria, carbon curing, alternative clinkers…. .

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… because they are recipe-based (cement & concrete)

Cement type		Clinker (%)	Slag (%)	SCM (%)	Limestone (%)
Portland limestone cement	CEM II A-L	80 - 94	-	-	6-20
	CEM II B-L	65 - 79	-	-	21-35
Portland composite cement*	CEM II A-M	80 -94	6 - 20		
	CEM II B-M	64 - 79	21 - 35		
Blast-furnace cement	CEM III/A	35 – 64	35 - 65	-	-
	CEM III/B	20 - 34	66 - 80	-	-
	CEM III/C	5 - 19	81 - 95	-	-
Pozzolanic cement**	CEM IV/A	65 - 89	-	11 - 35	-
	CEM IV/B	45 - 64	-	36 - 55	-
Composite cement***	CEM V/A	40 - 64	18 - 30	18 - 30	-
	CEM V/B	20 - 38	31 - 50	31 - 50	-

* Combination of slag, silica fume, fly ash, pozzolans, burnt shale and limestone
** Combination of silica fume, fly ash and pozzolan
*** Combination of slag, low-calcium fly ash and pozzolan

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… because they are non-harmonised (concrete)

Exposure category		No risk of corrosion or attack	Carbonation-induced corrosion				Sea water			Chloride other than from sea water			Freeze/thaw attack				Aggressive chemical environments		
		X0	XC 1	XC 2	XC 3	XC 4	XS 1	XS 2	XS 3	XD 1	XD 2	XD 3	XF 1	XF 2	XF 3	XF 4	XA 1	XA 2	XA 3
EN 206	min. cement content (kg/m³)	-	260	280	280	300	300	320	340	300	300	320	300	300	320	340	300	320	360
France	Min. cement content (kg/m³)	150	260	260	280	280	330	330	350	280	330	350	280	300	315	340	330	350	360
Germany	Informative - Min. cement content (kg/m³)	-	260	280	280	300	300	320	340	300	300	320	300	300	320	340	300	320	360
	Normative - Min. cement content (kg/m³)	-	240	240	260	280	300	320	320	300	320	320	280	300	320	320	280	320	320
Italy	Min. cement content (kg/m³)	-	260	280	280	300	300	320	340	300	300	320	300	300	320	340	300	320	360
Poland	Min. cement content (kg/m³) - Mass	-	260	280	280	300	300	320	340	300	320	320	300	300	320	340	300	320	360
Spain	Min. cement content (kg/m³) - Mass	200	-	-	-	-	-	-	-	-	-	-	300	275	300	275	275	300	325
	Min. cement content (kg/m³) - Reinforced	250	275	275	275	300	300	325	350	300	325	325	300	325	300	325	325	350	350
	Min. cement content (kg/m³) - Prestressed	275	300	300	300	300	325	325	350	300	325	325	300	325	300	325	325	350	350
UK	Min. cement content (kg/m³)	-	260	280	280	300	300	320	340	300	300	320	300	300	320	340	300	320	360

Table 1: Recommended limiting values for composition and properties of concrete

Source: Jamcem, 2023.

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Way forward

1) Replacing existing standards by performance-based standards

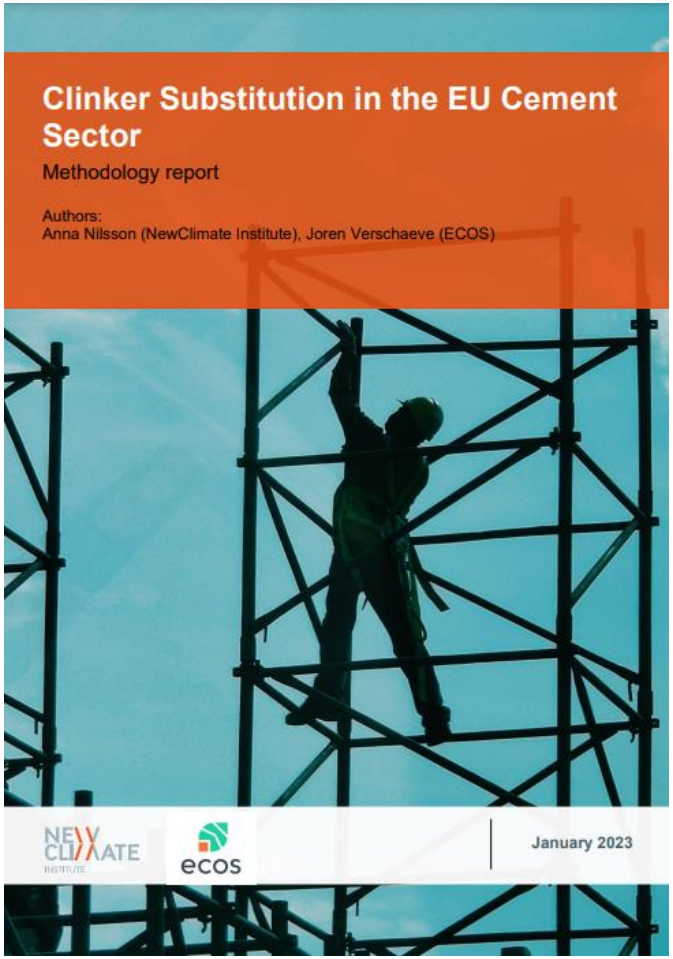
(!) These standards exist already (!)

Table 9.2.5. Default Minimum Strength Requirements of ASTM C 1157, MPa

	Cement type					
	GU	HE	MS	HS	MH	LH
1 day		10				
3 days	10	17	10	5	5	
7 days	17		17	10	10	5
28 days				17		17

2) Harmonising European concrete standards

What is the impact?

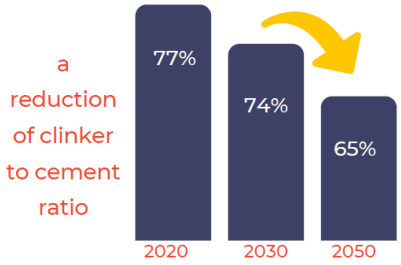


(Very) conservative modeling

'Slow' roll-out of performance-based standards ; no harmonisation ; other barriers unadressed

Mitigation potential of -52% in best scenario by 2050 compared to 2015 levels

Cement can reach net-zero by 2040 !



Roadmap Cembureau

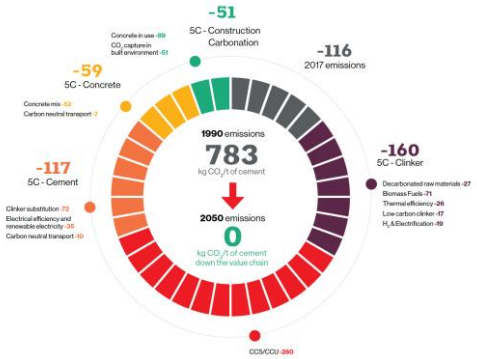
ALLIANCE for LOW-CARBON CEMENT & CONCRETE

Joint industry – NGO alliance committed to reach net zero by 2040

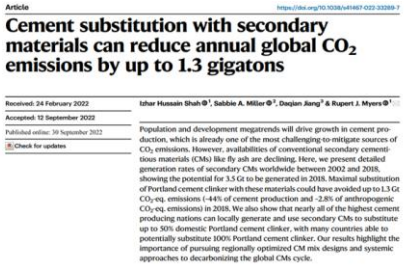
FICEM
FEDERACIÓN INTERAMERICANA DEL CEMENTO

Optimized Baseline scenario	2020	2030	2050
Cement (Mt)	196	198	227
Clinker/cement	0.66	0.53	0.51*
Clinker (Mt)	128	105	115
SCMs (Mt)	67	93	111

(*) This weighed clinker factor considers the clinker factors for all forms of distribution as well as supplementary cementitious materials used directly in concrete and cementitious mixes as a separate constituent of cement



nature


Article

Cement substitution with secondary materials can reduce annual global CO_2 emissions by up to 1.3 gigatons

Received: 24 February 2022
Accepted: 12 September 2022
Published online: 30 September 2022
Check for updates

Ishar Hussain Shah, Sabbie A. Miller, Daqian Jiang & Rupert J. Myers

Population and development megatrends will drive growth in cement production, which is already one of the most challenging-to-mitigate sources of CO_2 emissions. However, availabilities of conventional secondary cementitious materials (CMs) like fly ash are declining. Here, we present detailed generation rates of secondary CMs worldwide between 2002 and 2018, showing the potential for 3.5 Gt to be generated in 2018. Maximal substitution of Portland cement clinker with these materials could have avoided up to 1.3 Gt CO_2-eq. emissions (~4% of cement production and ~2.8% of anthropogenic CO_2-eq. emissions) in 2018. We also show that nearly all of the highest cement producing nations can locally generate and use secondary CMs to substitute up to 50% domestic Portland cement clinker, with many countries able to potentially substitute 100% Portland cement clinker. Our results highlight the importance of pursuing regionally optimized CM mix designs and systemic approaches to decarbonizing the global CMs cycle.

Many EU countries can theoretically substitute all clinker

MARIE CURIE ACTIONS

DETOCS – 0,40% clinker ratio (2030) to 0,25% (2035) in Europe

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Thank you

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