Africa's development of low-carbon concrete code policy

Joseph Mwiti Marangu, Ph.D

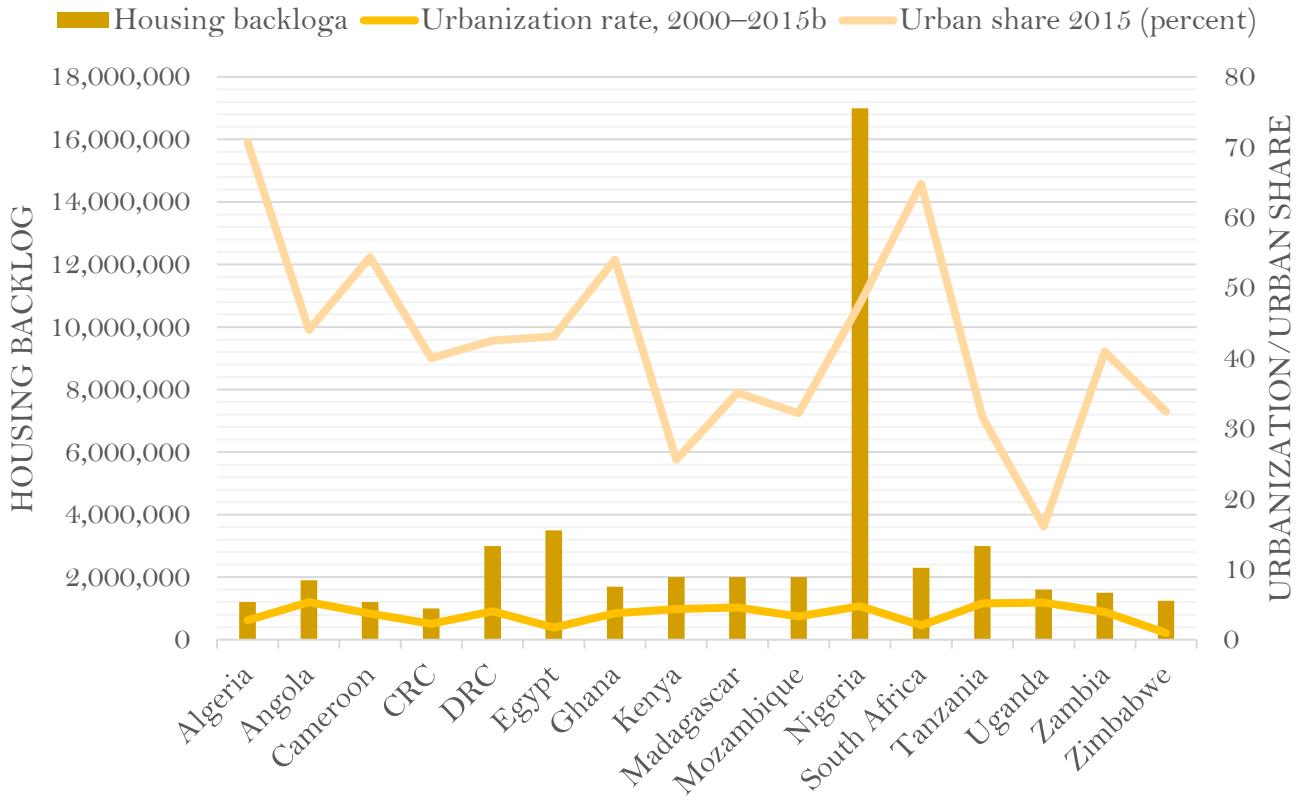
Director, Institute of Cement and Concrete

Meru University of Science &Technology - Kenya

Physical infrastructure in Sub-Sahara Africa (SSA)

- By 2050, Africa's urban population is expected to reach **1.23 billion**
- By 2030 the continent will no longer be predominately rural [UN-Habitat's State of African Cities 2010 report]
- The number of people living in African cities will triple over the **next 40 years and by 2050; 60%** of Africans will be city dwellers
- Six of the world's fastest growing economies are in Africa

Housing backlog in SSA; Selected countries with over 1million housing backlog



- Total housing backlog in Africa is up to 50,562,000 with more than ¾ from SSA
- About 199.5 million people in SSA live in slums, the highest number in the world.

(UN-Habitat's State of African Cities 2010 report)

What is the dream? Earth, timber or concrete debate

Timber

-Deforestation & biodiversity loss

Source: tschuma417 / stock.com

Mix of earth and thatch

- Cost and frequency of repairs

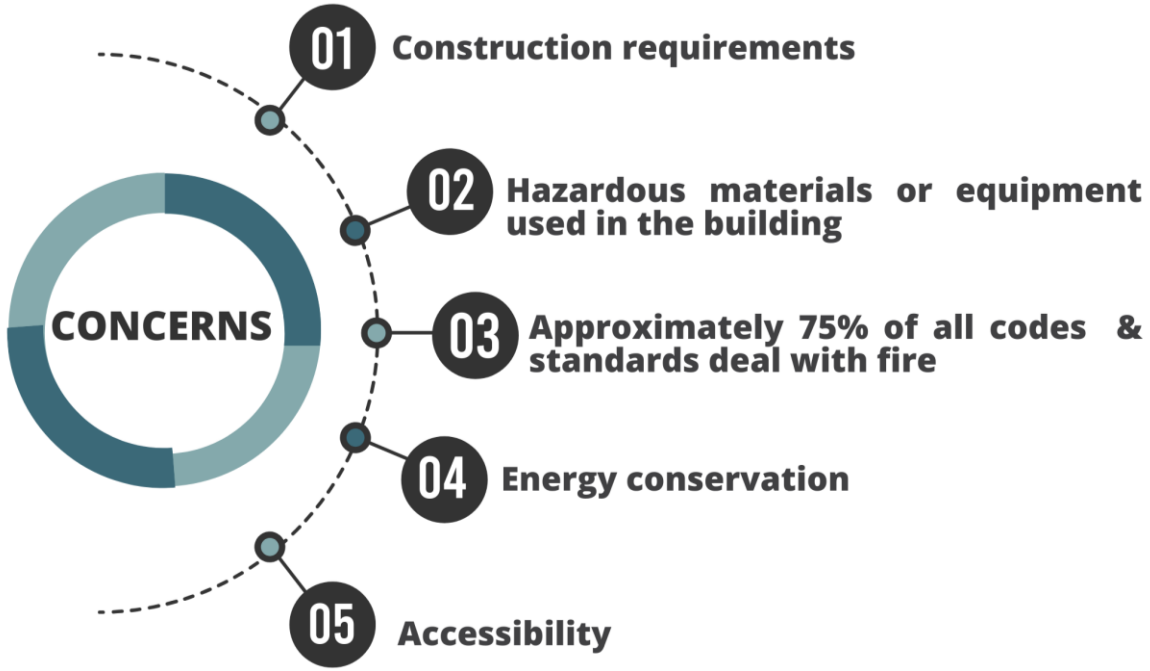
Cement & concrete

- Durable, decent etc

Who does the construction?

Towards building codes

- Ensure public health and safety throughout a building, majority have come into play “after-the-fact” as a lessons learnt especially from a major tragedy.

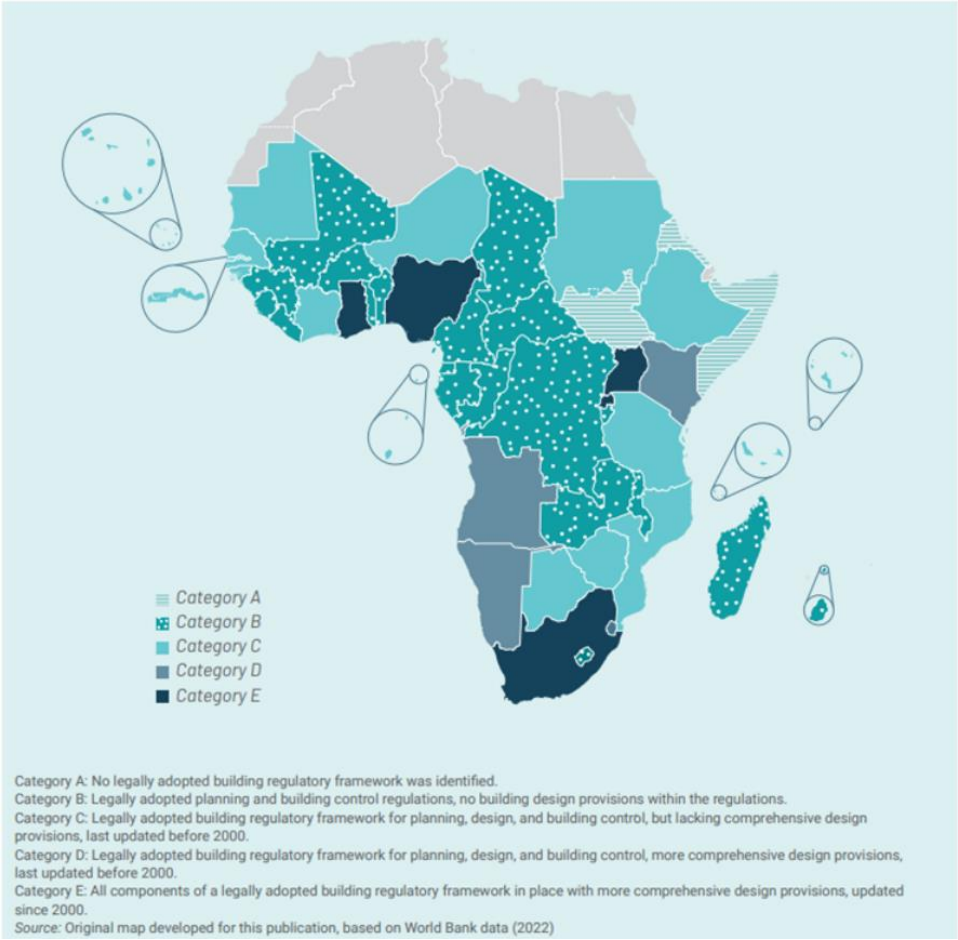


Current status on building codes

01 **Most SSA Africa countries are revising their building codes (World Bank Report 2022)**

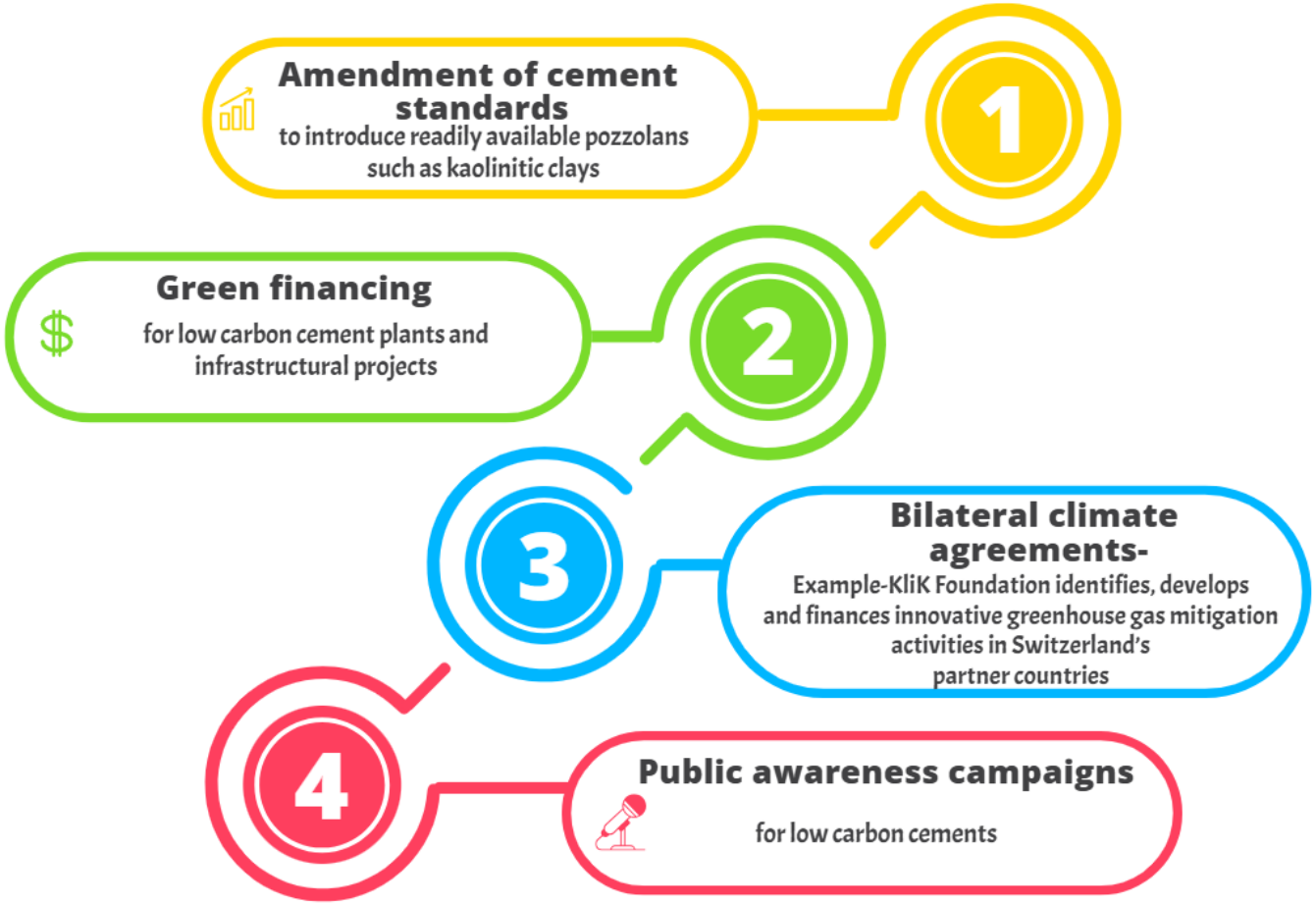
02 **Heavily rely on global north codes which;**
-Do not reflect their geographic climatic conditions
-Planning and design of the buildings etc.

03 **Ongoing adoption e.g. of Euro codes with national annexes**

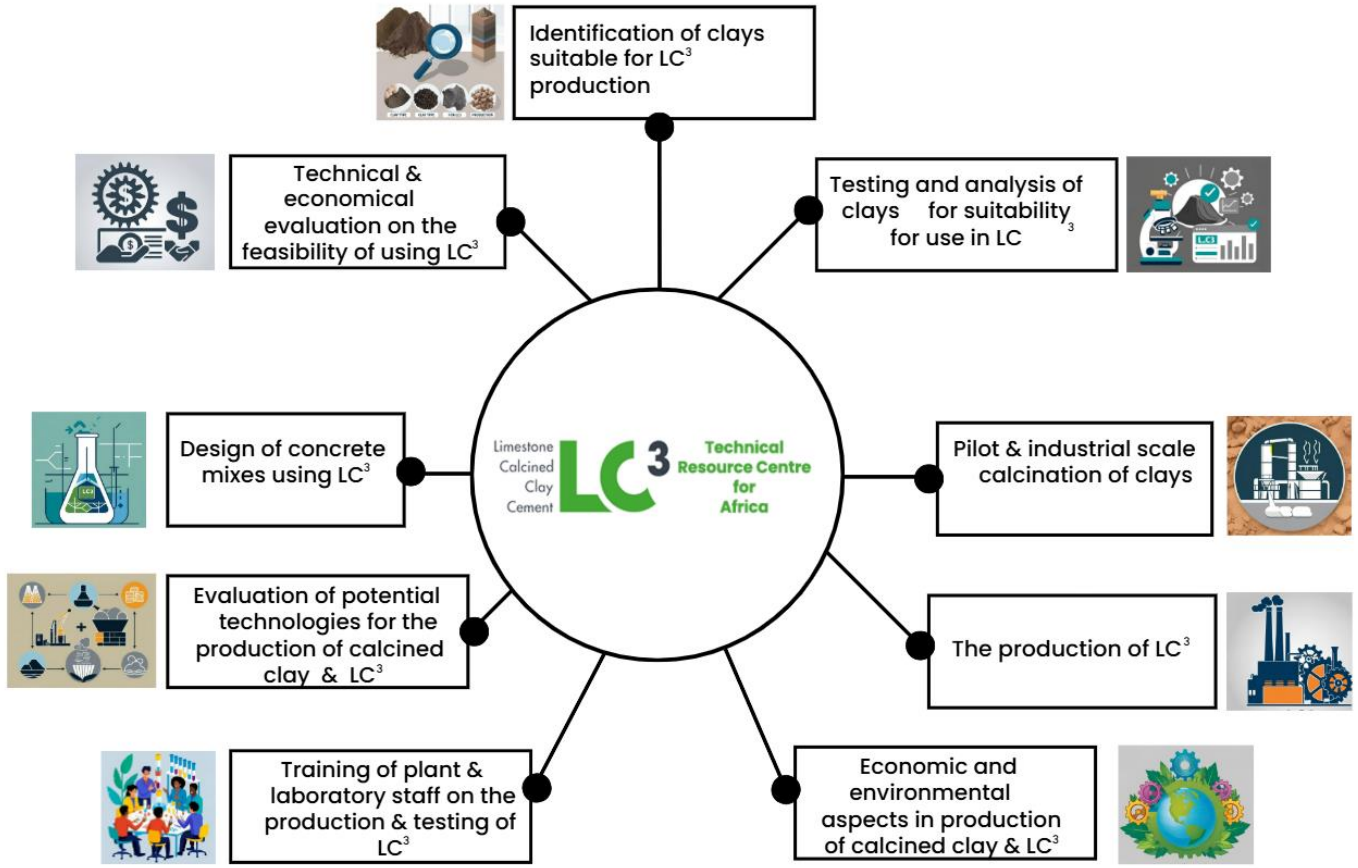


Category A: No legally adopted building regulatory framework was identified.
Category B: Legally adopted planning and building control regulations, no building design provisions within the regulations.
Category C: Legally adopted building regulatory framework for planning, design, and building control, but lacking comprehensive design provisions, last updated before 2000.
Category D: Legally adopted building regulatory framework for planning, design, and building control, more comprehensive design provisions, last updated before 2000.
Category E: All components of a legally adopted building regulatory framework in place with more comprehensive design provisions, updated since 2000.
Source: Original map developed for this publication, based on World Bank data (2022)

Steps to low carbon cement



What we do at LC^3-TRC Africa



Amendment of cement standards

- Example 1: EN 197 part 5: 2021

Table 1 — Portland-composite cement CEM II/C-M and Composite cement CEM VI

Main types	Notation of the products (types of cement)		Composition (percentage by mass a)										
			Main constituents										Minor additional constituents
			Clinker	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone		
						natural	natural calcined	siliceous	calcareous				
	Type name	Type notation	K	S	D [b]	P	Q	V	W	T	L [c]	LL [c]	
CEM II	Portland-composite cement [d]	CEM II/C-M	50-64	‹---------- 36-50 ----------›									0-5
CEM VI	Composite cement	CEM VI (S-P)	35-49	31-59	–	6-20	–	–	–	–	–	–	0-5
		CEM VI (S-V)	35-49	31-59	–	–	–	6-20	–	–	–	–	0-5
		CEM VI (S-L)	35-49	31-59	–	–	–	–	–	–	6-20	–	0-5
		CEM VI (S-LL)	35-49	31-59	–	–	–	–	–	–	–	6-20	0-5

a The values in the table refer to the sum of the main and minor additional constituents.

b In case of the use of silica fume, the proportion of silica fume is limited to 6-10 % by mass.

c In case of the use of limestone, the proportion of limestone (sum of L, LL) is limited to 6-20 % by mass.

d The number of main constituents other than clinker is limited to two and these main constituents shall be declared by designation of the cement (for examples, see Clause 6).

Amendment of cement standards

- Ghanaian LC3 standard: GS PAS 5: 2024

Table 1 - Limestone Calcined Clay Cement (LC3) and Composite Limestone Calcined Clay Cement (LC3-M)

Main types	Notation of the products (types of cement)		Composition (percentage by mass[a])										
			Main constituents										
			Clinker	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone		
						natural	natural calcined	siliceous	calca-reous				
	Type name	Type notation	K	S	D	P	Q	V	W	T	L	LL	
LC3	Limestone Calcined Clay Cement	LC3	35-64	-	-	18-35		-	-	-	18-30		0-5
LC3 - M	Composite Limestone Calcined Clay Cement	LC3 - M	35-64	6-10			12-25	6-10			18-30		0-5

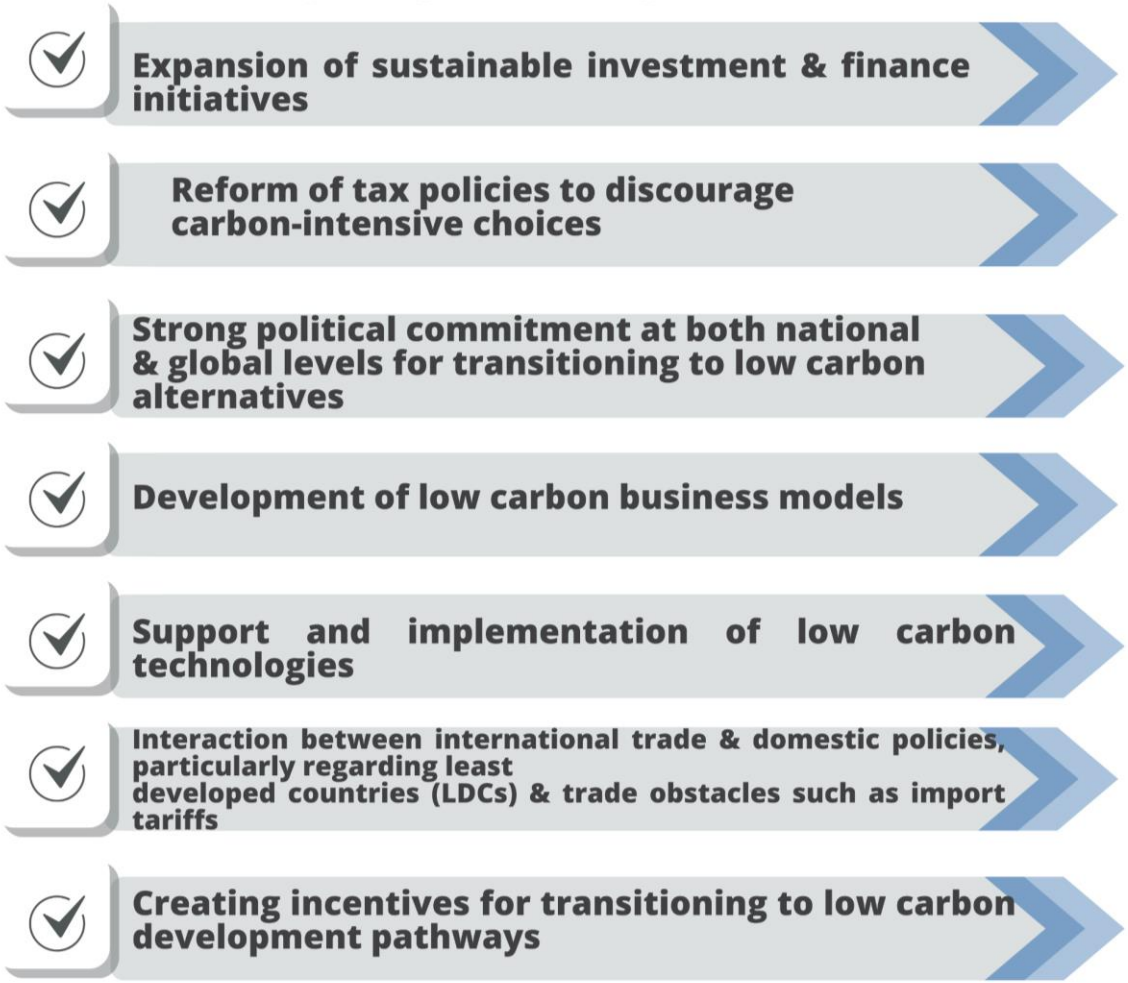
a. The values in the table refer to the sum of the main and minor additional constituents.

Amendment of cement standards

- Example 4: KS EAS 18 part 1: 2025 (Balloting stage in 8 EAC member states)

CEM II	Portland–slag cement	CEM II/A-S	80–94	6 - 20	–	–	–	–					
		CEM II/B-S	65–79	21 - 35	-	–	–	–					
	Portland-silica fume cement	CEM I/A-D	90 – 94	–	6 - 10	–	–	–					
	Portland–Pozzolana cement	CEM II/A-P	80 – 94	–	–	6 - 20	–	–					
		CEM II/B-P	65- 79	–	–	21 - 35	–	–					
		CEM II/A-Q	80 - 94	–	–		6 - 20	–					
		CEM II / B-Q	65 – 79	–	–	–	21 -35	–					
	Portland – fly ash cement	CEM II / A-V	80–94	–	–	–	–	6 - 20					
		CEMII / B-V	65 – 79	–	–	–	–	21 - 35					
		CEM II/A-W	80–94	–	–	–	–	–					
		CEMII/B-W	65 – 79	–	–	–	–	–	2				
	Portland–burnt shale cement	CEM II/A-T	80–94	–	–	–	–	–					
		CEM II/ B-T	65 – 79	–	–	–	–	–					
	Portland–limestone cement	CEM II/ A-L	80 - 94	–	–	–	–	–					
		CEM II/A-L	65- 79	–	–	–	–	–					
		CEM II/A-LL	80 - 94	–	–	–	–	–					
		CEM II/ B-LL	65 - 79	–	–	–	–	–	–	–	–	35	0- 5
	Portland composite cement[c]	CEM II/ A-M	80–88	← - - - - - - - - - - - - - - - - - 12- 20 - - - - - - - - - - - - - - - - - →									0 - 5
		CEM II/ B-M	65 -79	← - - - - - - - - - - - - - - - - - 21 - 35 - - - - - - - - - - - - - - - - - →									0- 5
		CEM II/ C-M	50-64	← - - - - - - - - - - - - - - - - - 36 - 50 - - - - - - - - - - - - - - - - - →									0-5
		CEM II/ D-M[d]	35-49	← - - - - - - - - - - - - - - - - - 51 - 65 - - - - - - - - - - - - - - - - - →									0-5

Conclusion: Policy alignment for better carbon reduction



Thank You!