

DETOCS Online training School

December 4, 2024

Claude Lorea

Cement ESG Innovation Director

Global Cement and Concrete Association

10 new members in the last 12 months

GCCA is an attractive organization

80%

GCCA members account for 80% of the global cement industry volume outside of China - and include several leading Chinese manufacturers.

Our Members

- Asia Cement Corporation
- Breedon Group
- **BUA Cement***
- Buzzi
- Cementir Holding
- Cementos Argos
- Cementos Moctezuma
- Cementos Pacasmayo
- Cementos Progreso
- CEMEX
- **Cimenterie Nationale***
- Çimsa Cimento
- CNBM
- CRH
- Dalmia Cement
- Dangote
- **Emirates Steel Arkan***
- Fletcher Building
- GCC
- Heidelberg Materials
- Holcim
- **Hima Cement***
- **Huaxin Cement***
- JK Cement
- JSW Cement
- Medcem
- Misr Cement Group
- Molins
- Neshar Israel Cement Enterprises
- Norm Cement
- **Northern Region Cement Company***
- Orient Cement
- PT Solusi Bangun Indonesia
- SCHWENK Zement
- Secil
- Siam Cement Group
- Siam City Cement
- Taiheiyo Cement
- Taiwan Cement Corporation
- TITAN Cement Group
- **TPI Polene***
- UltraTech Cement
- UNACEM
- Vassiliko Cement
- Votorantim Cimentos
- YTL Cement
- **Yura Cement***

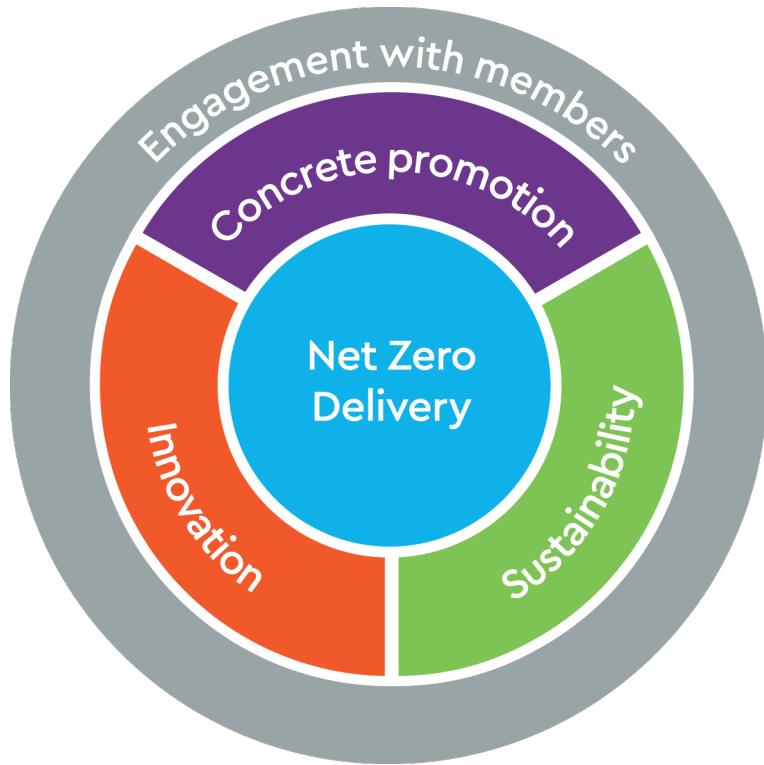
National & Regional Association Partners

- Asociación de Fabricantes de Cemento Portland – Argentina
- Asociación de Productores de Cemento – Peru
- Associação Brasileira de Cimento Portland – Brazil
- Association of German Cement Manufacturers (VDZ) – Germany
- Association Professionnelle des Cimentiers – Morocco
- Betonhuis – Netherlands
- BIBM – Europe
- CANACEM – Mexico
- Canadian Precast Prestressed Concrete Institute
- Cement Association of Canada
- Cement Concrete & Aggregates Australia
- Cement Industry Federation – Australia
- Cement Manufacturers Association – India
- Cement Manufacturers Ireland
- **China Cement Association***
- Concrete NZ – New Zealand
- European Cement Association (CEMBUREAU)
- European Federation Concrete Admixtures
- European Ready Mixed Concrete Organisation
- Federación Iberoamericana del Hormigón Premezclado – LatAm
- Federación Interamericana del Cemento (FICEM) – LatAm
- Japan Cement Association
- Korea Cement Association
- Mineral Products Association - United Kingdom
- National Ready Mixed Concrete Association – USA
- Portland Cement Association – USA
- **South India Cement Manufacturers Association***
- Thai Cement Manufacturers Association
- The Spanish Cement Association (Oficemen)
- Turkish Cement Manufacturers Association (TürkÇimento)

* New Members and National & Regional Association Partners

Our Mission

GCCA Strategic Pillars



GCCA Net Zero Roadmap



Why Concrete Matters?

Concrete is the backbone of modern society

Concrete provides a durable and versatile foundation for the infrastructure society needs, from roads and bridges to buildings and dams.

Its strength and longevity enable the development of urban environments, supporting economic growth and enhancing the quality of life for communities around the world.



Few of the Incredible Benefits of Concrete



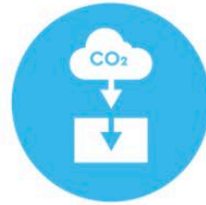
Albedo



Availability



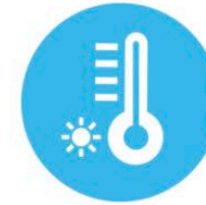
Balancing the energy grid



Carbon uptake



Circular economy



Concrete for heating (Electro-conductive)



Concrete roads



Design for disassembly



Disaster resilience



Durability



Fire resistance



Healthy buildings



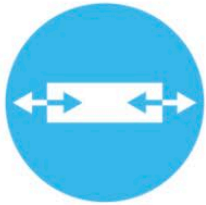
Passive cooling using thermal mass



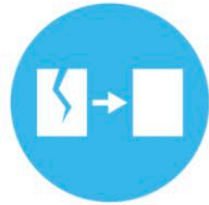
Photocatalytic concrete



Porous concrete



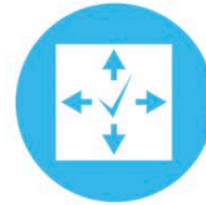
Prestressed concrete



Self-healing



Strength



Structure as finish



Versatility



Wide range of placements

Concrete – a key role to play in resilience and in adapting the world to the climate change



JOHNNY MILANO/The New York Times/Redu

Built Environment and the Role of Concrete



Concrete is fundamental to infrastructure key assets and hence concrete is key to delivering the vast majority of UN sustainable development goals.

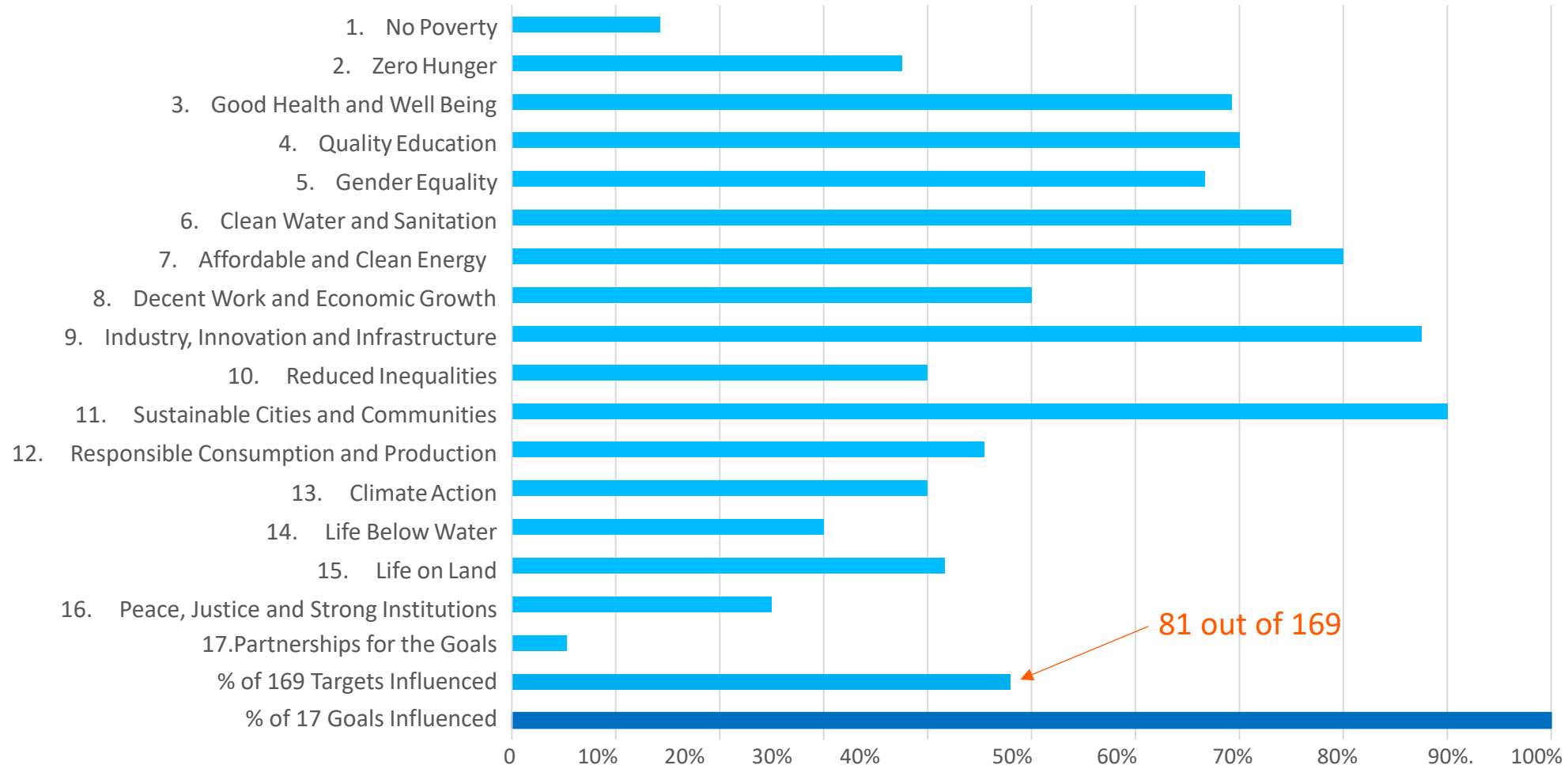
UNOPS, a UN agency, has published a report which identified that the built environment supports society in reaching 92% of the 169 targets in the 17 UN SDGs.

This 92% figure derives from consideration of all parts of the built environment: infrastructure (water, waste, energy, transport and digital communications), buildings and facilities.

92%

UNOPS, a UN agency, has published a report which identified that the built environment supports society in reaching 92% of the 169 targets in the 17 UN SDGs.

Concrete's impact on the UN SDGs





Concrete is essential to our lives – but we have to reduce its emissions.”

John Kerry, United States Special Presidential Envoy for Climate



Concrete and cement are not just fundamental to constructing roads, bridges and buildings.

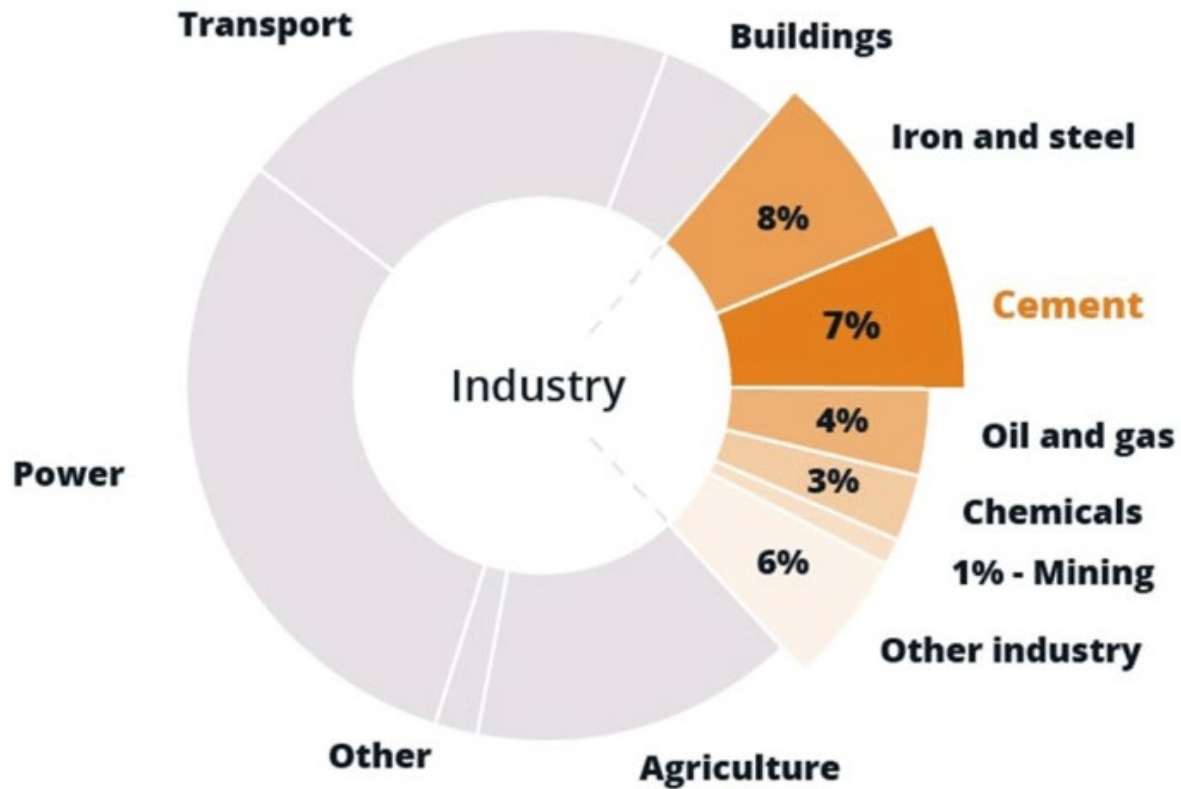
You are fundamental to building a better world.

And we have no time to lose. That means taking a quantum leap in climate action – and slashing global emissions. Starting now.”

António Guterres, Secretary-General of the United Nations

What is at stake ?

Our industry's carbon challenge



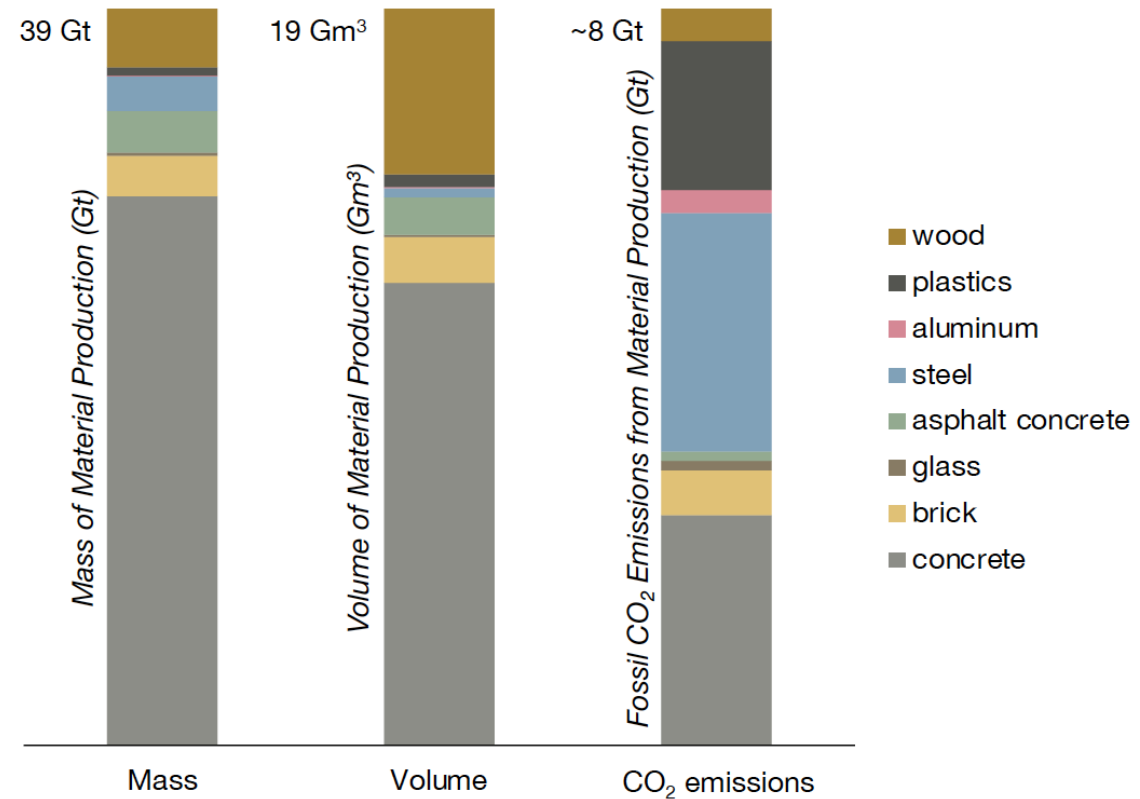
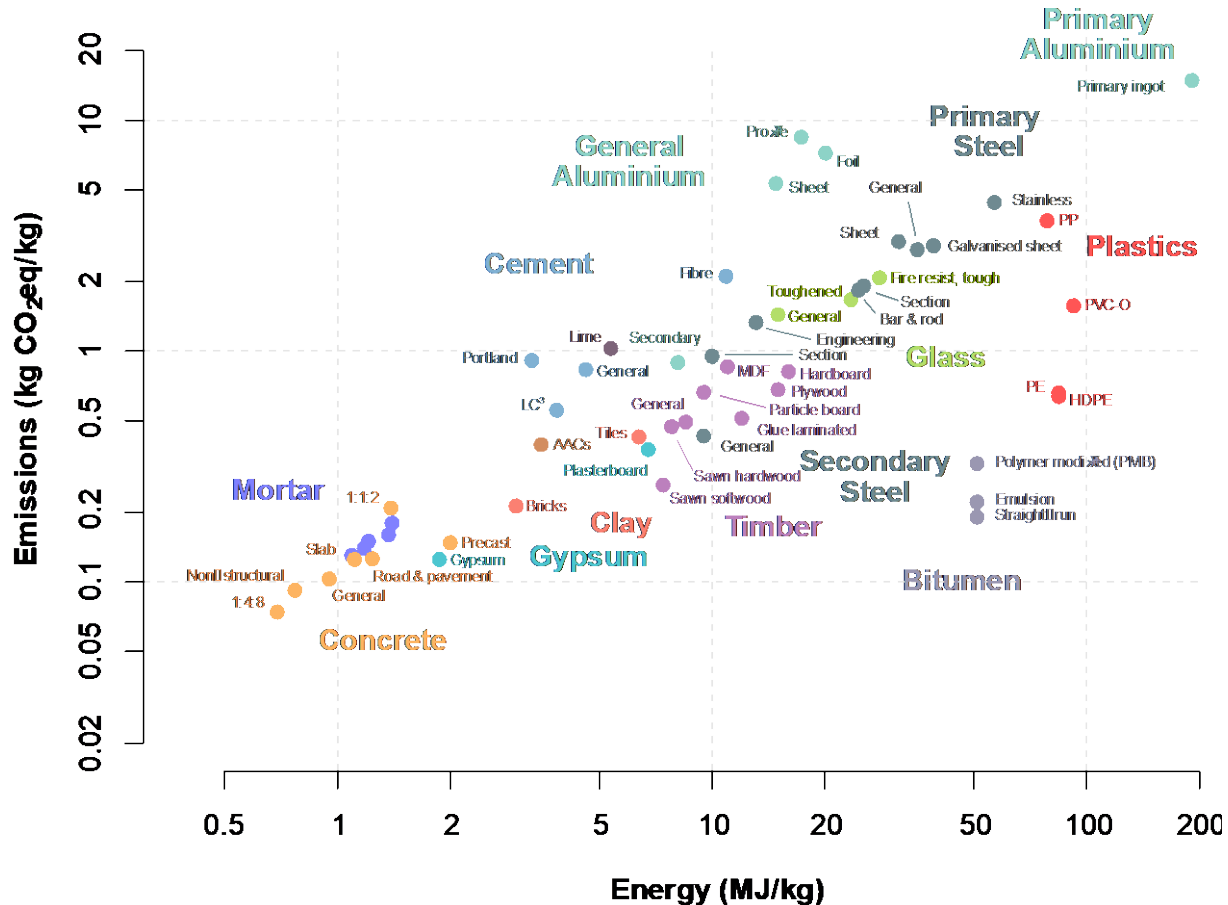
Cement and concrete accounts for approximately 7% of global CO₂

That is why in 2021, we launched our 2050 Net Zero Roadmap on behalf of the global industry.

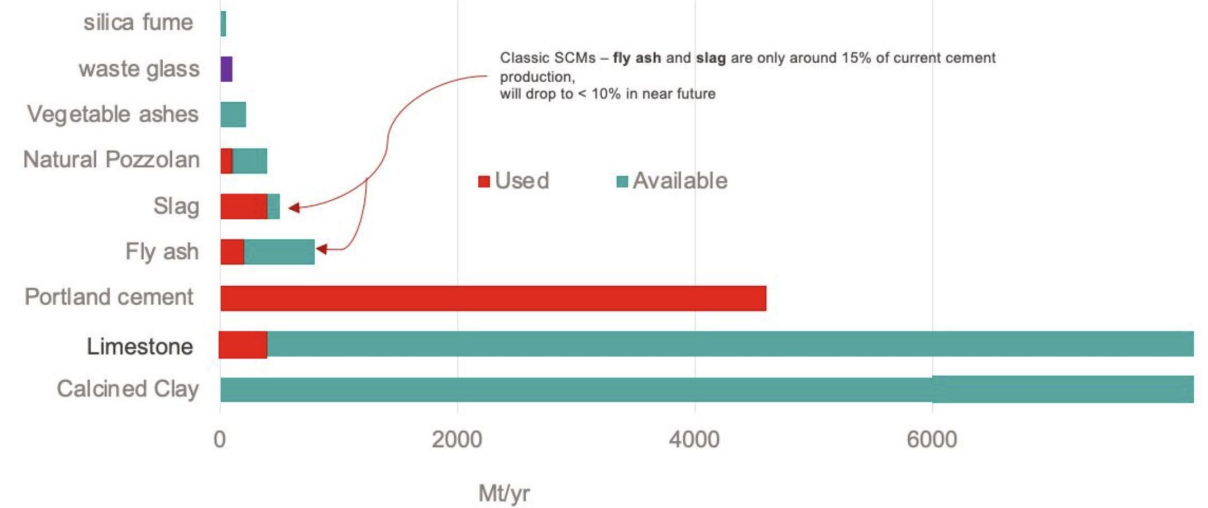
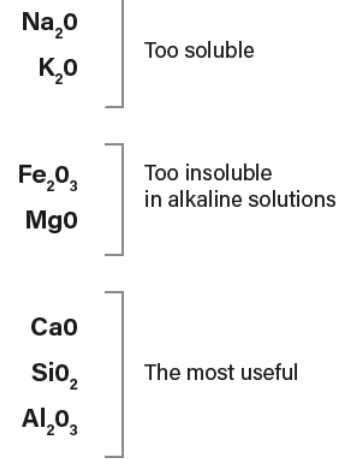
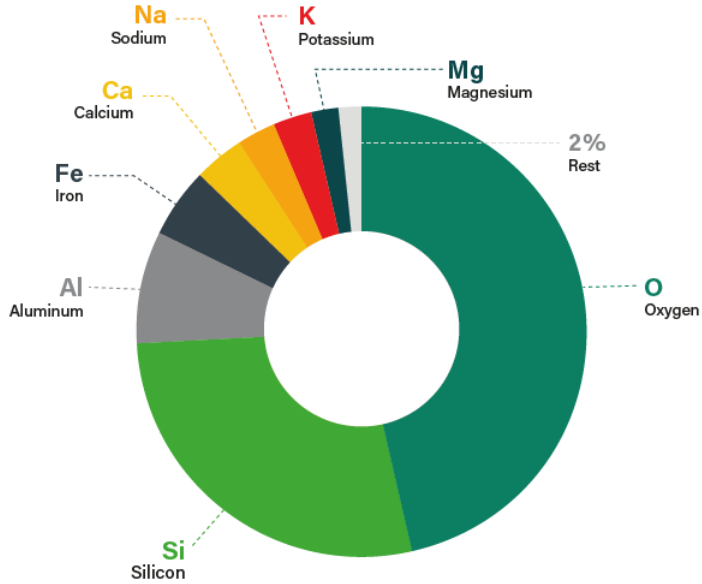
We were the first 'heavy industry' to launch a global roadmap with detailed levers and pathways to full decarbonisation.

We are committed to reaching net zero and providing the world with carbon neutral cement to enable a more sustainable world of tomorrow.

Concrete comes with heavy CO2 footprint... In large footprint relates to the wide usage of the material



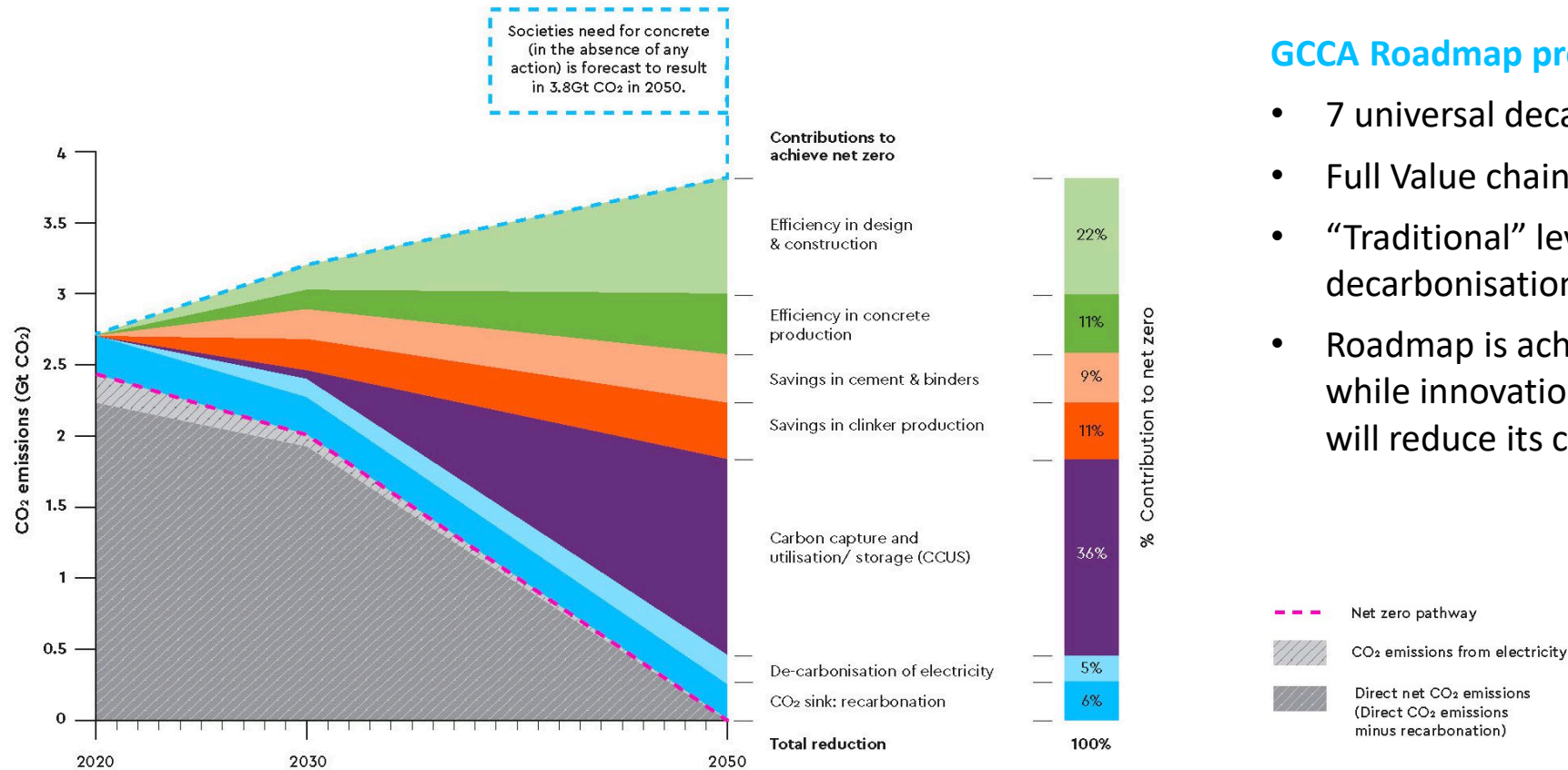
Concrete – there is no substitute



**Industry is custodian and must
reducing carbon footprint**

GCCA Roadmap as a North Star to Decarbonise Cement Industry

No silver bullet, all value chain contributes to decarbonisation agenda. CCUS ramp up required.



GCCA Roadmap proposes:

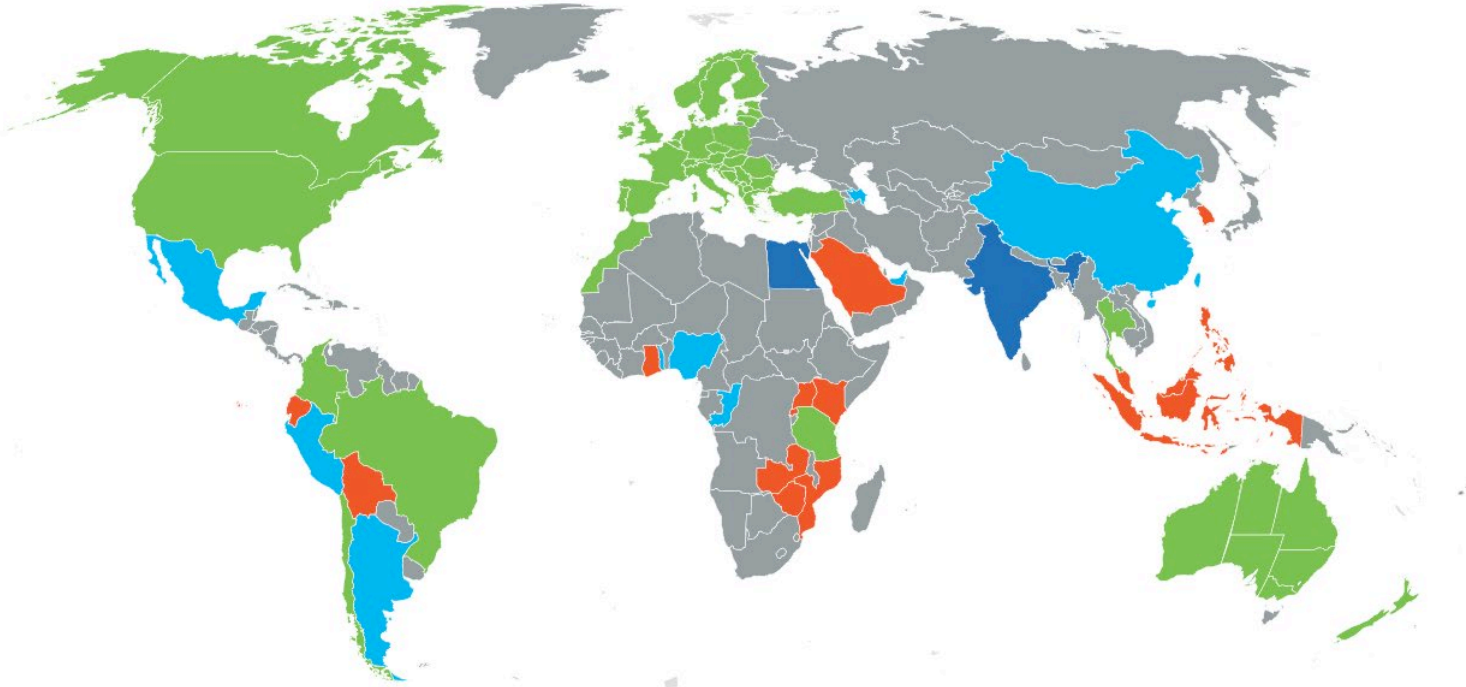
- 7 universal decarbonisation levers
- Full Value chain decarbonisation Strategy
- “Traditional” levers represents two-third of the decarbonisation potential while CCUS is one-third
- Roadmap is achievable within actual technology while innovation will accelerate transition and will reduce its cost

GCCA Net Zero Accelerator program

Close to 70% of cement capacity covered by NZA program + Milestone agreement with China

Progress of Roadmaps around the globe

World cement production covered by roadmaps



Summary of our three priorities:

1. Continue supporting development of national Cement & Concrete Roadmaps
2. Influence and leverage international initiatives to advance policy dialogue and promote local implementation
3. Identify and leverage financial support for decarbonisation projects and innovation

Our policy requirements

From Bangkok to Berlin, from Beijing to Bogota, from Lagos to Lima and from New York to New Delhi, a quiet revolution is happening. The cement and concrete industry is undergoing an industrial scale transformation to make progress against its mission of delivering net zero concrete for the world.

Despite the breadth of action and progress on our long-term project of deep decarbonisation, greater progress could be achieved today with the right policy support across the world to underpin the transition.

So far, since the 1990 baseline, we have achieved a 23% emissions reduction in CO₂. As we approach the halfway mark in “the decade to deliver” it is clear that we need to accelerate, and it is enabling policies that can unlock that transformational progress.



Supplementary Materials

Use of blended cements and Supplementary Cementitious Materials (SCMs) can be increased now through policies that ensure government procurement permits SCMs and latest material standards are available. In the short term policies need to promote and enable access to relevant materials and establish government funding programmes to develop material standards, including performance based standards.



Waste Treatment in Cement Kilns

The right policies enable the industry to replace the majority of fossil fuels with energy recovered from waste. In addition, recycling of mineral from waste is also achieved. And yet globally less than 10% of energy needed in cement kilns comes from waste. Policies need to recognise and implement the fact that waste treatment in kilns is more sustainable than landfill and incineration.

Our policy requirements

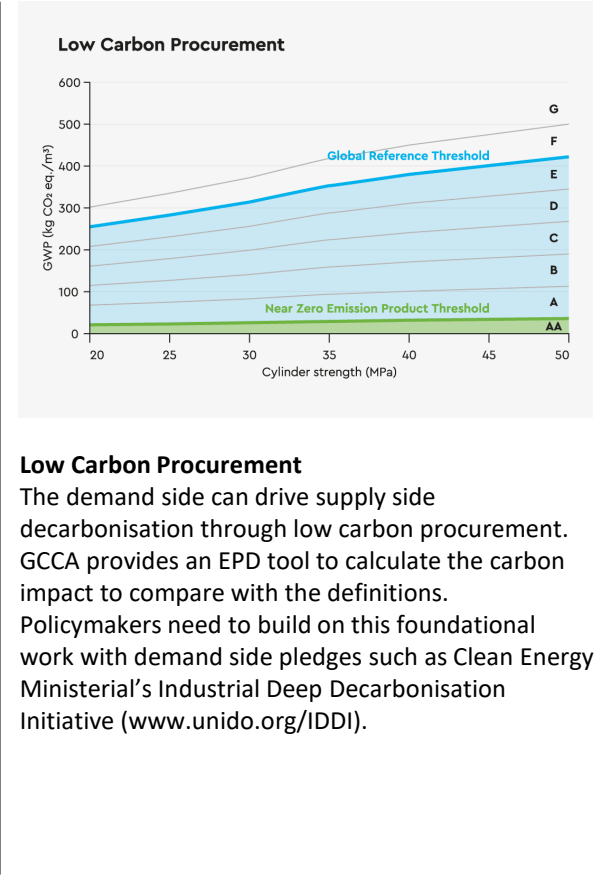


Carbon Capture Use and Storage

Policy across all geographies is not yet strong enough to drive the number and scale of projects needed for cement manufacturing to be on track to meet net zero by 2050. Policy needs to address public financing, recognition of carbon removal, transport and storage infrastructure, access to decarbonised electricity, carbon pricing and demand for low carbon product.

Carbon Pricing

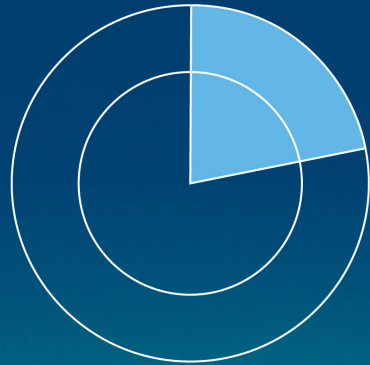
An appropriate carbon price, as well as long-term predictability of the carbon price, allows companies to make the investments needed to reduce their CO₂. Policymakers must ensure that use of carbon pricing does not lead to distortions of competition between domestic producers and importers. The transition towards carbon neutral economies is dependent on the acceptance of carbon constraints and costs by all actors along economic value chains.



Low Carbon Procurement

The demand side can drive supply side decarbonisation through low carbon procurement. GCCA provides an EPD tool to calculate the carbon impact to compare with the definitions. Policymakers need to build on this foundational work with demand side pledges such as Clean Energy Ministerial’s Industrial Deep Decarbonisation Initiative (www.unido.org/IDDI).

KEY PROGRESS: CO₂ REDUCTION – GNR



CO₂ emissions*

23%

Reduction in Net CO₂ emissions
per tonne cementitious
(1990 baseline)



Fossil Fuel

21%

Reduction in fossil fuel consumption
(1990 baseline)



Energy Efficiency

19%

Energy efficiency improvement
(1990 baseline)

* Note 23% is a rounded figure – actual figure, accurate to 1 decimal places, is 23.25%

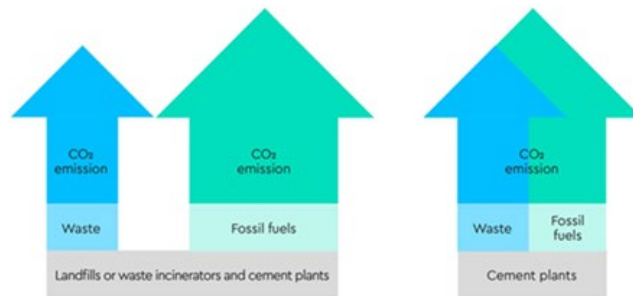
Savings in clinker production



With an increase in use of alternative fuels, there can be a slight decrease in the thermal energy efficiency. Higher substitution rates of alternative fuels in combination with different parameters, for example burnability, higher moisture content, design and size of the plant, can typically result in a slight increase in thermal energy demand. This effect was taken into account in the forecasting.

Alternative fuels are derived from non-primary materials i.e. waste or by-products and can be biomass, fossil or mixed (fossil and biomass) alternative fuels. There are current examples of cement kilns operating with 100% alternative fuels which demonstrates the potential of this lever.

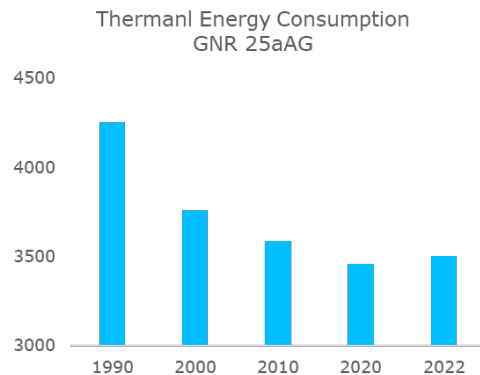
On average globally, alternative fuel use is forecast to increase from the current 6% to 22% and 43% by 2030 and 2050 respectively.



Energy efficiency in focus – The dilemma

Enhanced overall energy efficiency:

- a. Reduction of the thermal energy intensity towards BAT
- b. Fuel substitution
- c. Reduction of thermal electricity demand
- d. Excess heat recovery
- e. Renewable power generation

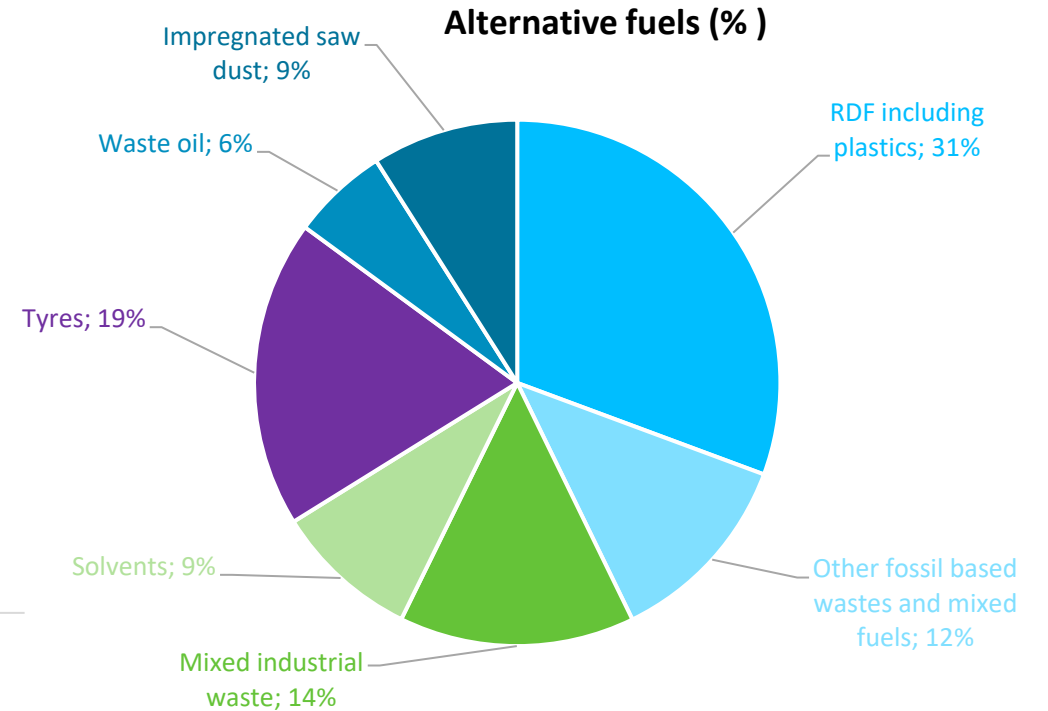
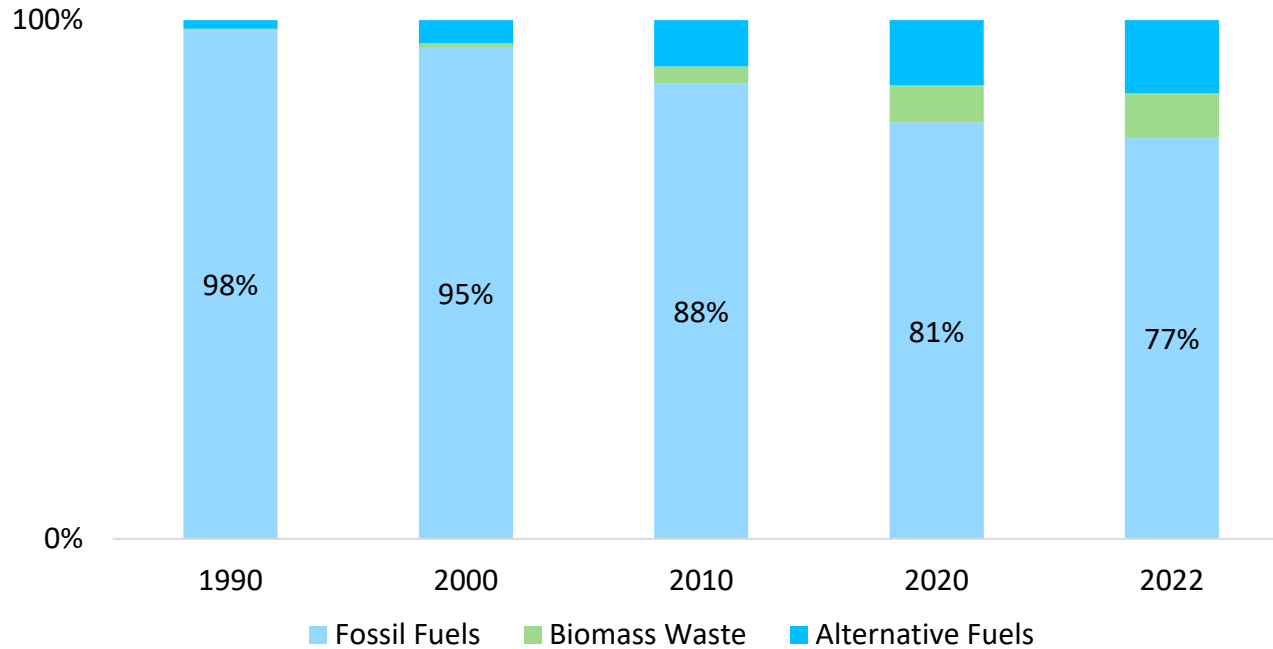


Energy efficiency improvements offset by additional energy requirements related to the use of other carbon mitigations levers;

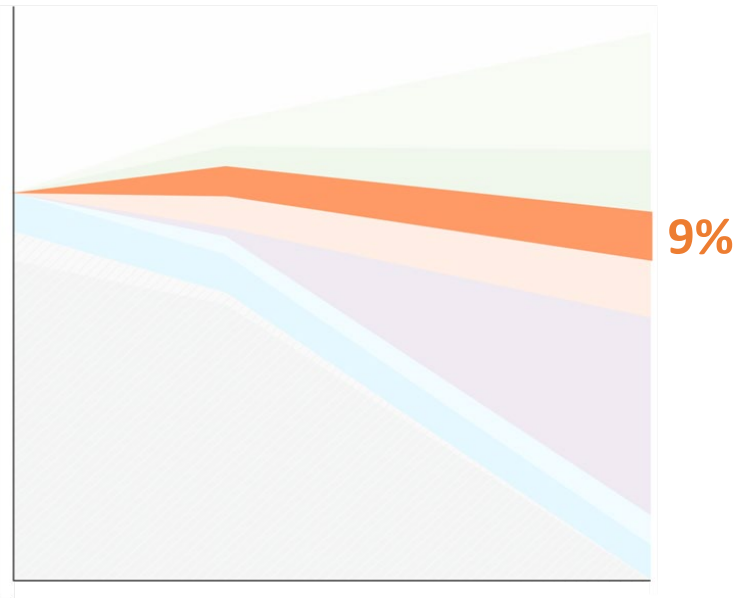
- a. A greater use of alternative fuels results in an increased specific thermal energy demand
- b. The reduction of the clinker to cement ratio also incur an additional energy demand
- c. The integration of carbon capture equipment in cement plants leads to additional electricity demand and thermal energy use...
- d. Environmental regulations to lower dust and emissions of NO_x and SO_2 could also lead to higher cement specific electricity demand levels

Fossil Fuel Substitution and % distribution of alternative fuels

% Fossil fuel substitution – 25AaGFC



Savings in cement and binders



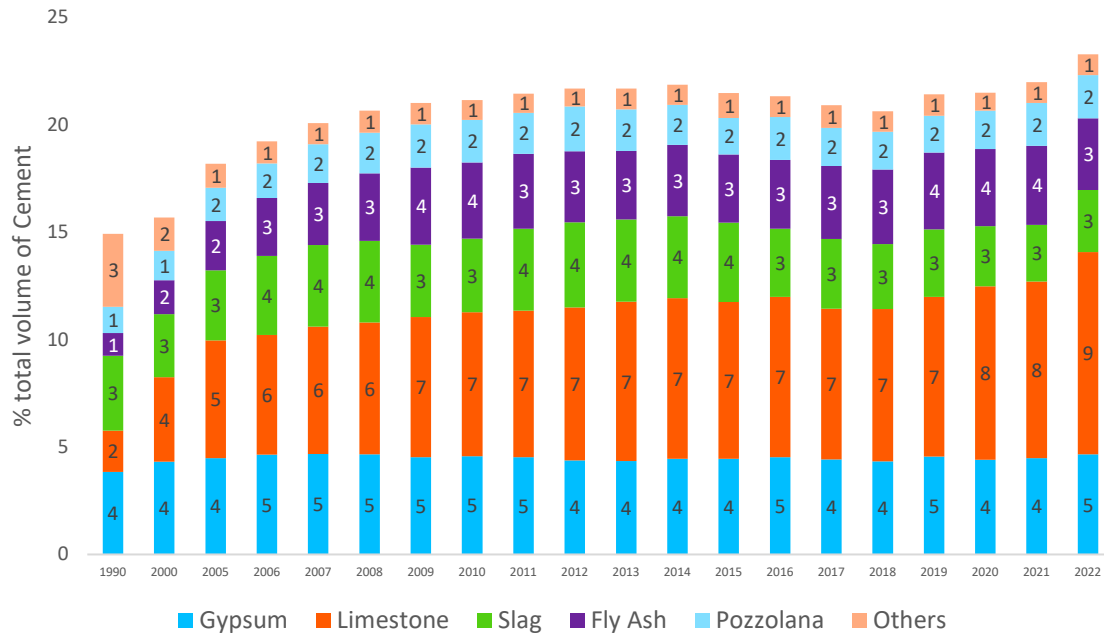
Key measures:

- At the cement plant or the concrete plant, fly ash, ggbs, ground limestone and other materials can be added to deliver concretes with reduced CO₂ emissions
- Availability of suitable materials around the world varies now, and will into the future
- In coming decades there will be increased use of ground limestone and the introduction of calcined clays to both compensate for reduced supply of fly ash and ggbs, and further reduce the clinker binder ratio. Calcined clays rely on clay deposits that are geographically spread and sufficiently abundant to meet projected demand.
- On average globally, the clinker binder factor is currently 0.63. It is projected to reduce to 0.58 and 0.52 by 2030 and 2050 respectively.

Challenges to further advance clinker substitution

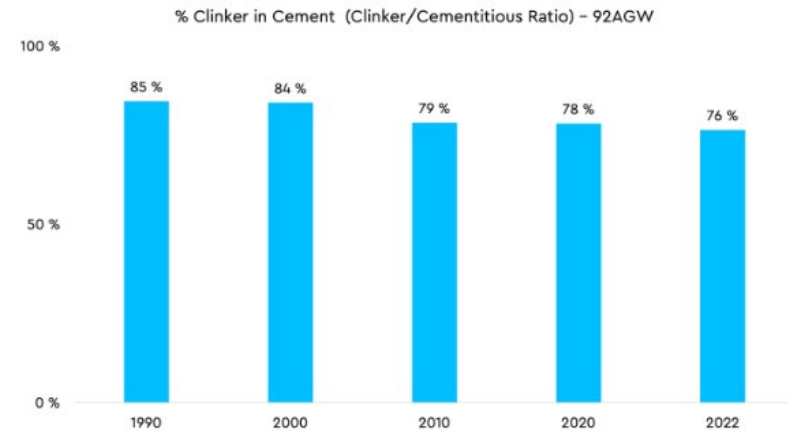
Whilst availability of materials can be a limitation on clinker binder ratio, client acceptance is a current barrier in fully exploiting this lever in some developed and emerging economies.

Mineral Component used to produce Cement - Weighted Average (12AG)



Challenges ahead

- Clinker substitute availability
- Product development
- Test methods development
- CAPEX
- Market acceptance
- Standards (building codes and products)



Industry tracker increases transparency and visibility of industry efforts in developing calcined clays production

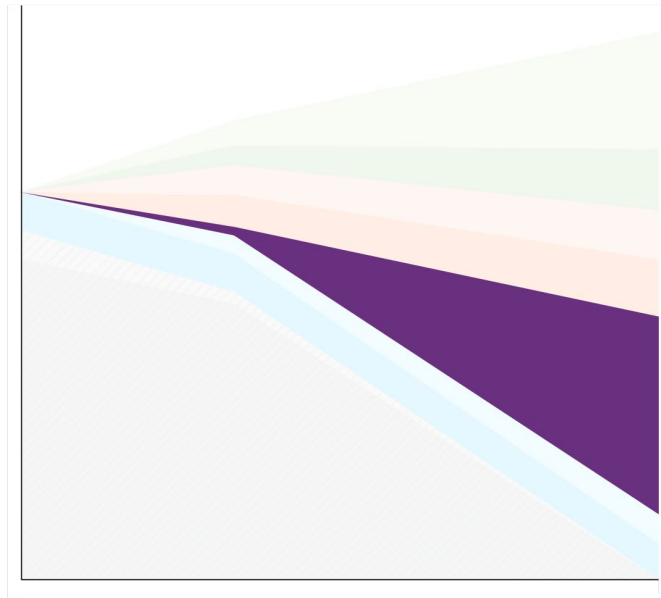


- Calcined clay is potentially amongst the most abundant SCMs around the world, as slag and fly ash will fade away
- Blends of Portland cement with metakaolin are fairly widely tested and accepted in standards around the world, including in Europe and North America. Further standards are being discussed after new European standard was released .
- Metakaolin is much more reactive than other pozzolans helping to accelerate the reactions that harden concrete. This improves the early strengths of concrete.
- The need to activate metakaolin through heating the raw material to relatively high temperatures make the production of metakaolin a more costly exercise than other supplementary cementitious materials (SCMs)

The Green Cement Technology Tracker is developed jointly by the Global Cement & Concrete Association (GCCA) and the Leadership Group for Industry Transition (LeadIT) in collaboration with the UN Climate Change High-Level Champions.



Carbon capture utilisation and storage



**1370 Mt
by 2050**

2030 MILESTONE: CARBON CAPTURE PROGRESS

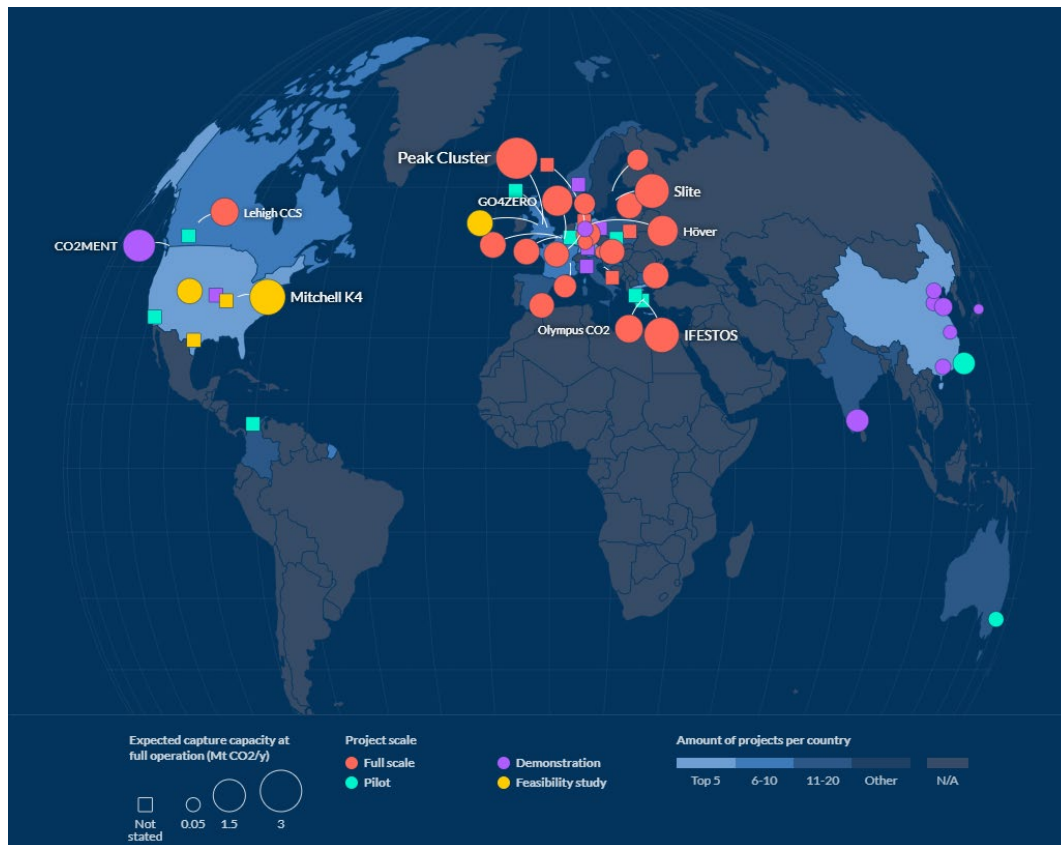
Carbon capture technology is applied at industrial scale in

10 plants

to contribute to delivering net zero concrete

Number of CCUS projects in Cement industry has surged in the last 3 years

New industry tracker will increase transparency and visibility of industry efforts in developing carbon capture projects

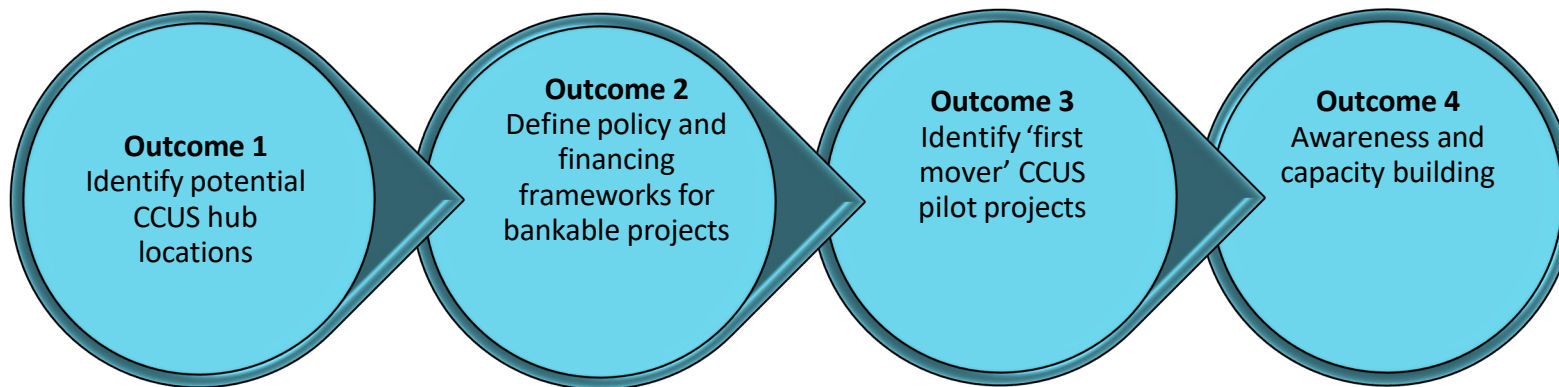


<https://www.industrytransition.org/green-cement-technology-tracker/>

58 CCUS projects announced & underway around the world of which 30 industrial scale [~ 25 Mt]

+ 42 projects in pipeline of which 29 full scale [~ 26 Mt]

Study outcomes



Study activities

- | | | | |
|--|---|--|---|
| <ul style="list-style-type: none"> • A general overview of the role of CCUS for cement decarbonisation • Deep-dive into potential cement-CCUS hubs in India • Create buy in of industry leaders and regulator • Determine economic value of potential hubs | <ul style="list-style-type: none"> • Assess existing regulatory context for CCUS in India • Perform gap analysis against existing frameworks in other jurisdictions • Develop appropriate business models for cement/CCUS hubs • Identify funding opportunities | <ul style="list-style-type: none"> • Identify 2-3 potential leading projects from pipeline • Perform high-level capture technology review • Perform conceptual design studies • Support feasibility studies for first mover projects • Produce development plans where feasible | <ul style="list-style-type: none"> • Raise awareness throughout cement sector and build capacity on role of CCUS to decarbonise cement • Report out at CEM-15 in Brazil • Potential next country to work on – Brazil |
|--|---|--|---|



GCCA runs 3 World Class Innovation platforms

Driving Innovation:

Innovandi is the GCCA innovation arm, which runs 3 world class innovation platforms to accelerate and foster innovation to help the industry decarbonise and produce carbon neutral concrete by 2050.

Collaboration with the academic world / universities

80

PhDs working on essential Innovation matters

+10m

In million the equivalent cost of direct PhDs research members have access to.

74+15

Partner and Core innovation projects

INNOVANDI
Global Cement & Concrete Research Network



450+

Scientists connected

Collaboration with startups

70

Start-ups from around the world have applied to our 2023 Innovandi Open Challenge

INNOVANDI
Open Challenge

£6.8m

Paid Media equivalent for our Open Innovation Campaign

INNOVANDI
Entrepreneur Network

6

Selected Start-ups presenting at Demo Day

INNOVANDI Global Research Network - GCCRN

Bringing the worlds of global industry and academia together to drive and support innovation in the cement and concrete sector through essential actionable pre-competitive research focused on the needs of the industry



Leveraging the collective skills and resources of our worldwide network.



benefit from work funded in academia by other sources

Projects are aligned with the Innovandi Research Roadmap created by Industrial Partners.



Strong presence in the most important conferences in the cement, concrete, and construction sector



the network connects

450+
scientists

in the field of cement and concrete

value of its research is worth

10 Million
€/year
(80 PhDs)

directly funds around

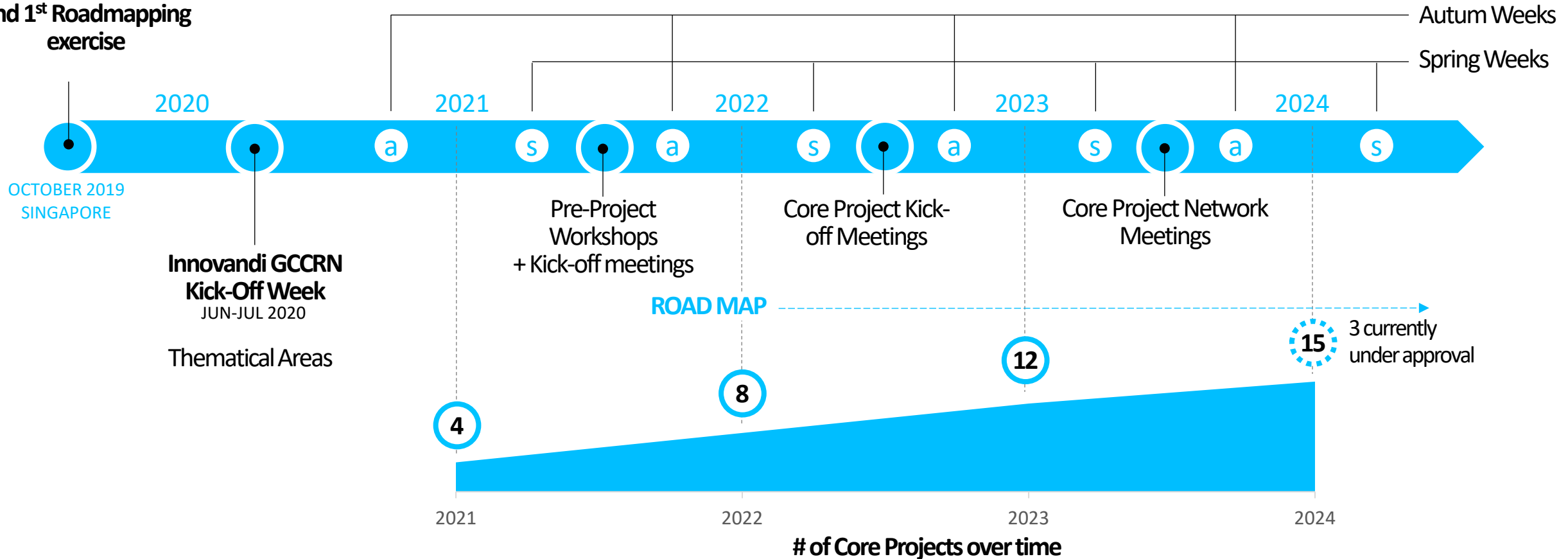
1.2 Million
€/year

in research solely focused on reducing the CO₂ footprint of concrete

Advancing Knowledge to Address Industry Decarbonization

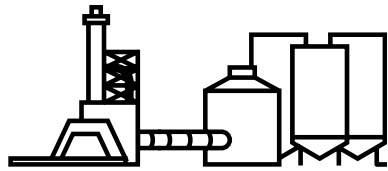
Innovandi GCCRN
launch announcement
and 1st Roadmapping
exercise

ANNUAL MEETINGS



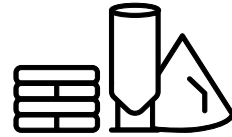
Ongoing Innovandi GCCRN Core projects

Clinker Production



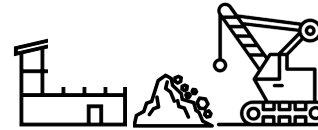
- **Artificial Intelligence**-driven Acceleration of Cement Manufacturing
- Cooling rates in the presence of minor
- Use of **electric energy** for cement production
- Early age properties at **low clinker factor**
- Grinding Aids on clinker **Reactivity and Strength**

Cement and Binders including Calcined Clays



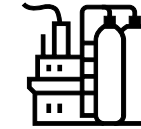
- Time lapse into the rheology of **OPC-LS blends**
- Early development of pore solution and structure
- Clay particle structure and surface charge
- Physico-chemical properties of **calcined clay** to performance of LC3

Recycling / Recarbonation



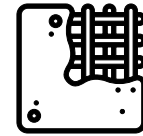
- LCCA/LCA for methods of **recycling concrete**
- Production and usage of **carbonated** or uncarbonated RC Fines

CCUS (Carbon Capture Utilization and Storage)



- Post-combustion **electrochemical CO2 capture** with pillared clays in PSA processes
- Carbonated **Microstructure** via **CO2 Utilization**

Durability



- **Carbonation** and **corrosion**
- Durability **performance** of **low CO2 concrete** and systems

INNOVANDI OPEN CHALLENGE – A UNIQUE ACCELERATOR where most exciting start-ups partner directly with GCCA members

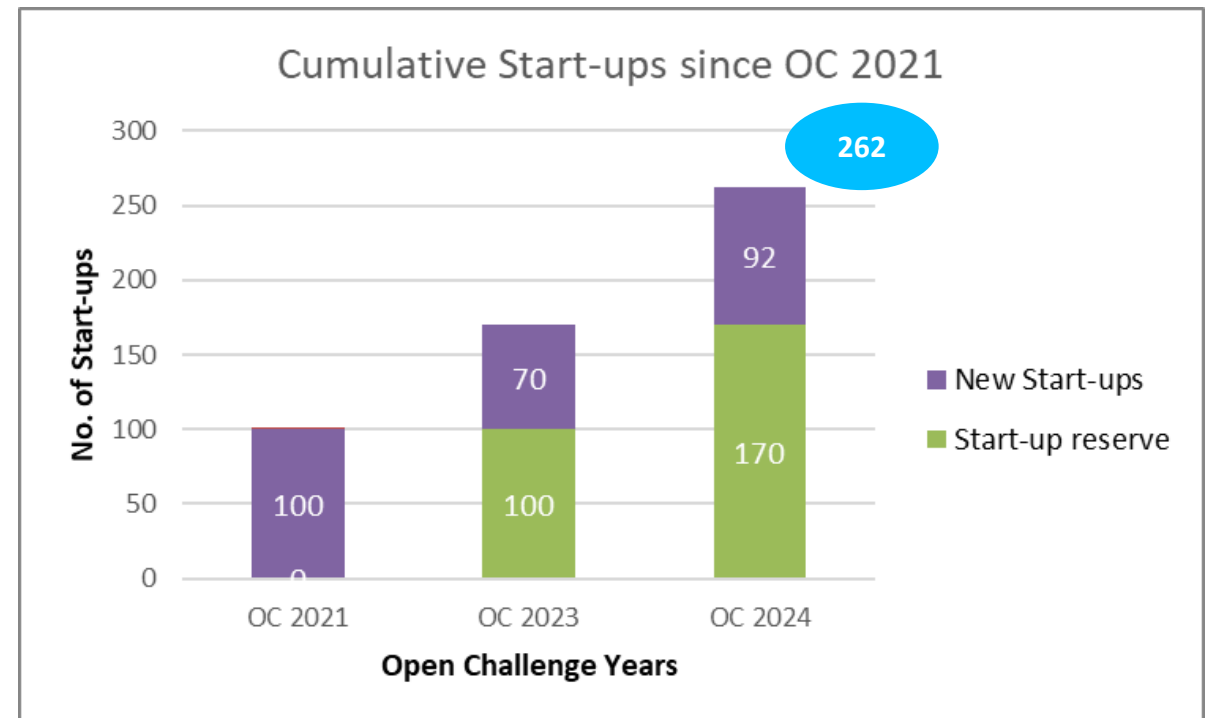
- First of its kind industry-led accelerator
- World class expertise from the cement and concrete industry
- Fine tuning of technologies as per industry needs and challenges
- Acceleration of technologies from lower TRL's & scale-up
- Direct start-ups funding
- Start-ups will gain unique access to:
 - Plants, labs and research facilities
 - Expertise and infrastructure of 40 members across the world
 - Support to move from ideas to prototype, pilot-tests, proofs of concepts, business cases



Image from Innovandi Open Challenge 2022 Demo Day at VdZ Dusseldorf, Germany

INNOVANDI OPEN CHALLENGE – How far have we come?

- Members have evaluated **250*** innovations (start-ups) since 2021
- Evolving every year with **sourcing high-quality start-ups globally**
 - Top sourcing from USA, UK and India
 - Start-ups from Europe, China, Africa, LatAm, Canada, Asia
- 60+ cement and concrete experts as mentors
- Open Challenge **GCCA members doubled** in the 2nd year
 - Most repeat members since 2021 challenge
 - Adding new members to the program every year
- **57% startups with TRL 4-7 range**, need for support for acceleration
- **GCCA Members per consortium increased** from **3** per start-up to **9** members per start-up
- Consortiums types – material testing, feasibility and pilot plant



* Considering 5% repeat start-ups every year

INNOVANDI OPEN CHALLENGE – Overview

Challenge themes are dealing with deep tech innovations requiring substantial investment for implementation and with an impact at scale on climate change

1st Open Challenge, 2021-2022

- Examined CCUS innovations
- Over 100 startups were sourced 20 were invited to pitch and **6 made it to consortia** with GCCA members

2nd Open Challenge, 2023-2024

- 2023 Challenge focusses on new materials/ingredients for low carbon concrete
- Over 70 start-ups were sourced 15 were invited to pitch and **4 made it to consortia** with GCCA members
- Demo Day scheduled on Thursday, 6 June 2024, Bangkok

3rd Open Challenge, 2024-2025

- Continued efforts for CCUS
- Announced 20 February 2024
- 29 start-ups Shortlisted
- Pitch Days – 22 and 23 May 2024

1st OPEN CHALLENGE – Carbon Capture and Use

1st Open Challenge, 2021-2022

- focused on **Carbon Capture Use and Storage**
- **Over 100 start-ups were sourced, 22 were invited** to pitch, **6 consortium formed**, and Demo Day took place in October 2022, but 4 consortium are still active
- CarbonOro
 - **Feasibility study** for cement flue gas
- Carbon Upcycling, Fortera and Coomtech
 - **Material testing** database
- Nuada and Carbon BioCapture
 - **On-going pilot commissioning**

CarbonOro



Carbon
Upcycling
Technologies

Nuada
Capturing the future

CARBON
BIOCAPTURE

FORTERA
Sustainable Materials Inspired By Nature

2nd OPEN CHALLENGE – New Materials/ingredients for low carbon concrete

- 2023 Challenge focusses on new materials/ingredients for low carbon concrete
- Over 70 start-ups were sourced 15 were invited to pitch and **4 made it to consortia** with GCCA members
- Envicore
 - Technical feasibility of the technology
- Queens Carbon
 - Technical feasibility of the technology
- Chement
 - Technical feasibility of the technology
- NeoCrete
 - Technical feasibility of the technology
- Demo Day scheduled on Thursday, 6 June 2024, Bangkok



3rd OPEN CHALLENGE – Carbon Capture, Use and Storage Innovations

3rd Open Challenge, 2024-2025

- 2024 Challenge continues efforts in CCUS
- Over 92 start-ups were sourced 29 were invited to pitch on 22 May and 23 May 2024
- Follow-up discussions held on August / September 2024
- Consortium formation stage

Other start-ups include:

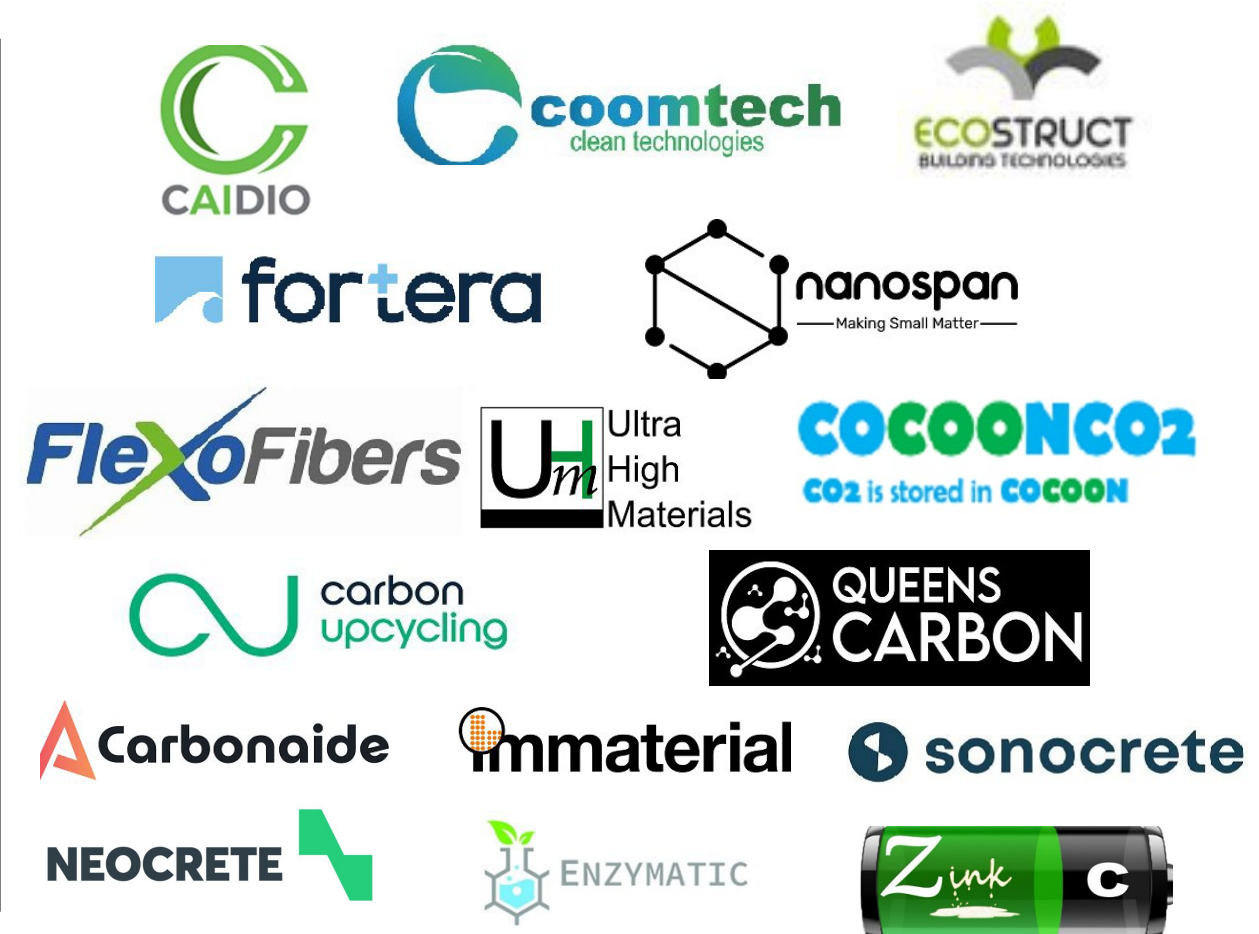
- *Leaf-Tech Ltd., UK*
- *HC to Green, The Netherlands*
- *TorbCap, UK*
- *CR2A, China*
- *National Institute of Technology, Calicut, India*
- *Carbon Capture & Storage (CCS) Limited, Hong Kong*



INNOVANDI ENTREPRENEUR NETWORK – MENTORSHIP AND NETWORKING PROGRAM

Benefits of entrepreneur network

- Building an ecosystem of startups interested in collaborating to support our shared net zero mission.
- Access to our mentorship webinar programme for startups via 4 webinars/workshops per year
- First-hand information on our Innovandi Open Challenge
- Networking with GCCA members and peers



GCCA Concrete Future Pavilion Launch - Action & Progress Report Launch & Reception

Wednesday 13 November 2024

16:30 – 18:00



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Thank you



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