



Global Cement and Concrete
Association

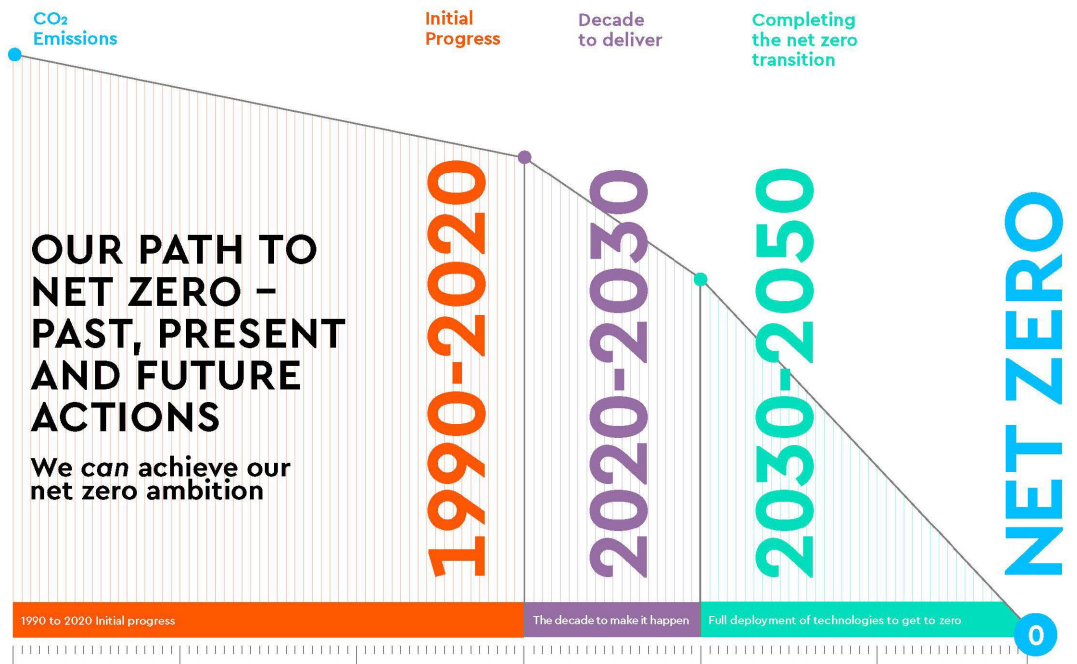
CONCRETE FUTURE

CCUS – Enabling a net zero future

Claude LOREA
GCCA
FICEM, Guatemala, May 2024

GCCA 2050 ROADMAP

Our path to net zero – past, present and future actions



Savings in clinker production

- thermal efficiency
- savings from waste fuels ("alternative fuels")
- use of decarbonated raw materials
- use of hydrogen as a fuel

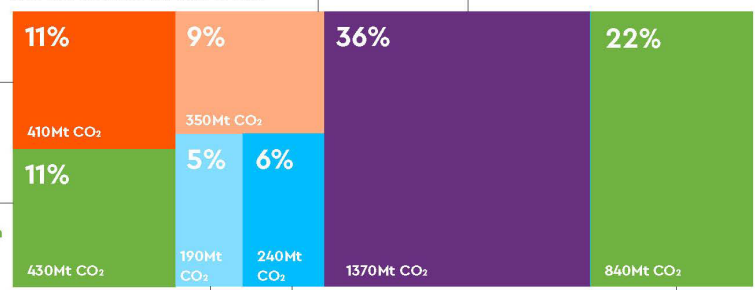
Savings in cement and binders

- Portland clinker cement substitution. Also expressed through clinker binder ratio
- alternatives to Portland clinker cements

Carbon capture and utilisation/storage

- carbon capture at cement plants

PERCENTAGE CONTRIBUTION TO NET ZERO AND CO₂ EMISSION SAVINGS IN 2050



Efficiency in concrete production

- optimised mix design
- optimisation of constituents
- continue to industrialise manufacturing
- quality control

Decarbonisation of electricity

- decarbonisation of electricity used at both cement plants and in concrete production

CO₂ sink recarbonation

- natural uptake of CO₂ in concrete – a carbon sink

Efficiency in design and construction

- client brief to designers to enable optimisation
- design optimisation
- construction site efficiencies
- re-use and lifetime extension

2020 TO 2030 - THE DECADE TO MAKE IT HAPPEN

2030 CO₂ REDUCTION MILESTONES:

(Compared with 2020 Baseline)

Concrete

25%

CO₂ reduction per m³ of concrete by 2030

Cement

20%

CO₂ reduction per tonne of cement by 2030

2030 MILESTONE: CARBON CAPTURE PROGRESS

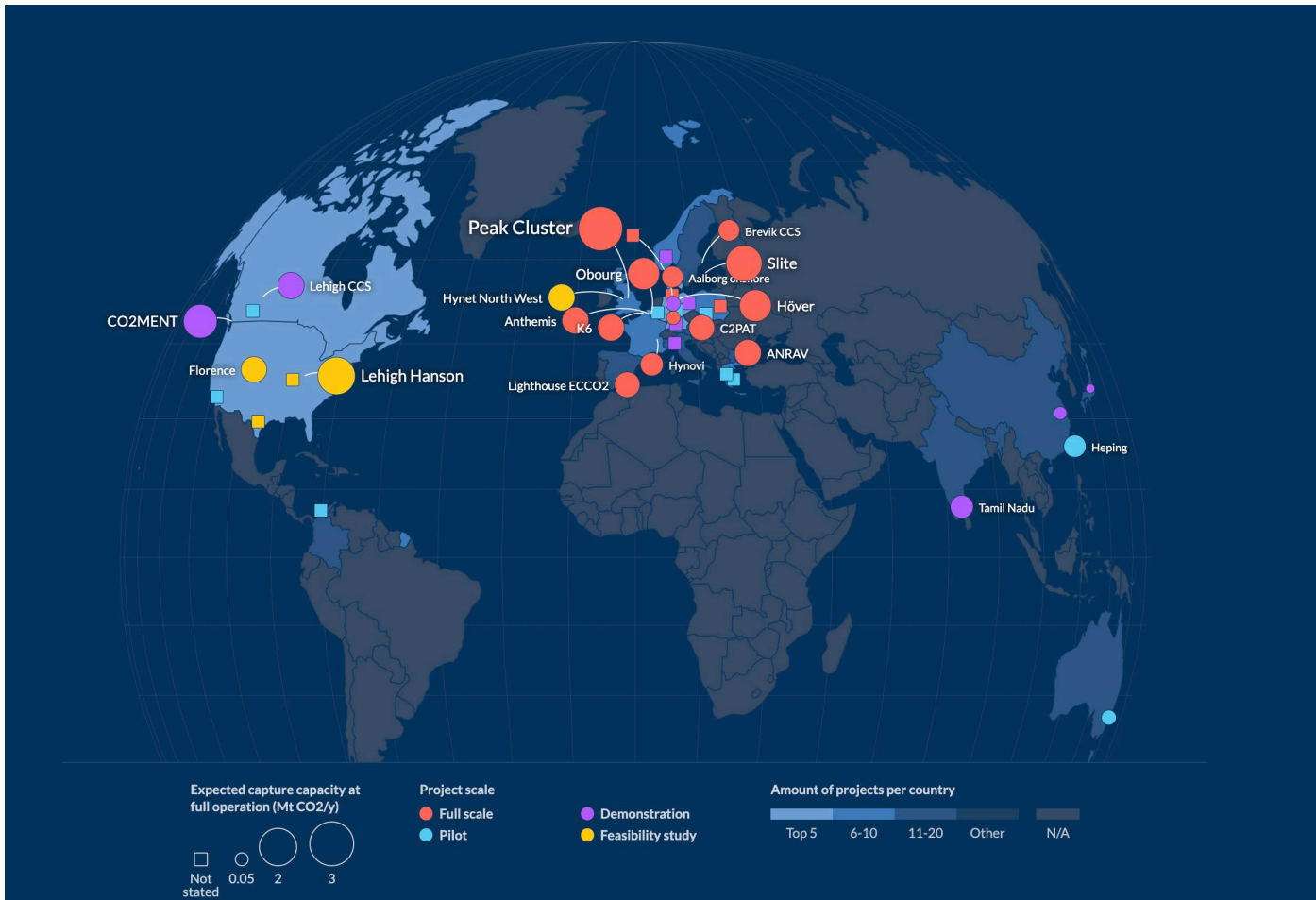
Carbon capture technology is applied at industrial scale in

10 plants

to contribute to delivering net zero concrete

Launch of Cement CCUS industry tracker with Lead IT


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



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

50+ CCUS projects
announced & underway
around the world

+ 100 projects in pipeline



CCUS – GCCA 2024 activities

CCUS: A KEY STRATEGIC AREA OF COOPERATION FOR THE GCCA MEMBERS

GCCA CCUS Collaboration Platform
CCUS Task Force and collaboration with



INTERNATIONAL
CCS KNOWLEDGE
CENTRE



GCCA is involved into very important Work Program to help mature and deploy the CCUS technologies

Advocacy

- GCCA CCUS policy paper
- CEM CCUS collaboration
- Other collaboration: GCCSI, OGCI, IEA GHG, UNIDO

Innovation

- Innovandi GCCRN and Innovandi Open Challenge
- Further collaboration on high TRL under the same model as the open challenge
- Financing new projects

Knowledge building

GCCA CCUS Guide/ Handbook :

- Good practices sharing
- Members capacity building
- Collaboration with CCS Knowledge Centre

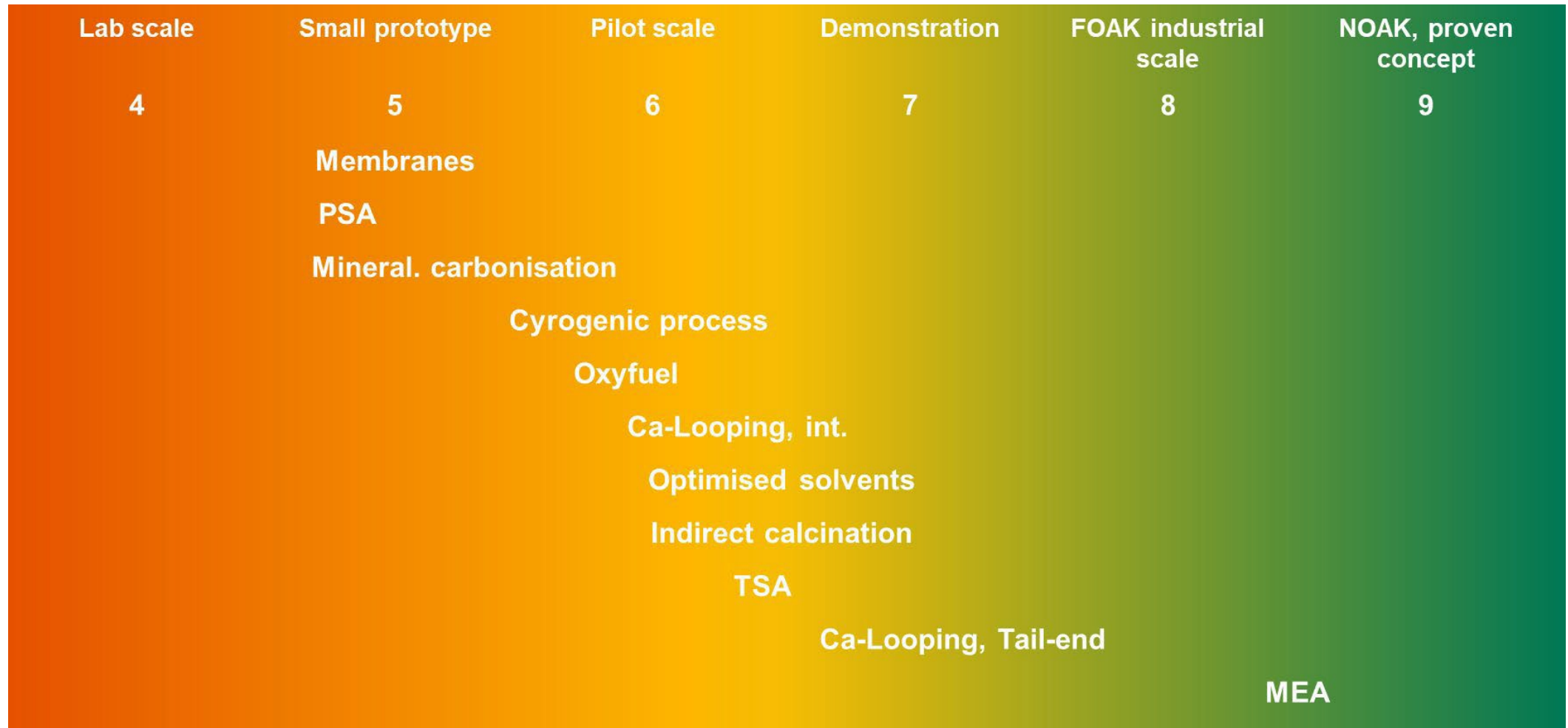
Support for national initiatives

- e.g., Nigeria, India, Brazil, Thailand...

A photograph of a modern building with a curved, metallic facade. The building features multiple levels of curved balconies or walkways, creating a sense of depth and movement. The facade is made of dark, reflective panels. A large, curved glass section is visible in the lower part of the image, reflecting the sky and surrounding environment. The sky is a clear, light blue. The overall aesthetic is futuristic and innovative.

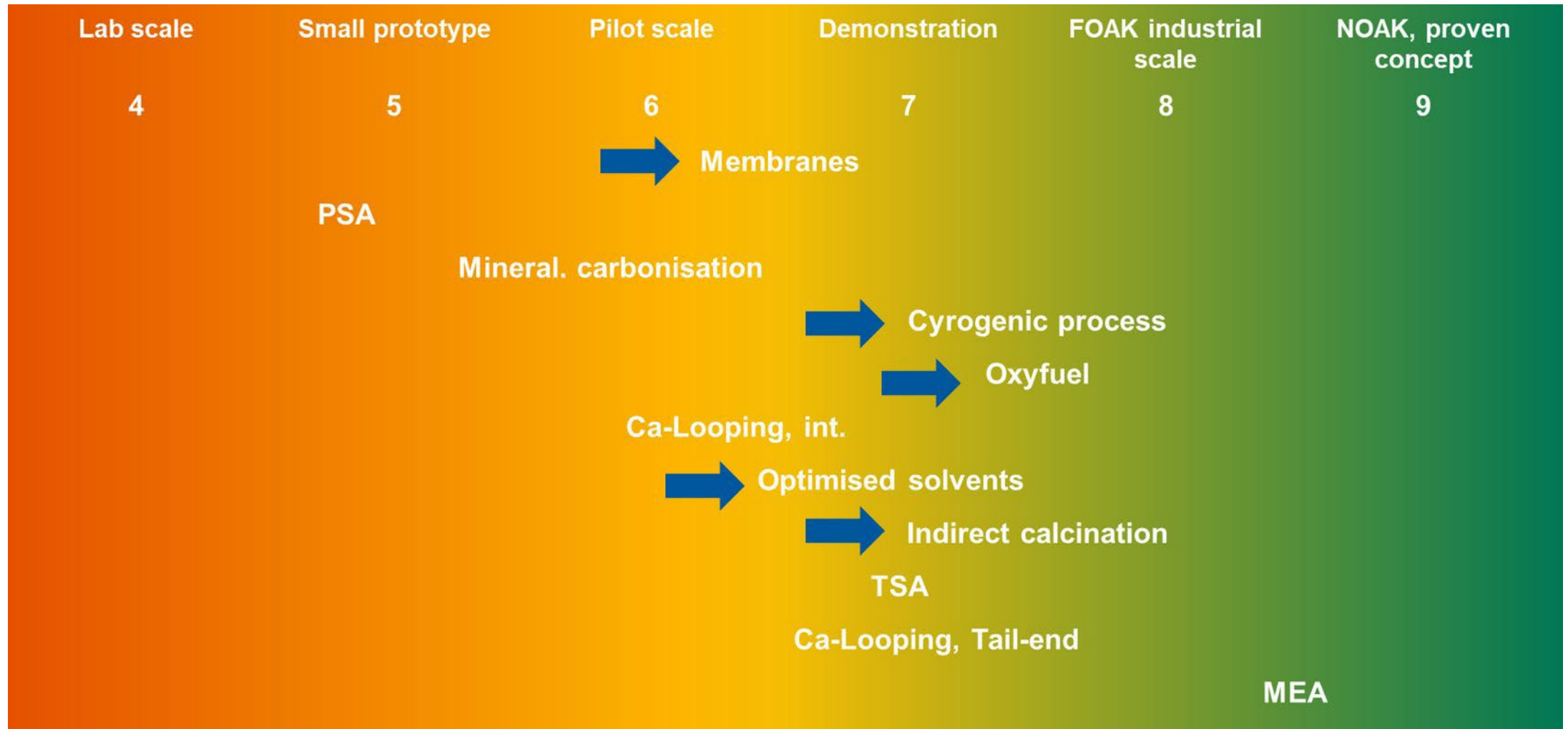
Innovation

In cement & concrete sector investment in CCUS projects will enable rapid advancement of technology maturity – 2022 TRL level



Source: ECRA technology papers - <https://ecra-online.org/research/technology-papers/>

In cement & concrete sector investment in CCUS projects will enable rapid advancement of technology maturity – Expected 2027 TRL level



Source: ECRA technology papers - <https://ecra-online.org/research/technology-papers/>

OVERVIEW Projects related to CCUS



Post-combustion electrochemical CO₂ capture (ECC) for cement plants AND and carbon dioxide capture with pillared clays in PSA processes

Conventional post-combustion solvent-based capture technologies require heat (typically 2.4-3.7 MJ/kgCO₂) for solvent regeneration. This is one of the main drawbacks in cement plants, due to the lack of sufficient waste heat available from the process.



CarbonOrO

CarbonOrO - carbon capture technology using unique bi-phasic amine with a lower cost of capture.

Nuada

Nuada (MOF Technologies) - carbon capture with Metal-Organic Frameworks (MOFs) using little or no solvents.

Carbon Upcycling Technologies

Carbon Upcycling Technologies - captures CO₂ within solid waste materials to produce SCMs.

FORTERA
Low CO₂ Cement Inspired By Nature

Fortera - captures CO₂ emissions from cement plants, combining it with calcium oxide to make reactive calcium carbonate.

CARBON BIOCAPTURE

Carbon BioCapture - captures CO₂ emissions from cement plants using microalgae and converts to biomass

3RD OPEN CHALLENGE 2024 - 29 SELECTED START-UPS

Row 1: **Ardent**, UniSieve, GREENCORE®, CARBONQUEST, CAPTIVATE TECHNOLOGY

Row 2: CTS CARBON TO STONE, CO₂/Split™, EXTERRA, OmnaGen, airbridge

Row 3: Cool Planet Technologies, Remedium A Remedy for Earth, Dotz, Greenovate Solutions Pvt. Ltd., Carbonaide

Row 4: Carbon America, AGC, [Lightning Bolt Icon], AJF, [Rocket Icon], concrete 4change, CARBON LIMIT, ASCON GROUP

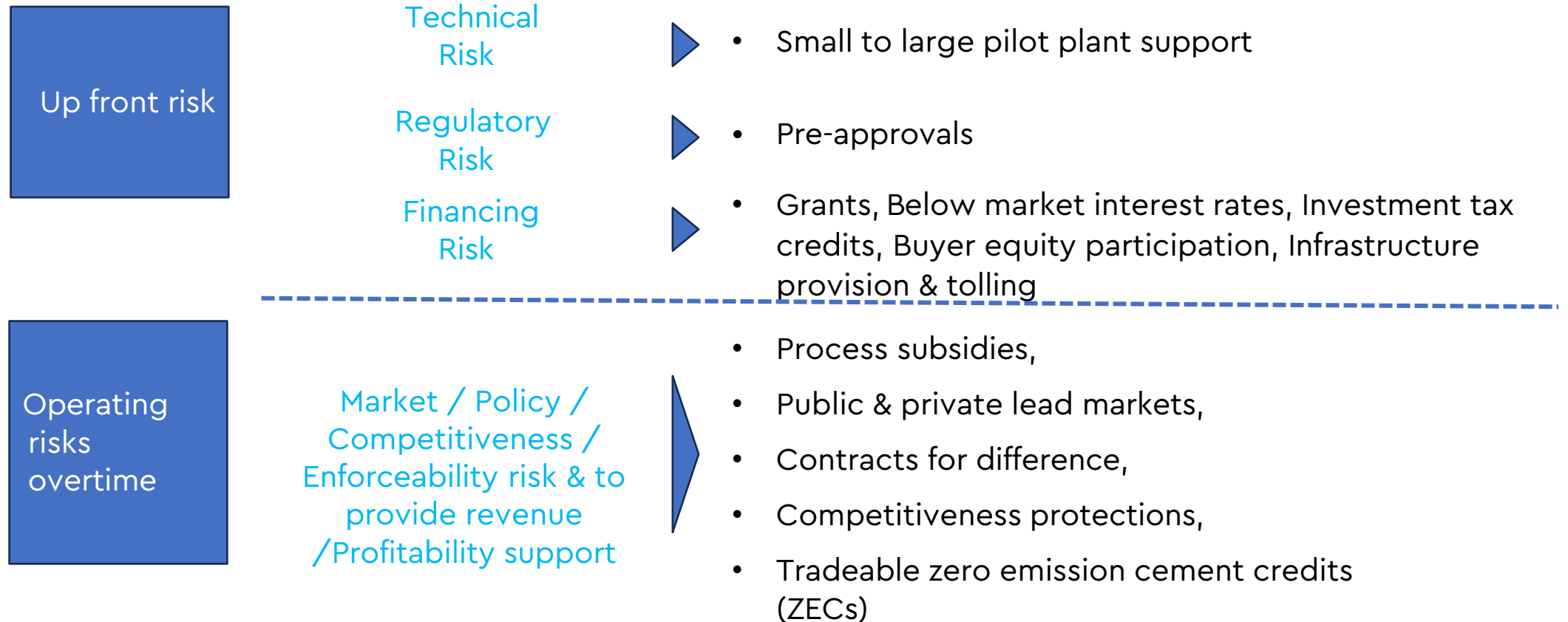
- Other start-ups include:
- Leaf-Tech Ltd., UK
 - HC to Green, The Netherlands
 - TorbCap, UK
 - CR2A, China
 - National Institute of Technology, Calicut, India
 - Carbon Capture & Storage (CCS) Limited, Hong Kong



Advocacy

How to ensure competitiveness of "Near Zero Technologies" while carbon price remains below abatement cost ?

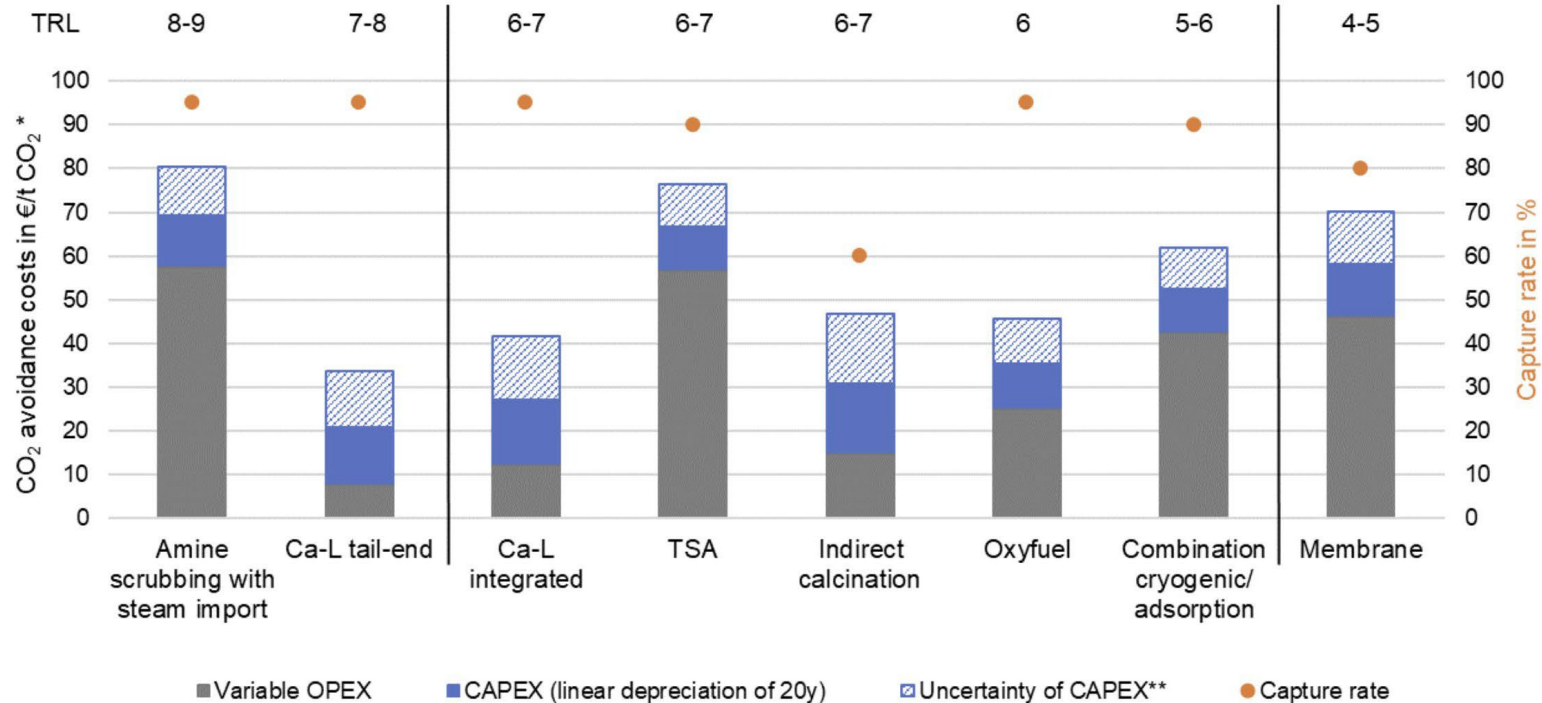
Possible mechanism to de-risk investment in carbon capture



Source: Prof. Chris Bataille – Columbia University Center for Global Energy Policy (CGEP) / Institut du Développement Durable et des Relations Internationales (IDDRI.org)

Carbon Capture technology cost still subject to evolve.

Early – state aid – investment program will result in new technology to emerge and cost to reduce



* Relative additional production costs, amine scrubbing = 100

** All assumptions been made are given in detail in the ECRA Technology Papers (2022)

Note: Costs for transport and storage are not included, they make up for 60 – 80 €/CO₂

How to ensure competitiveness of "Near Zero Technologies" while carbon price remains below abatement cost – including transport and storage ?

UNLOCKING A NET ZERO FUTURE – THE ROLE OF AND PUBLIC POLICY

A comprehensive policy framework will need to be developed to:

- make low-carbon cement manufacturing investable
- stimulate demand for near zero concrete products
- create the infrastructure needed for a circular and net zero manufacturing environment.

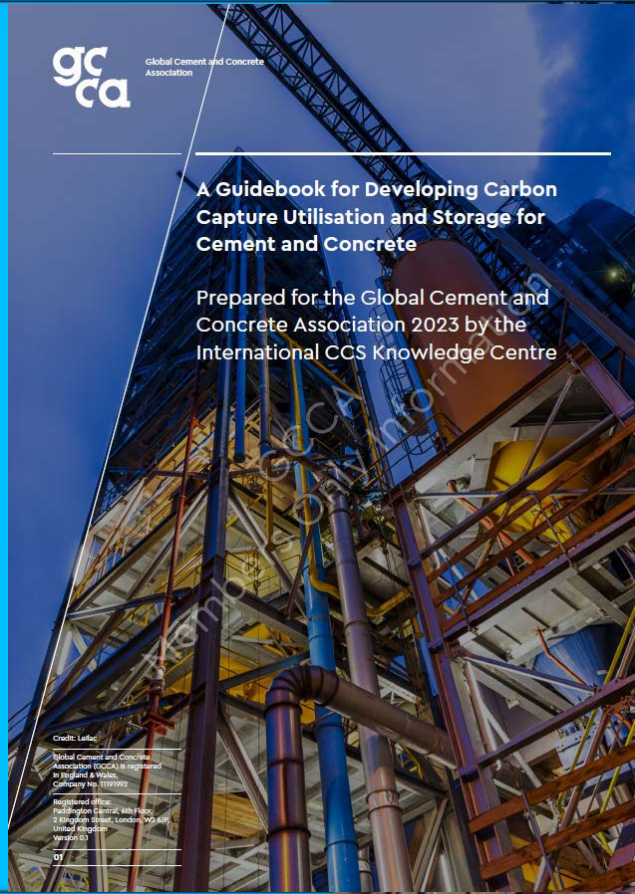
Key aspects of policy asks for CCUS

- Carbon pricing & carbon leakage
- Procurement & Demand signal
- Integrate CCUS in public financing mechanisms
- Support innovation
- CCUS infrastructure (transport and storage)
- Establish public-private partnerships to speed-up CCUS developments, including shared investment in CO₂ transport and storage networks.
- Renewable energy
- Support R&D including for new uses in other sectors of CO₂ captured by the cement industry.



Best Practices Sharing





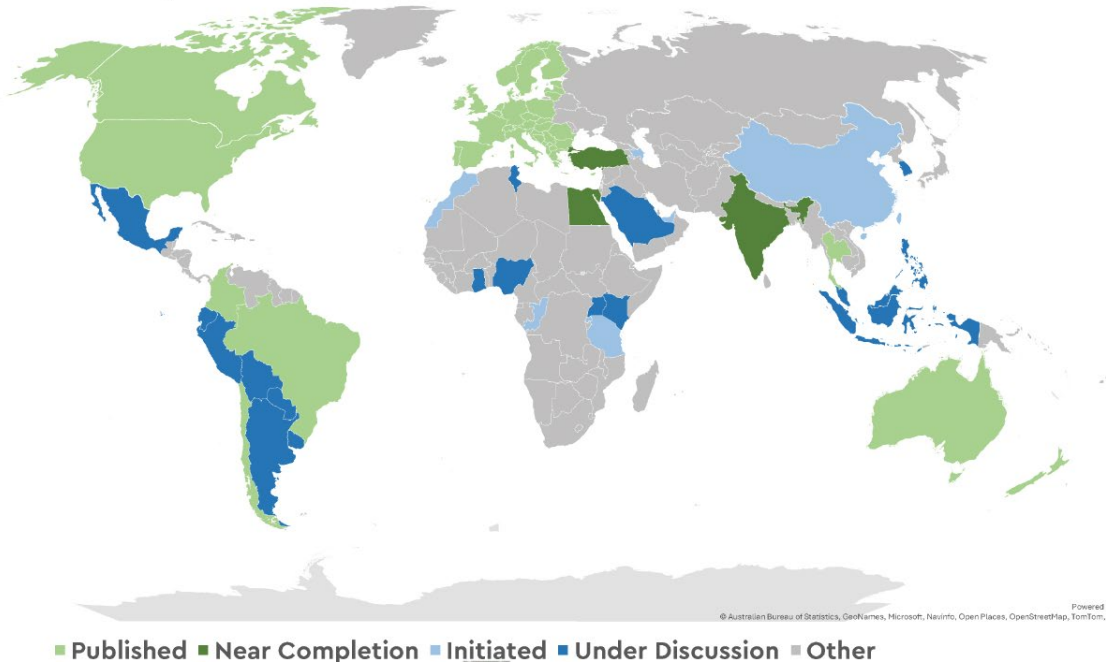
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Supporting national initiatives

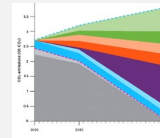


NET ZERO DELIVERY: NET ZERO ACCELERATOR WITH GOOD PROGRESS

Country Roadmaps - Net Zero Accelerator Initiative



KEY DELIVERABLES



Roadmap Levers and CO₂ impact
Per lever, quantification of potential CO₂ reduction 2030 & 2050



Policy
Per lever, identification of enabling policies



Lighthouse Projects
Per lever, identification of lighthouse projects

GCCA – GCCSI – CEM CCUS collaboration on decarbonisation of India's cement industry 2023-2024

Study outcomes

Outcome 1
Identify potential CCUS hub locations

Outcome 2
Define policy and financing frameworks for bankable projects

Outcome 3
Identify 'first mover' CCUS pilot projects

Outcome 4
Awareness and capacity building

Study activities

- 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

- 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

- 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

- 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 is a key enabler for CCUS deployment in cement

- **Pilot projects and demo** are picking up pace across the globe, but we only have one commercial scale project for cement [2030 milestone = 10 plants]
- It is critical to create the right framework conditions and infrastructure within this decade to ensure full deployment beyond 2030
- As of 2030 capture capacity of 1.3/1.5 Mt needs to be build every week. 250 to 400 projects needs to be in the pipeline in 2030

Technology works but we need to:

- Finance - De-risk
- Deploy technology
- Develop infrastructure for CO₂ transport and storage – including need for mapping
- Ensure supporting policies including public acceptance, liability and carbon accounting

