Global Cement and Concrete Association

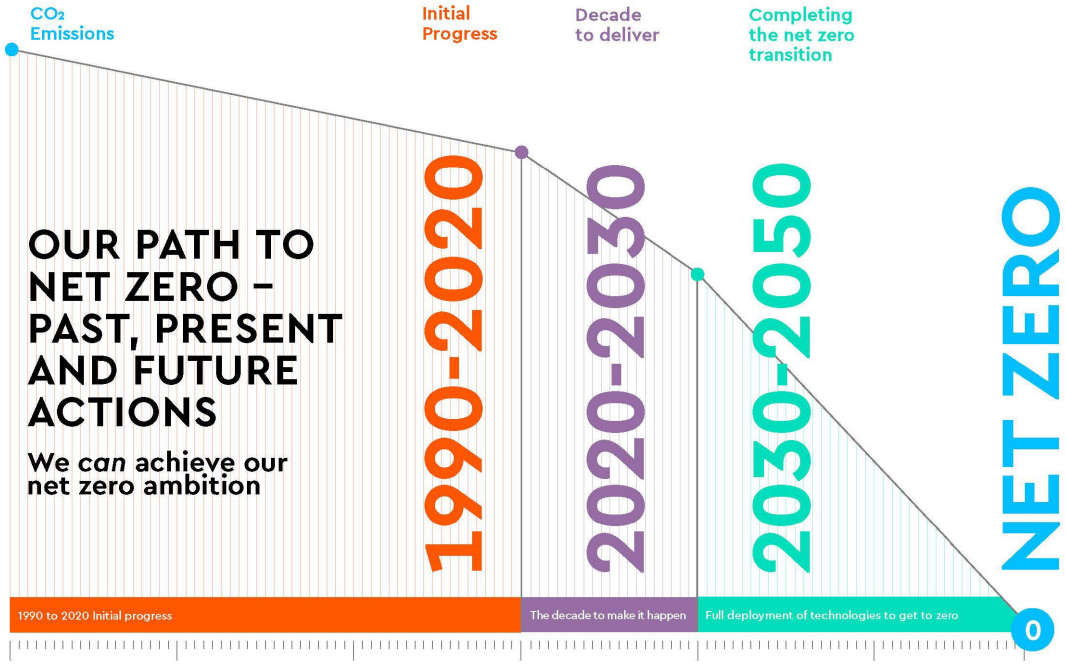
CONCRETE FUTURE

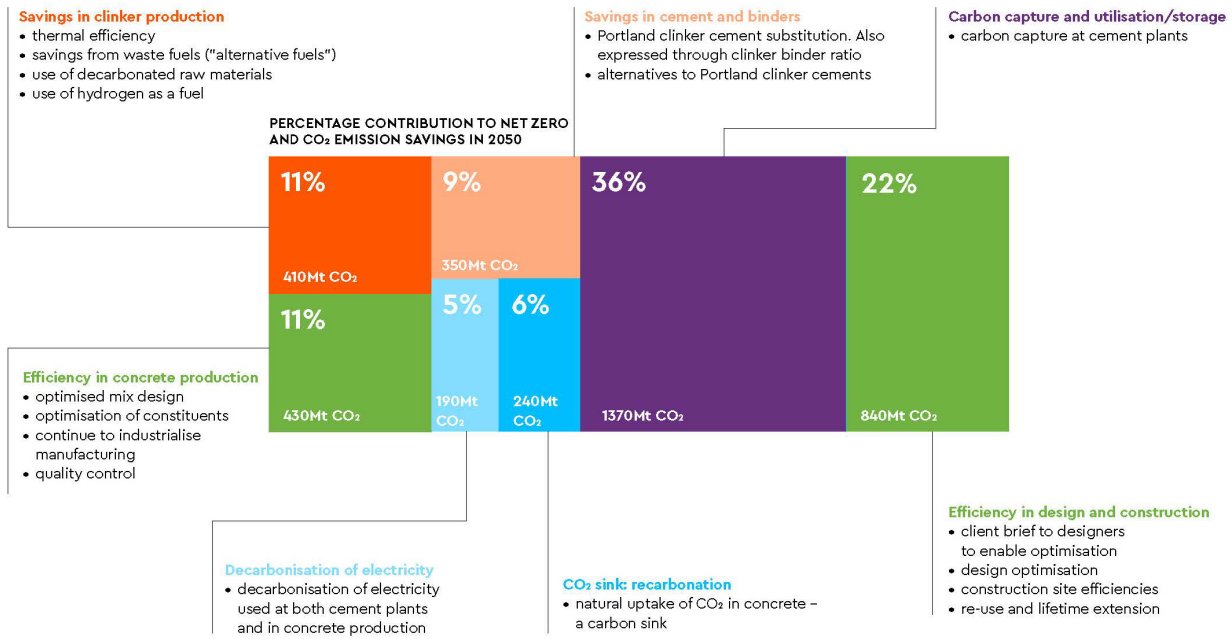
CCUS – Enabling a net zero future

Claude LOREA
GCCA
FICEM, Guatemala, May 2024

GCCA 2050 ROADMAP

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





2020 TO 2030 - THE DECADE TO MAKE IT HAPPEN

2030 CO_2 REDUCTION MILESTONES:

(Compared with 2020 Baseline)

Concrete

25%

CO_2 reduction per m^3 of concrete by 2030

Cement

20%

CO_2 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

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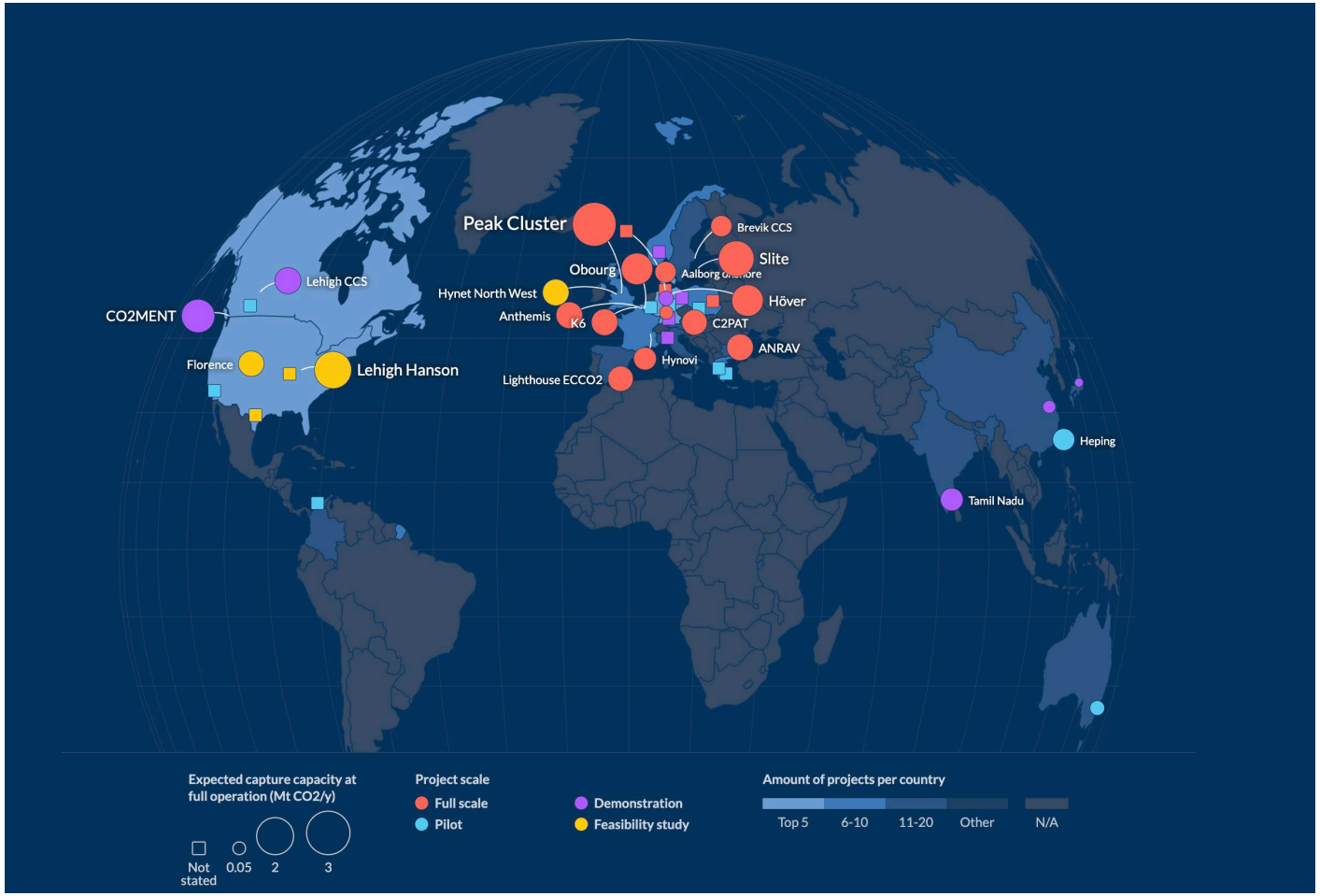
Launch of Cement CCUS industry tracker with Lead IT

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

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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

CARBON CAPTURE, UTILIZATION & STORAGE
ACCELERATING CCUS TOGETHER
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

OGCI
OIL AND GAS CLIMATE INITIATIVE

UNIDO
United Nations Industrial Development Organization

GLOBAL CCS INSTITUTE

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 :

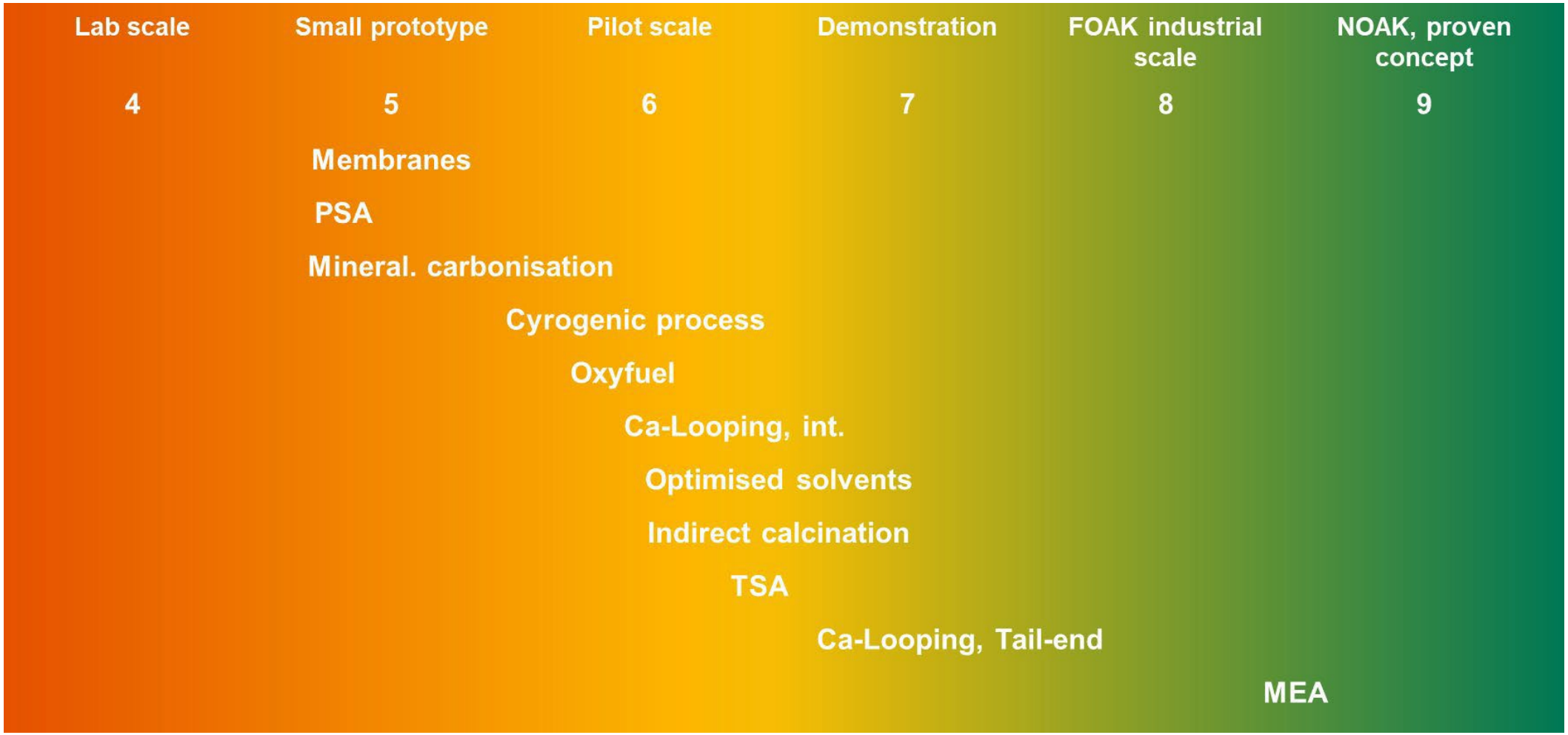
- Good practices sharing
- Members capacity building
- Collaboration with CCS Knowledge Centre

Support for national initiatives

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

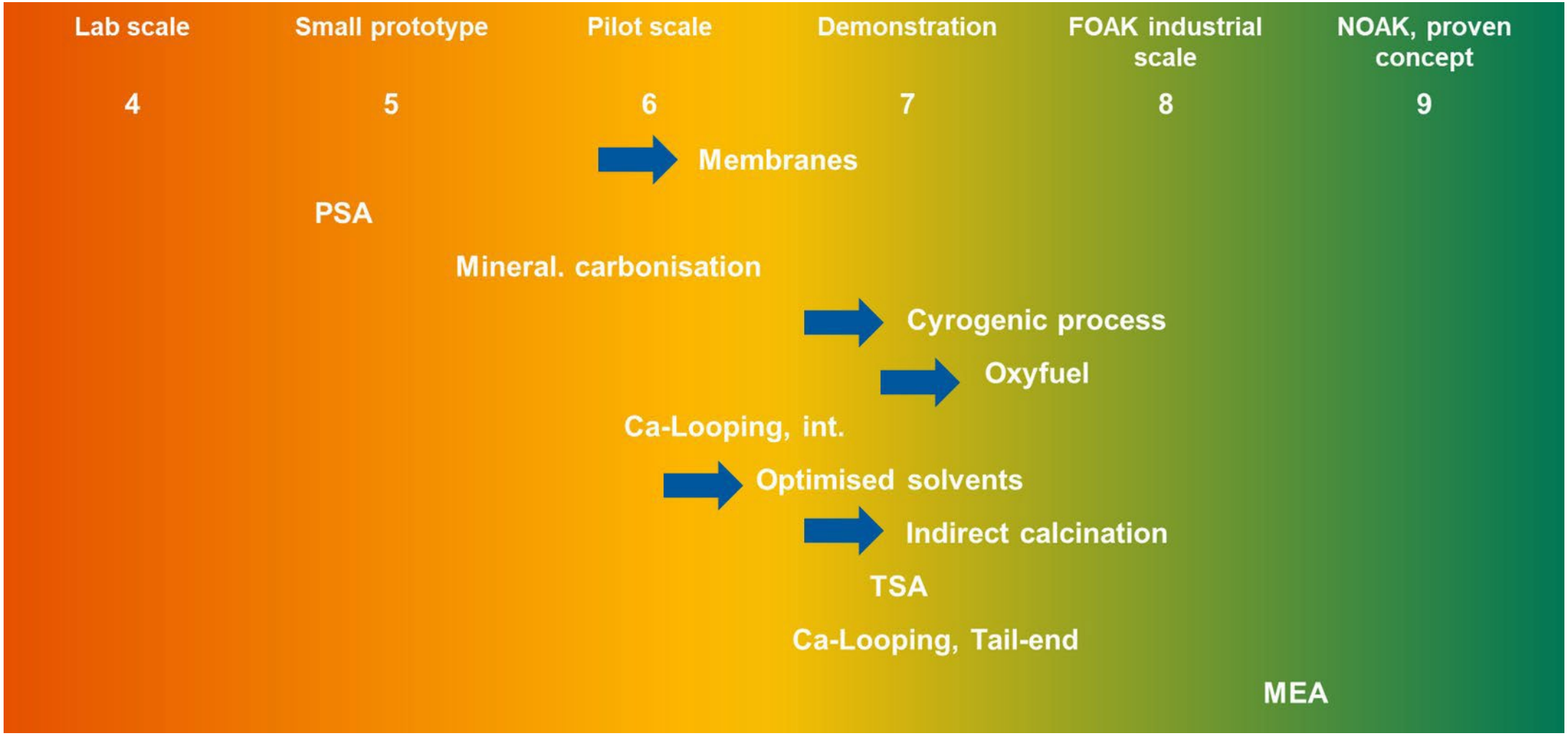
Innovation

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

INNOVANDI
Global Cement and Concrete Research Network

Post-combustion electrochemical CO_2 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/kgCO_2) 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.

INNOVANDI
Open Challenge

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

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

Carbon Upcycling Technologies - captures CO_2 within solid waste materials to produce SCMs.

Fortera - captures CO_2 emissions from cement plants, combining it with calcium oxide to make reactive calcium carbonate.

Carbon BioCapture - captures CO_2 emissions from cement plants using microalgae and converts to biomass

3RD OPEN CHALLENGE 2024 - 29 SELECTED START-UPS



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

Up front risk

- **Technical Risk**
  - Small to large pilot plant support
- **Regulatory Risk**
  - Pre-approvals
- **Financing Risk**
  - Grants, Below market interest rates, Investment tax credits, Buyer equity participation, Infrastructure provision & tolling

Operating risks overtime

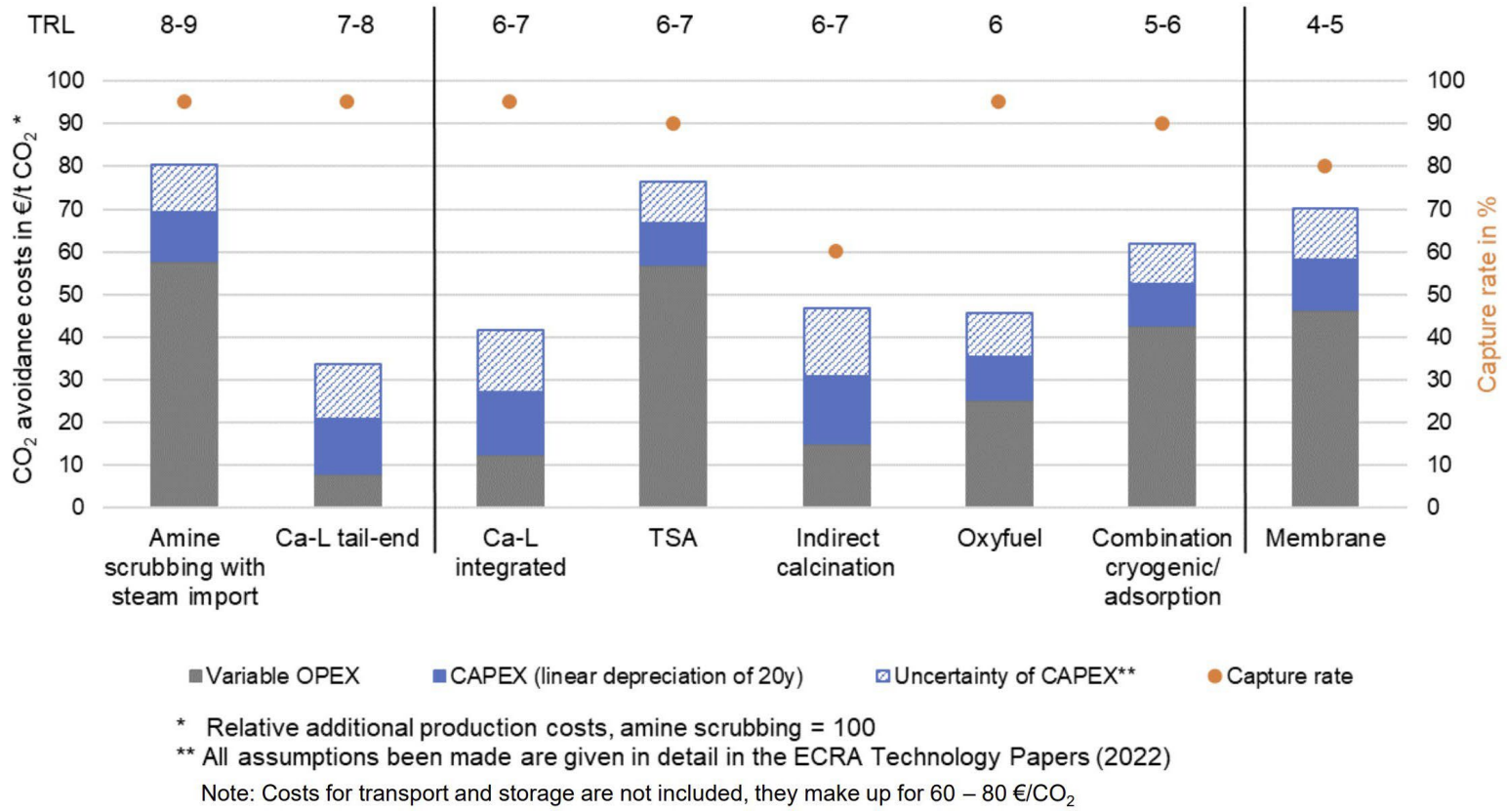
Market / Policy / Competitiveness / Enforceability risk & to provide revenue /Profitability support

- Process subsidies,
- Public & private lead markets,
- Contracts for difference,
- Competitiveness protections,
- Tradeable zero emission cement credits (ZECs)

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 €/CO_2

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

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

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 CO_2 transport and storage networks.
- Renewable energy
- Support R&D including for new uses in other sectors of CO_2 captured by the cement industry.

Best Practices Sharing

Global Cement and Concrete Association

CCUS Handbook

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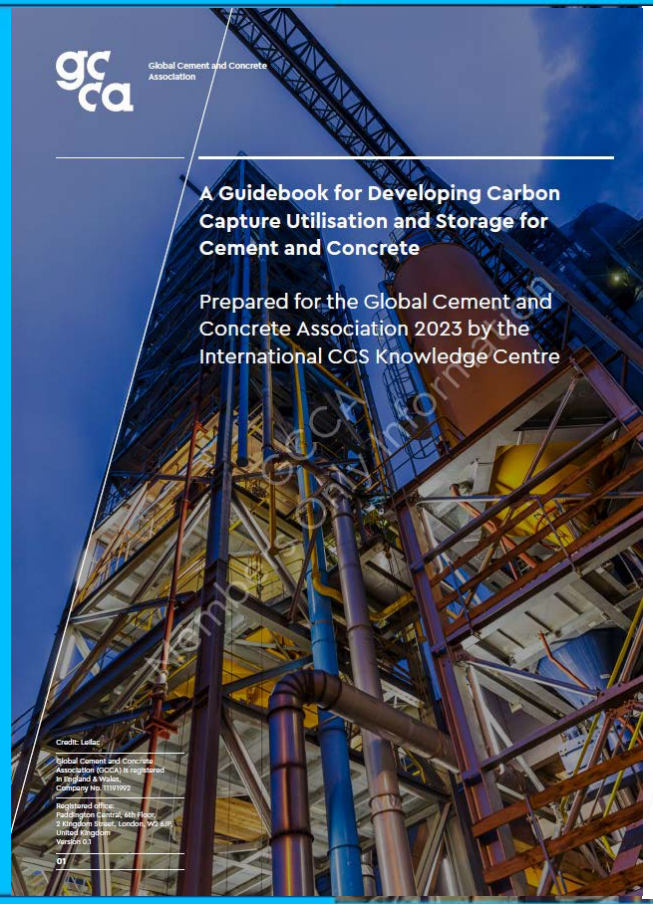
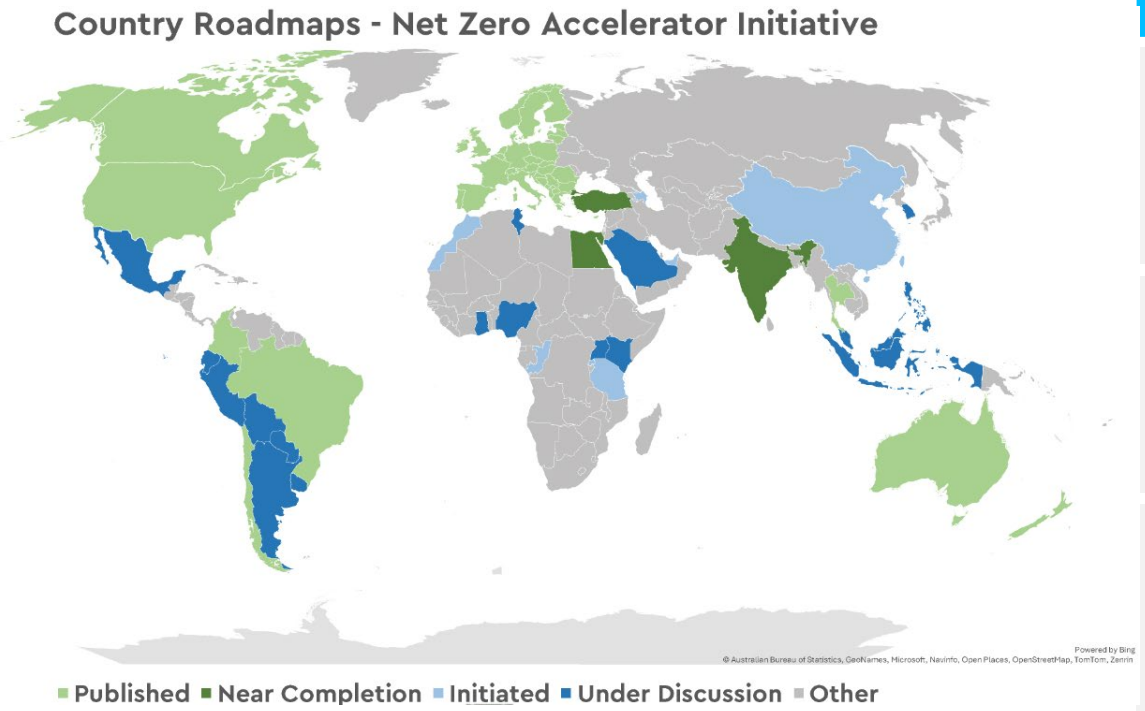


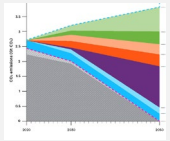
GCCA Members Only

Supporting national initiatives

NET ZERO DELIVERY: NET ZERO ACCELERATOR WITH GOOD PROGRESS



KEY DELIVERABLES



Roadmap Levers and CO_2 impact
Per lever, quantification of potential CO_2 reduction 2030 & 2050

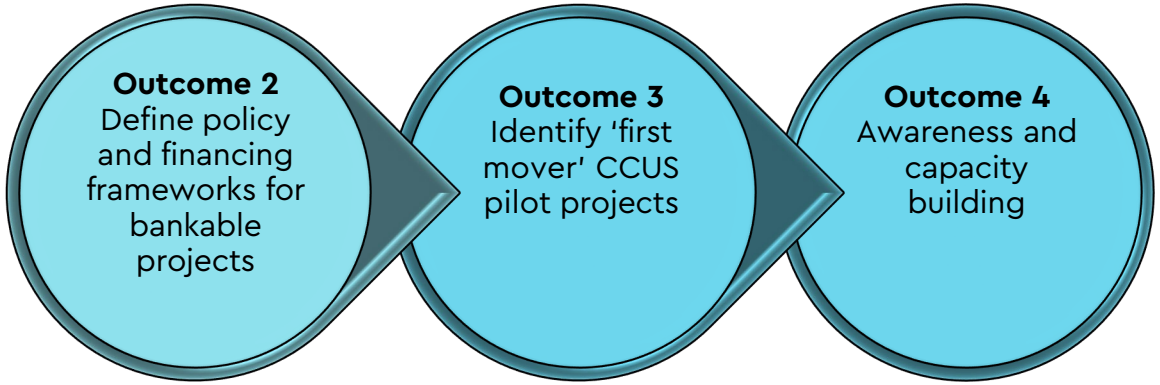
Policy
Per lever, identification of enabling policies

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



CARBON CAPTURE, UTILIZATION & STORAGE
ACCELERATING CCUS TOGETHER
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

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

GLOBAL CCS INSTITUTE

gcca Global Cement and Concrete Association

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 CO_2 transport and storage – including need for mapping
- Ensure supporting policies including public acceptance, liability and carbon accounting