

# Carbon Capture Utilisation and Storage for The Cement Sector

CEM CCUS Initiative Webinar

*Thursday 21 January 2021, 14:00 – 15:00 CET*

*In partnership with:*



# SOME HOUSEKEEPING ITEMS

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# SOME HOUSEKEEPING ITEMS (CONTINUED)

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<https://www.youtube.com/user/cleanenergypolicy>

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# Webinars to disseminate country and sector experience

The screenshot shows a YouTube browser window displaying a playlist titled "CEM: Carbon Capture, Utilization and Storage" by Clean Energy Solutions Center. The main video is "Tomakomai CCS Demonstration Project at 300 thousand tonnes cumulative injection" with a duration of 1:00:23. The video description includes the text: "CEM CCUS Initiative Webinar: CCUS in Japan, June 25<sup>th</sup>, 2020" and "Yoshihiro Sawada, Jiro Tanaka, International Affairs Department, Japan CCS Co., Ltd." The JCCS logo is visible in the bottom right corner of the video frame. The playlist on the right contains six items, including "Key Financing Principles for CCUS", "Direct Air Capture of CO2: Helping to Achieve Net-zero Emissions", "Progress and Layout for Carbon, Capture, Utilization and Storage in...", "A Roadmap to At-scale Deployment of Carbon Capture, Use, and Storage...", and "Approaching Final Investment Decision: CCUS Developments in...". The video player interface shows 367 views and a date of Jun 30, 2020. The Windows taskbar is visible at the bottom of the browser window.

<https://www.youtube.com/playlist?list=PLKRmGa9s99JVssP8Gb5buwLg3Bl1lls>

# AGENDA

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## Welcome & Introductory Remarks

- Jarad Daniels  
*Director, Office of Strategic Planning, Analysis, and Engagement*  
U.S. Department of Energy
- Claude Lorea  
*Cement Director*  
Global Cement and Concrete Association

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## Industry views

- Jamie Gentoso  
*CEO – US Cement*  
LafargeHolcim US
- Rob van der Meer  
*Director of EU Public Affairs*  
Heidelberg Cement
- Tongbo Sui  
*VP Sinoma International, DG of Sinoma Research Institute*  
Sinoma - CNBM

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## Panel Discussion and Q&A Session



Jarad Daniels  
*Director, Office of Strategic Planning, Analysis, and Engagement*  
U.S. Department of Energy

Jarad Daniels leads the Office of Strategic Planning, Analysis, and Engagement within the Department of Energy (DOE) Office of Fossil Energy, including domestic programs and international engagements conducted in close collaboration with industry, academia, and multi-lateral organizations.

Mr. Daniels has twenty-five years of experience with the DOE, managing advanced technology programs and working in several national laboratories throughout the United States. His expertise includes domestic and global energy and environmental technologies, policies, and programs.

Mr. Daniels holds a Master of Science degree in Chemical Engineering from the University of California at Berkeley.



Claude Lorea  
*Cement Director*  
Global Cement and Concrete Association

Ms Loréa leads all aspects of GCCA's work related to cement. She drives the association's work to continuously improve the sustainability performance of the industry through innovation, as well as developing and sharing good practices and global guidelines. Ms Loréa also leads GCCA's innovation workstream and managed the establishment of Innovandi, the Global Cement and Concrete Research Network. She has developed a special interest and expertise in CCUS and international climate policy, as well as regulatory requirements and trends.

Ms Loréa is a member of the GCCA executive team based at the headquarters in London and recently launched the 'women in cement and concrete network'. Ms Lorea joined the GCCA from the European cement industry body, CEMBUREAU where she led on key work for more than a decade.

Ms Loréa gained a degree in Civil Engineering from the University of Brussels.



Jamie Gentoso  
CEO – US Cement  
LafargeHolcim US

Jamie Gentoso is the Chief Executive Officer for the US Cement organization of LafargeHolcim. An accomplished leader and a registered Professional Engineer, Jamie is responsible for all cement product lines, overseeing an organization of approximately 2,800 employees, 15 cement and grinding plants and more than 100 cement terminals across 43 states. She holds a degree in civil engineering and a master's in business, both from The University of Michigan.

Ms. Gentoso is passionate about the cement/concrete industry, enhancing its contributions to society and reducing its impact on our environment. She sits on the Board of Directors for several industry organizations, including the Portland Cement Association, Ready Mix Concrete Foundation, the Concrete Industry Management (CIM) program and many others in the past. She is a lifelong athlete, enjoys running, outdoor activities and spending time with her 3 school aged children.





Rob van der Meer  
*Director – EU Public Affairs*  
Heidelberg Cement

Rob van der Meer is Director EU Public Affairs at HeidelbergCement. As chemical engineer he started his career in public services as responsible for environmental permitting with focus on emissions to the air, for the Provincie Limburg in the Netherlands.

In 1996 he started in the cement industry as a process engineer in the Maastricht plant of ENCI. Later (2004) he was appointed CO2 coordinator for HeidelbergCement in Heidelberg (Germany).

Since 2007 he is in charge of EU Public Affairs in the department of Group Communications & Investor Relations of HeidelbergCement in Heidelberg (Germany).

Rob van der Meer graduated in 1991 as a chemical engineer from the Technical University Twente in the Netherlands.



Tongbo Sui

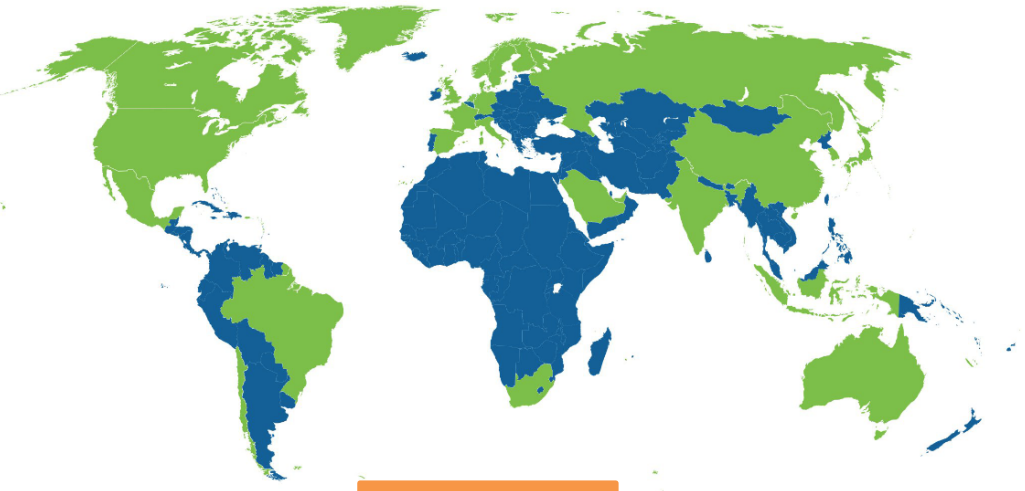
*Vice President of Sinoma International, DG Sinoma Research Institute*  
Sinoma

Dr. Tongbo SUI, born in November 1965, is currently vice president of Sinoma International Engineering Co. Ltd for technical innovation. He has been intensively engaged for over 20 years in R&D of low energy & low CO<sub>2</sub> clinker cements (mainly in reactive belite-rich clinker and belite-ye'elimite clinker system) as a solution to addressing cement and concrete sustainability.

He is also visiting professor at Tongji University of China, University College London of UK and senior advisor of China Cement Association, and active in international organizations as co-chair of Working Group 5 for Cement Innovation under Global Cement and Concrete Association, and member of ACI, ASTM, RILEM & ICT.

He is the recipient of various academic awards including awarded national expert by the State Council, the 2nd class national prize for technological invention awarded by the State Council for the R&D of low energy and low emission reactive belite-rich Portland cement, and international award for the outstanding contribution to the technology for cement and concrete sustainability issued at Seville, Spain.

# The Clean Energy Ministerial (CEM) is a global process



**27 CEM Members**

■ Clean Energy Ministerial participant

**90%**

Clean energy investments

**75%**

Global CO<sub>2</sub> emissions

## The CEM CCUS Initiative

Saudi Arabia, United States, South Africa, Norway, Japan, United Arab Emirates, Mexico, United Kingdom, Observer: China, Canada, Netherlands.

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

- Lead countries:** Norway, Saudi Arabia, the United States and United Kingdom
- Participating CEM members:** Canada, China, Japan, Mexico, Netherlands, South Africa and United Arab Emirates; in addition, the European Commission is an observer
- Industry:** oil and gas, cement, steel, ...
- Financial institutions:** private banks, investment firms, multilateral banks (MDBs)
- Organizations:** Carbon Sequestration Leadership Forum (CSLF), International Energy Agency (IEA), IEA Greenhouse Gas R&D Programme (IEAGHG), Mission Innovation (MI), Global CCS Institute (GCCSI), and Oil and Gas Climate Initiative (OGCI)

# CEM CCUS Initiative: accelerating CCUS together by:



Actively **including CCUS** within Clean Energy Ministerial agenda and global clean energy discussions.



Facilitating identification of both near and longer-term **investment opportunities**.



Bringing **together** governments, the private sector and the investment community.



Disseminating **best practice** in CCUS policy, regulation and investment.

# CCUS: positive energy – but we must keep the wheel turning!

## EMERGING POLICY and AMBITIONS

- 30+ countries with “net-zero” ambitions by ~2050!
- EU: 2050 net-zero target; CEF, Innovation Fund etc.
- NOR: Gov. investment in Longship & Northern Lights
- UK: GBP800m fund & business models
- NL: SDE++ and EUR100m EU support
- US: 45Q tax credits
- China: 2060 net zero target
- JP: 2050 net-zero; commercialise CCUS by 2030
- UAE: ADNOC to ramp up CCUS by 500% by 2030
- ...

## RESETTING STRATEGIC NARRATIVE

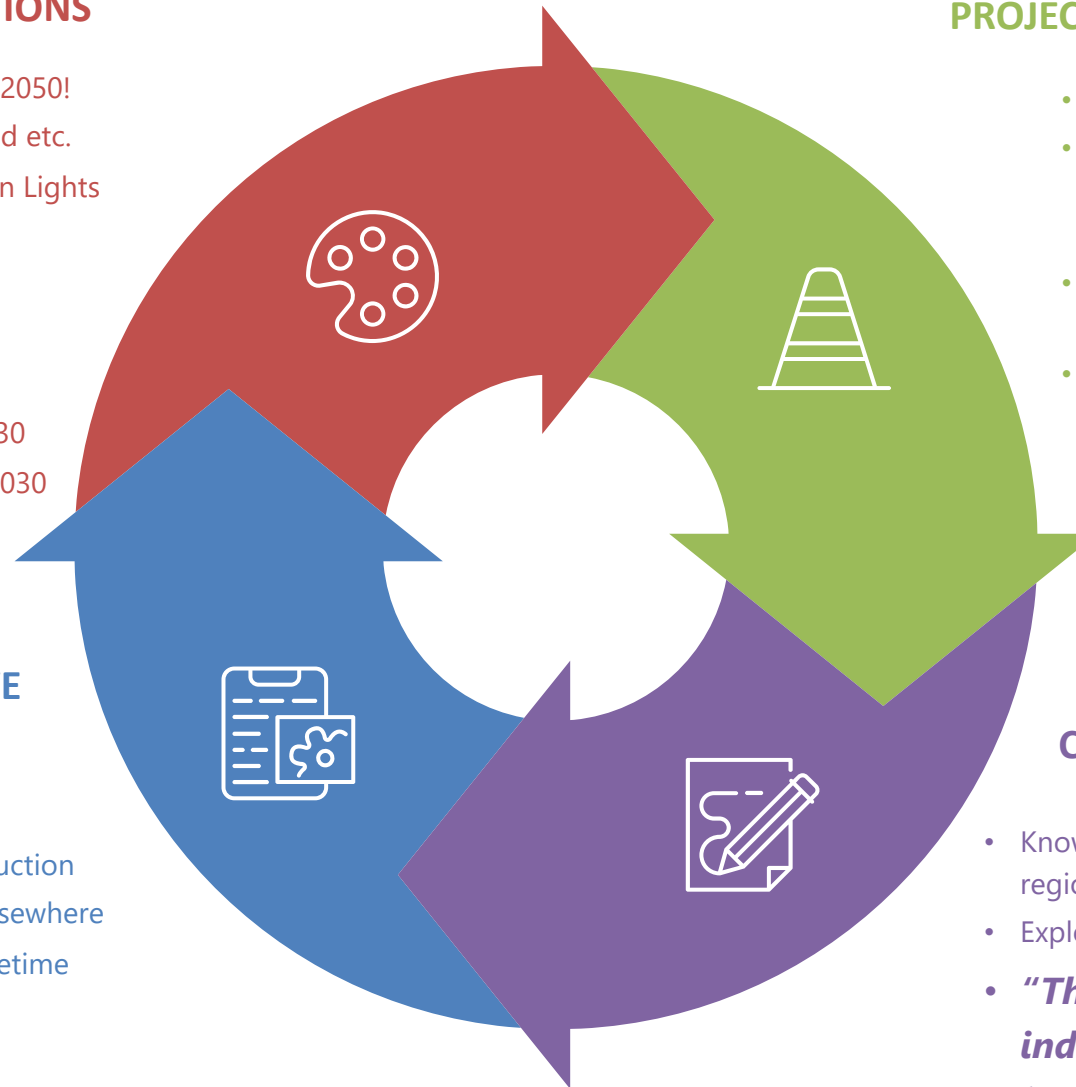
- From “burden” to “opportunity”
- Decarbonise hard-to-abate industry sectors
- CCUS as partner in low-carbon hydrogen production
- CO2 removal & CCUS as offset for emissions elsewhere
- Decarbonise existing power assets with long lifetime

## PROJECT DEVELOPMENT SPEEDS UP

- 20 projects today
- 30 new projects announced since 2017: US, Europe, Middle East, Korea, China, Australia, New Zealand etc.
- 16 projects closest to implementation (FID in 12 months) represent USD27bn in investment
- Joint infrastructure → hubs emerging as a way forward, with common transport and storage infrastructure for a multitude of capture facilities

## COLLABORATION REMAINS CRITICAL

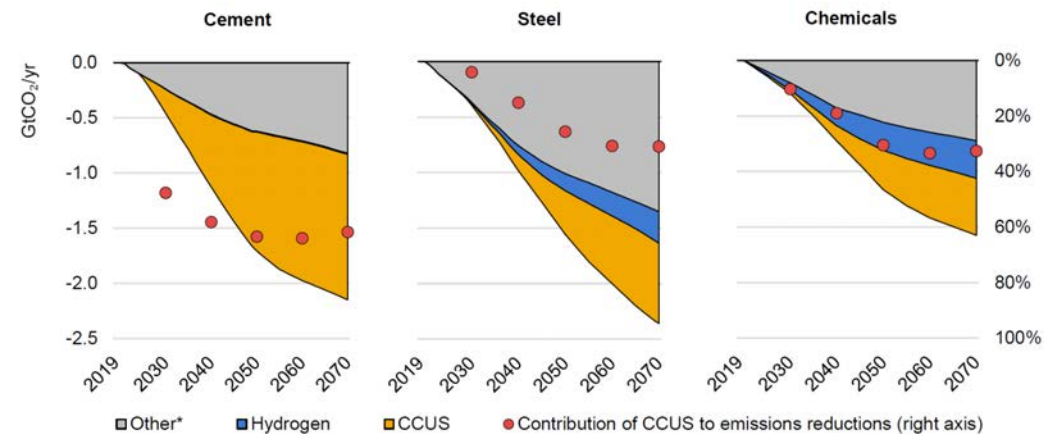
- Knowledge-sharing between projects, countries and regions
- Exploiting regional synergies, strategies and investment
- **“Three-legged stool”**: **government, industry, finance sector all have their role to play**



# CCUS: a critical solution across many sectors and industries

- CCUS is far from only being a power-sector technology...
- ...in fact, its role is more important in heavy industry, including cement, where a large share of emissions are process-related
- In 2019, the process emissions were 2,5Gt globally, equivalent to India's total annual emissions
  - 63% of these emissions were from the cement sector
- CCUS is a central solution to reduce process emissions, particularly in the cement sector

Figure 2.11 Global CO<sub>2</sub> emissions reductions by abatement measure in heavy industry in the Sustainable Development Scenario relative to the Stated Policies Scenario



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\* Other includes material efficiency, technology performance, electrification, bioenergy and other fuel shifts.



Global Cement and Concrete  
Association

# **GCCA Climate Ambition**

## **Towards carbon neutral concrete**

CARBONEUTRAL

# Concrete's essential role in the modern world

Population growth and increasing urbanisation will drive a growing global requirement for critical infrastructure over coming decades.

- This includes the need for crucial amenities such as clean water and sanitation.
- It is also anticipated that there will be a significant increase of built floor space, including the provision of safe dwellings.
- At the same time there is a growing need for resilient construction to protect our cities and natural environment from a changing climate.

Concrete is vital to meeting these challenges and for providing sustainable development.

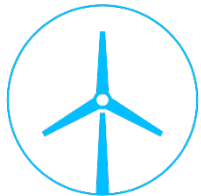




# How can carbon neutral concrete be achieved?



- Eliminating our direct energy-related emissions and maximising the co-processing of waste from other industries, which substitutes the use of fossil fuels involved in cement manufacture.



- Reducing and eliminating indirect energy emissions through renewable electricity sources where available.



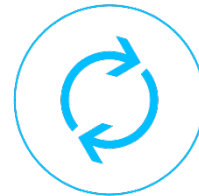
- Reducing process emissions through new technologies and deployment of carbon capture at scale.

We believe in the coming decades, we can provide society with carbon neutral concrete. We are already working to achieve this and recognise the need to accelerate our actions today.

In the coming years we can achieve carbon neutral concrete by:



- Reducing the content of both clinker in cement and cement in concrete, as well as more efficient use of concrete in buildings and infrastructure.



- Reprocessing concrete from construction and demolition waste to produce recycled aggregates to be used in concrete manufacturing.



- Quantifying and enhancing the level of CO<sub>2</sub> uptake of concrete through re-carbonation and enhanced re-carbonation in a circular economy, whole life context.

# GCCA's policy framework for action on cement and concrete

## This includes measures which:

- Promote investment in state-of-the-art technology for new and retrofit plants.
- Facilitate increased use of waste and by-products as alternative fuels and raw materials; enable governments and industry to work together to implement circular economy strategies and promote waste avoidance, collection and sorting, pre-treatment, recovery, recycling and co-processing.
- Support the research and development of breakthrough technologies as well as the acceleration and scaling-up of proven efficient low carbon technologies, with a particular focus on CCUS and new and alternative binders. Policies should help mitigate the risk through investment mechanisms.
- Promote cooperation between government and industry to develop CO<sub>2</sub> transport and storage infrastructure.
- Drive the demand for sustainable building materials by helping to stimulate market demand for innovative products by construction contractors and customers.
- Support life-cycle assessment-based methodologies, tools and databases to enable a whole-life based approach to procurement. Appropriate sustainability assessment methods using life cycle analysis are to be preferred in public and private tendering.
- Recognise at national level the uptake of CO<sub>2</sub> by existing concrete in the built environment.
- Energy performance of buildings calculation methods should be sophisticated enough to take account of thermal mass.
- Electricity systems should facilitate demand response, i.e. interaction between the grid and households, where the consumer enjoys a share of the cost savings.
- Enable revision of building codes and regulations to facilitate the adoption of innovations without jeopardising safety and durability and recognising the increased need for resilience in the built environment.
- Establish the means of recognising that the resilience of the built environment can contribute to favourable social and economic benefits for society.
- Establish the means of recognising that concrete can contribute to favourable emission benefits in other sectors of the economy.
- Access to recycled concrete for utilisation for recarbonation.

# Agenda

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## Welcome & Introductory Remarks

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*Director, Office of Strategic Planning, Analysis, and Engagement*  
U.S. Department of Energy
- Claude Lorea  
*Cement Director*  
Global Cement and Concrete Association

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*VP Sinoma International, DG of Sinoma Research Institute*  
Sinoma - CNBM

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## Panel Discussion and Q&A Session

# LafargeHolcim Fast Facts



**~75**  
countries



**~2,300**  
operating sites



**~72,000**  
employees



**26.7**  
billion CHF net sales  
Like-for-like



**Net Zero**  
pledge

**SBTi**  
validated 2030 targets

**ESG**  
Sustainalytics rating

**Green Solutions**  
1/3 of our sales



**Global R&D**  
center in France

**5**  
regional R&D hubs  
**50% of R&D**  
In green construction

**40% of Patents**  
In green construction



The world's global leader in building materials and solutions

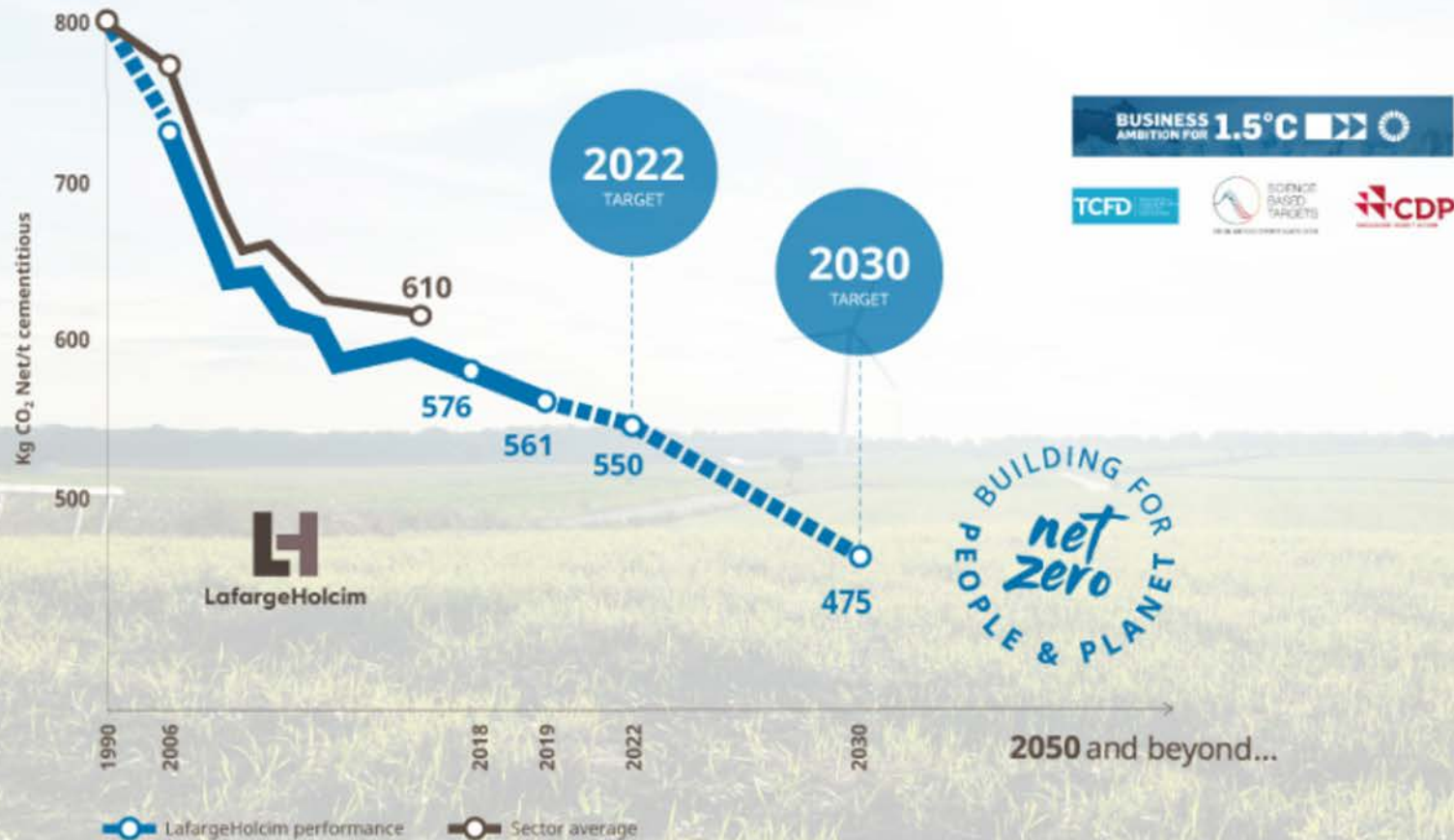
Leading the way in sustainable construction

Biggest Research & Development organization

All figures represent FY 2019

# Our Net Zero Roadmap

Driving green construction with *net zero* pledge



# Demand is driven by population growth, urbanization, improved living standards and sustainable construction

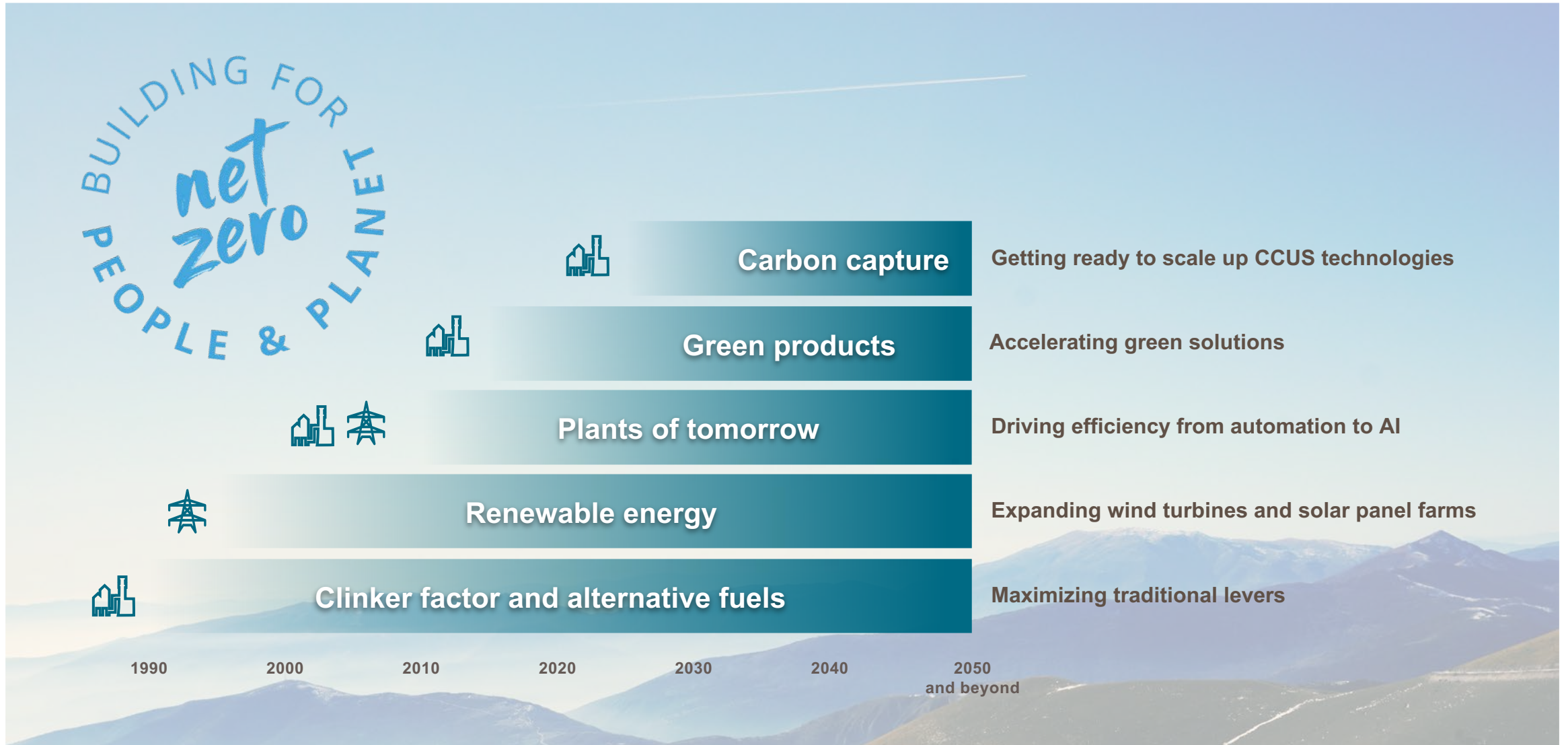
By 2050 population is expected to grow **22%** to 9.7 billion. **2.5 billion** more people are expected to live in cities

**Concrete remains the best building material providing the greatest durability, longevity, resilience and the lowest embodied energy and carbon intensity versus other materials.**

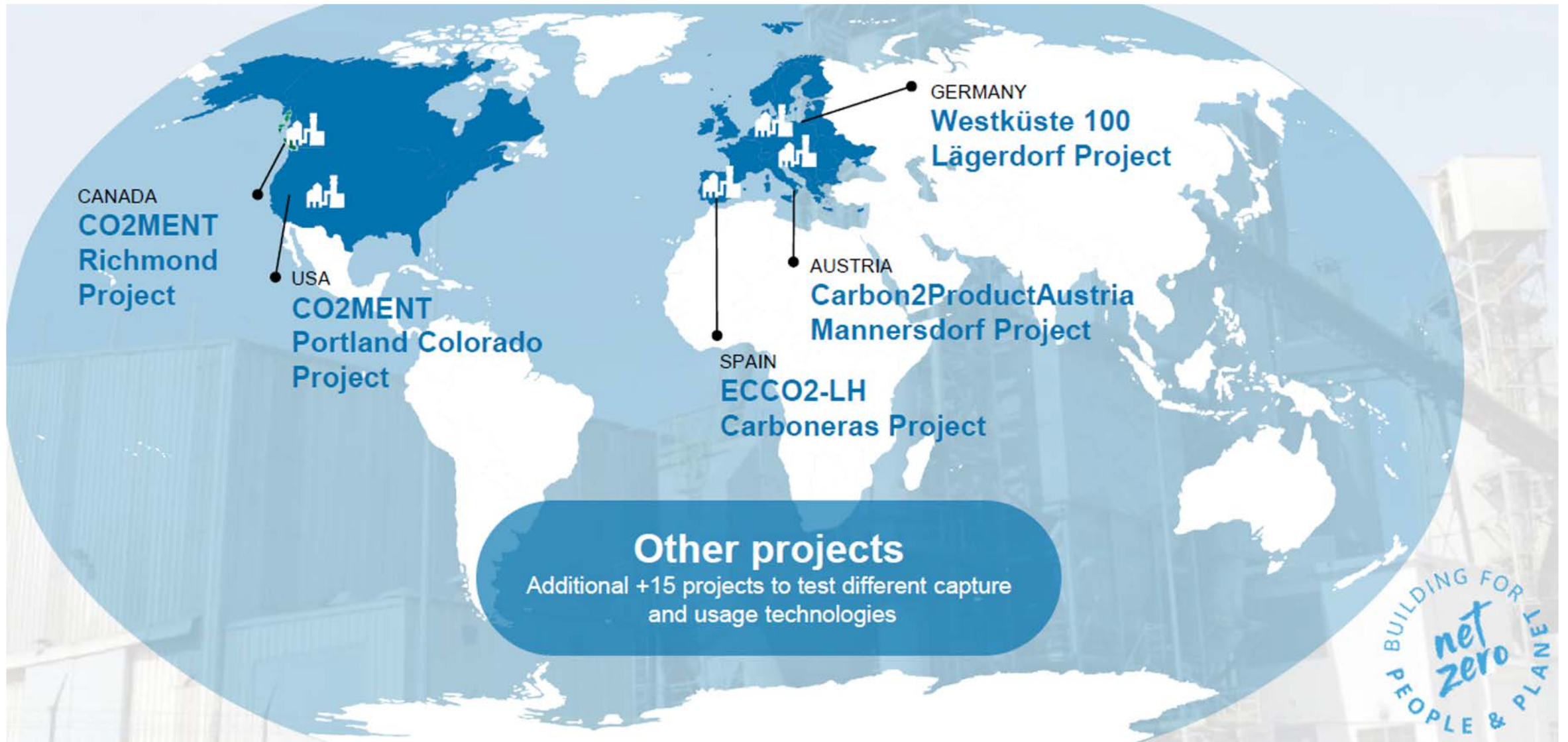
**G20 leaders have pledged an astounding USD 5 trillion to fight the economic consequences of COVID-19. Infrastructure and building will be a natural choice for policymakers on where to invest.**

**This brings a huge opportunity to “Build Back Better”**

# Our building blocks to net zero



# LH CCUS Projects





# Carbon Capture Utilization and Sequestration Solutions (CCUS) - How we're multiplying our efforts to achieve our ambitions

## **Fostering >20** Industry & Government **Partnerships**

**Technology developers**  
**Chemical and other industries**  
**Green Energy producers**  
**Governments**  
**Universities**  
**Startups**

## **&** **Furthering** these core **Factors**

**Public Acceptance**  
**Renewable Energy**  
**Infrastructure**  
**Regulatory Frame**  
**Governmental Support**  
**Funding**



## Policy Must Support CCUS:

- Continued investment in research & Innovation is necessary to capture CO2 both in scale & economically
- Innovation for novel use of captured CO2 must continue
- Investment in CO2 transport & storage infrastructure
- A Price on Carbon can be an effective way to stimulate reduction however it must be...
  - Effective - Focus on reduction outcomes
  - Market Based - Economy Wide
  - Durable & Responsive - adapt over time
  - Do no harm - support competitiveness within the economy
  - Promote Equity - distribute costs & benefits as well as promote investment in disadvantaged communities



**Moving towards a  
zero CO2  
economy through  
a cross-sectoral  
value chain  
approach**



## By 2030, LafargeHolcim will



**Accelerate use of low-carbon & carbon-neutral products**, incl. ECOPact and Susteno



**Recycle 100m tons of waste and byproducts** for energy and raw materials



**Scale up the use of calcined clay** and develop novel cements with new binders



**Double\*** waste-derived fuels in production to reach 37%



**Reach 475** kg net CO2 per ton of cementitious material



**Operate its first net-zero** carbon cement **production** facility



\* Compared to 2018 baseline

# HeidelbergCement CCUS projects

Rob van der Meer

Group Communications & IR

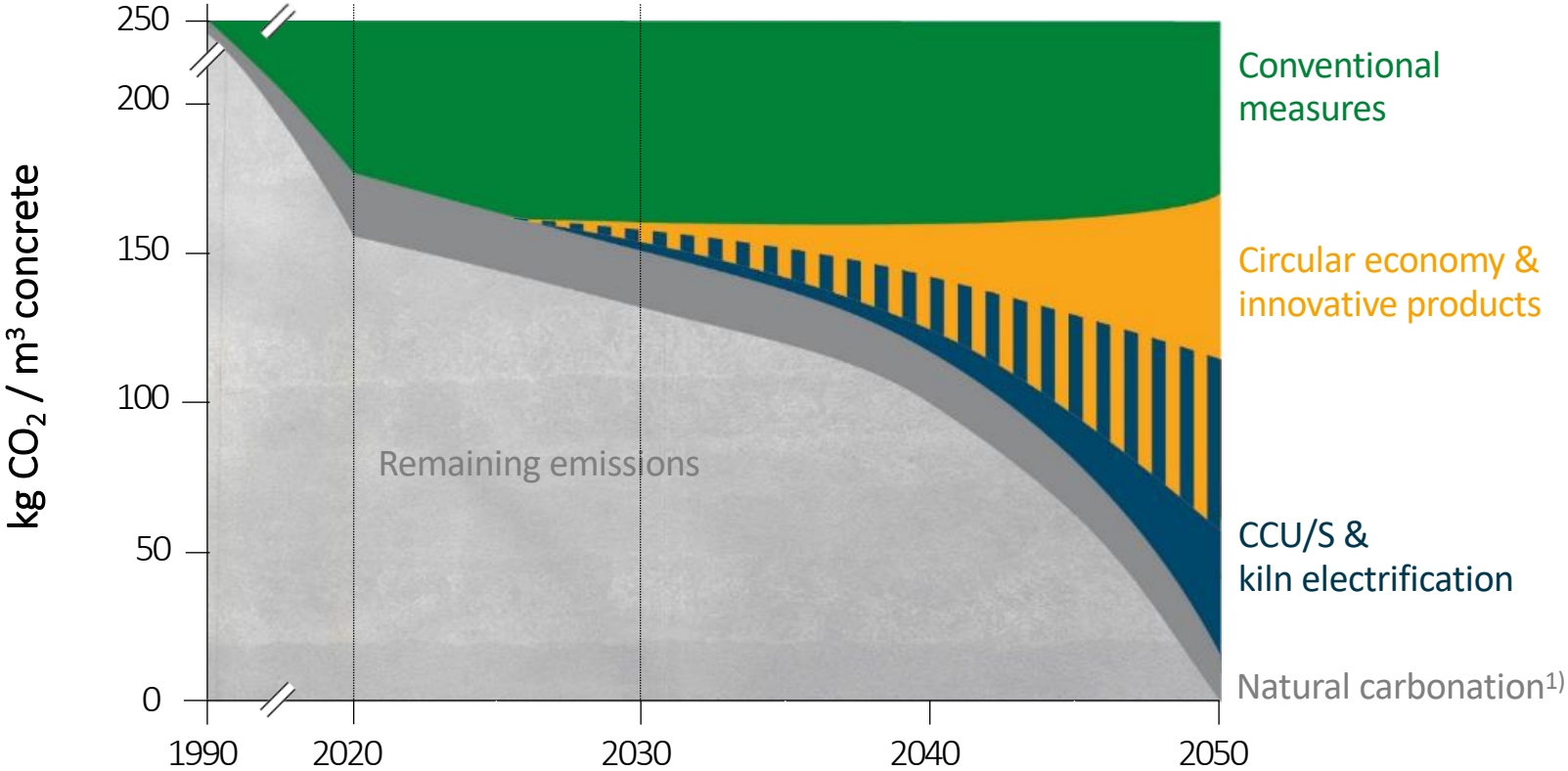
21/01/2021

Our goal is to realize  
carbon neutral concrete  
by 2050 at the latest.



CARBON  
NEUTRAL

# Carbon neutrality by 2050 requires a variety of localized approaches



1) Natural carbonation is the absorption of CO<sub>2</sub> from the atmosphere during the lifetime of a concrete construction

# Resource and energy-efficient capture to get from 20% to > 95% CO<sub>2</sub>

TRL 8

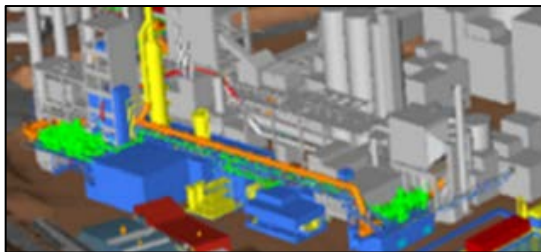
## Post combustion (Amine)

Early Stage:  
4 research projects in Europe

Pre-industrial:  
Edmonton, Canada



Industrial/commercial:  
Brevik, Norway

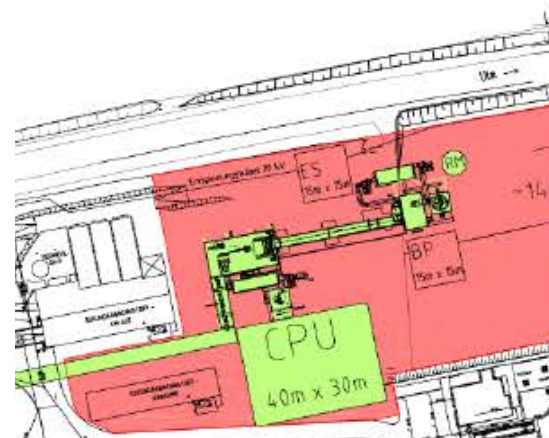


TRL 5

## Oxyfuel

Early Stage:  
Preparatory research work done together with ECRA/UMONS

Pre-industrial:  
CI4C, Germany

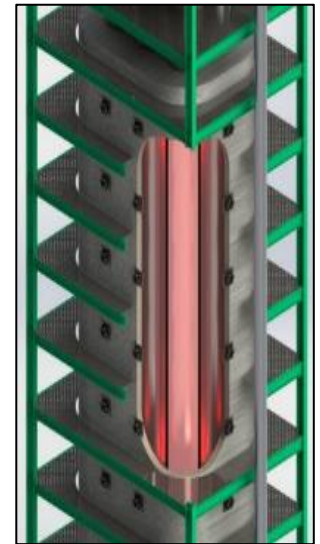


TRL 6

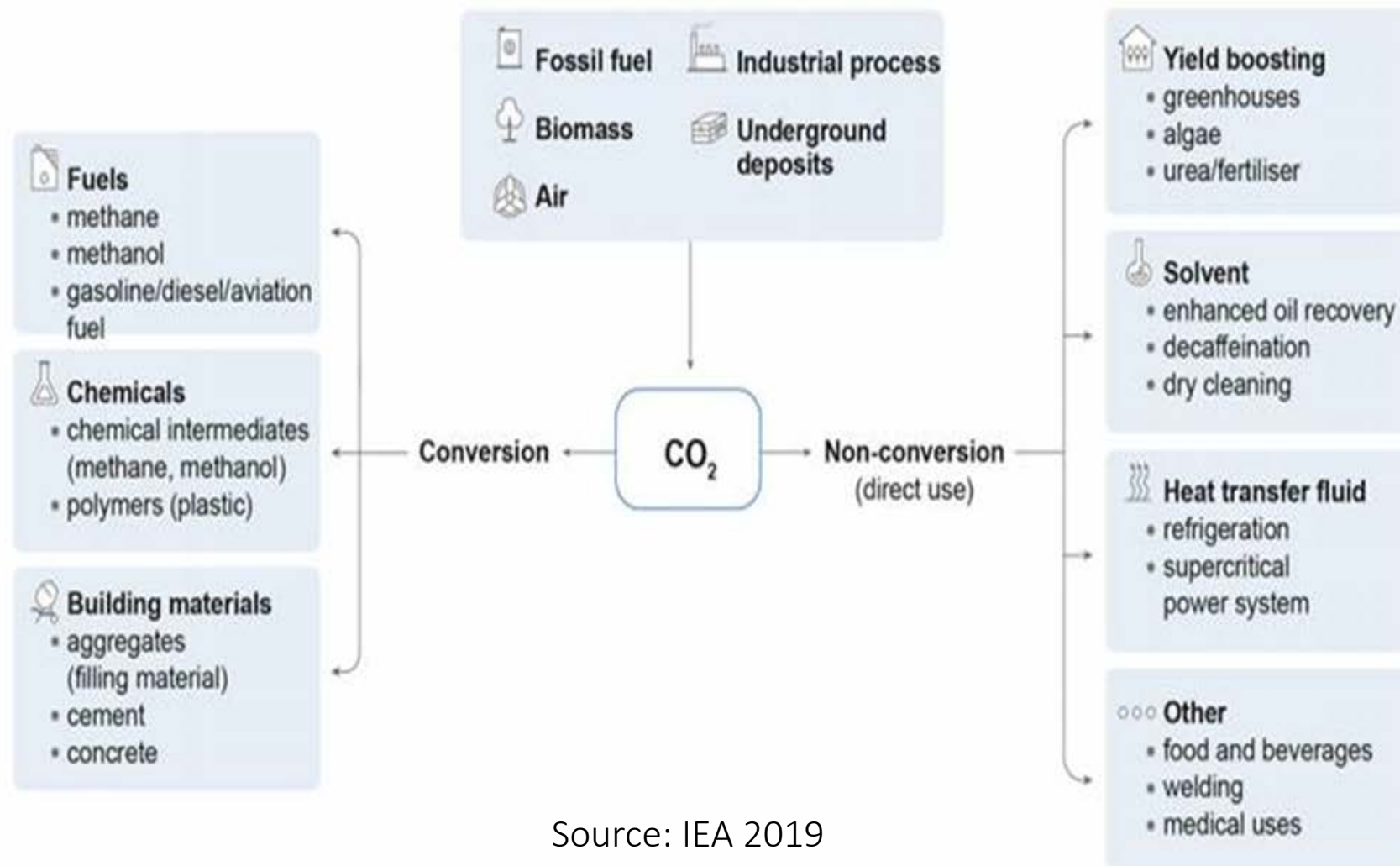
## Direct separation (LEILAC)

Pilot: LEILAC-1, Belgium

Pre-industrial:  
LEILAC-2, Germany



# Resource and energy-efficient use of CO<sub>2</sub>



Source: IEA 2019



# Resource and energy-efficient use of CO<sub>2</sub>

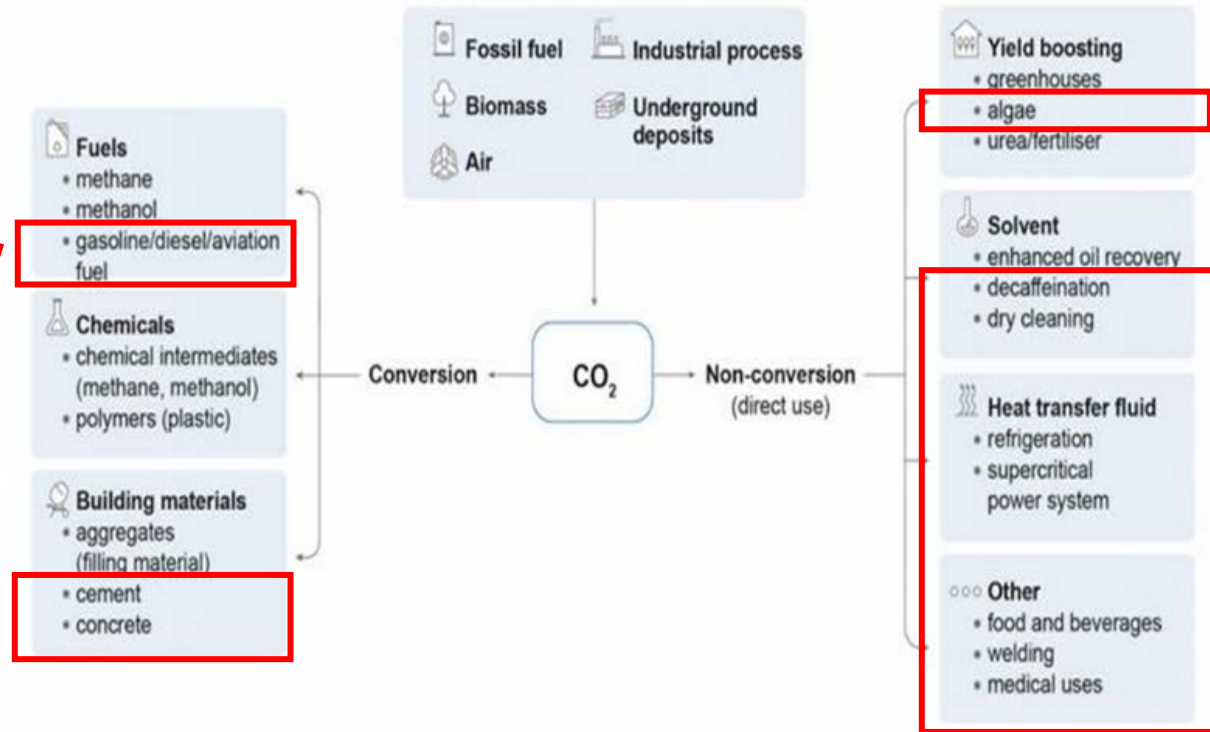


**C<sup>2</sup>inCO<sub>2</sub>**

Funding: Bundesministerium für Bildung und Forschung

Industry: HEIDELBERGCEMENT, LOESCHE, thyssenkrupp

Academia: Fraunhofer, RWTH AACHEN UNIVERSITY, Bauhaus-Universität Weimar



Source: IEA 2019

# CCS offshore and onshore safe sequestration

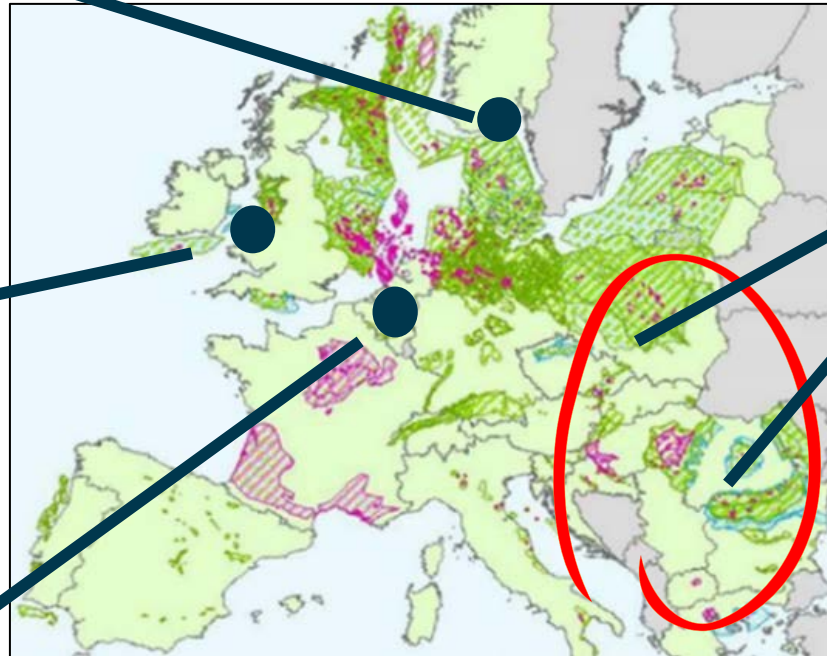
Northern Lights



HyNet



Porthos



**Onshore location + acceptance to be developed by HC with partners**

Evaluation suitable storage locations

Team-up with Geological Institutes

Co-development with (local) Storage Solution Provider (oil/gas world)

Deep understanding of the national laws and policy on CCS

Societal Acceptance is a pre-requisite



## 3 Fundamentals for decarbonation

### 1. Technical requirements

The four elements for emissions reductions in cement industry have to be explored to the maximum:

1. Recarbonation and mineralization, for which 100% recycling will be needed.
2. Traditional emissions reduction measures: alternative fuels, thermal and electrical energy efficiency, renewable electrical energy, etc.
3. New and improved low carbon cementitious binders: clinker substitution, cement substitution, new binders, new clinkers, etc.
4. Carbon capture followed by use and/or (geological) storage

We are convinced that from a technical perspective carbon neutrality of concrete can be reached

### 2. Infrastructure...

... for CO<sub>2</sub>, H<sub>2</sub>, renewable electricity and recycled concrete is urgently needed.

This is not a cement-specific issue (apart perhaps for the CO<sub>2</sub> infrastructure and recycled concrete) but a general necessity for energy-intensive industries.

Delay of infrastructure necessities endangers the carbon neutrality ambitions for 2050 (and before)

### 3. Economical feasibility / livability of carbon neutral products

Legislation and policy framework secure an economical basis for energy-intensive industries to become carbon neutral as soon as possible.

Long-term predictability of legislation + Whole life cycle basis of carbon costs + Fair level playing field

CCUS key pillar for Carbon  
Neutrality 2050....

 **CO<sub>2</sub>**  
CARBON  
NEUTRAL



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conditions of the credit business and, in particular, additional uncertainties arising out of the subprime, financial market and liquidity crises; the outcome of pending investigations and legal proceedings and actions resulting from the findings of these investigations; as well as various other factors.

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**CEM CCUS - GCCA webinar**  
**January 21, 2021**

# **CCUS-China Cement Industry**

**SUI Tongbo**

**Sinoma Int'l, CNBM**

**Beijing, China**

## Outline

**Part I: Exemplified CCUS Innovation in China Cement Sector**

**Part II: Policy & Future perspective**

## **Part I:**

# **Exemplified CCUS Innovation in China Cement Sector**



## 1. CCUS-Cement (Calcium Looping)

**Demo Project 2014:** Taiwan Cement Corporation, technically supported by Industrial Technology Research Institute (ITRI)

### Test Results:

- The CO<sub>2</sub> capture rate: + 1 t/h;
- The CO<sub>2</sub> capture efficiency higher than 85% for 7 hours The accumulated time of unit operation test in this pilot plant + 600 hours;
- and that for the fully-continuous looping test is more than 300 hours

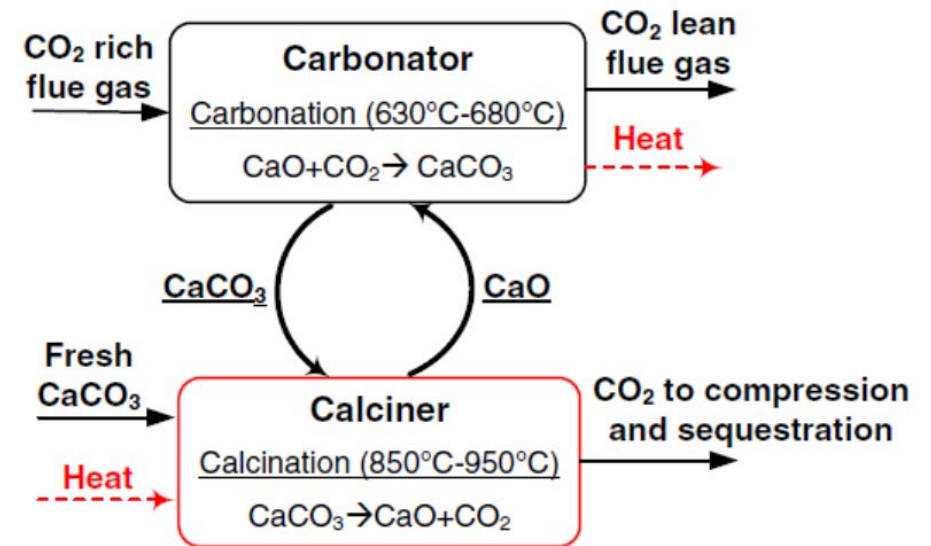


Fig. 1 Calcium-Looping process principle

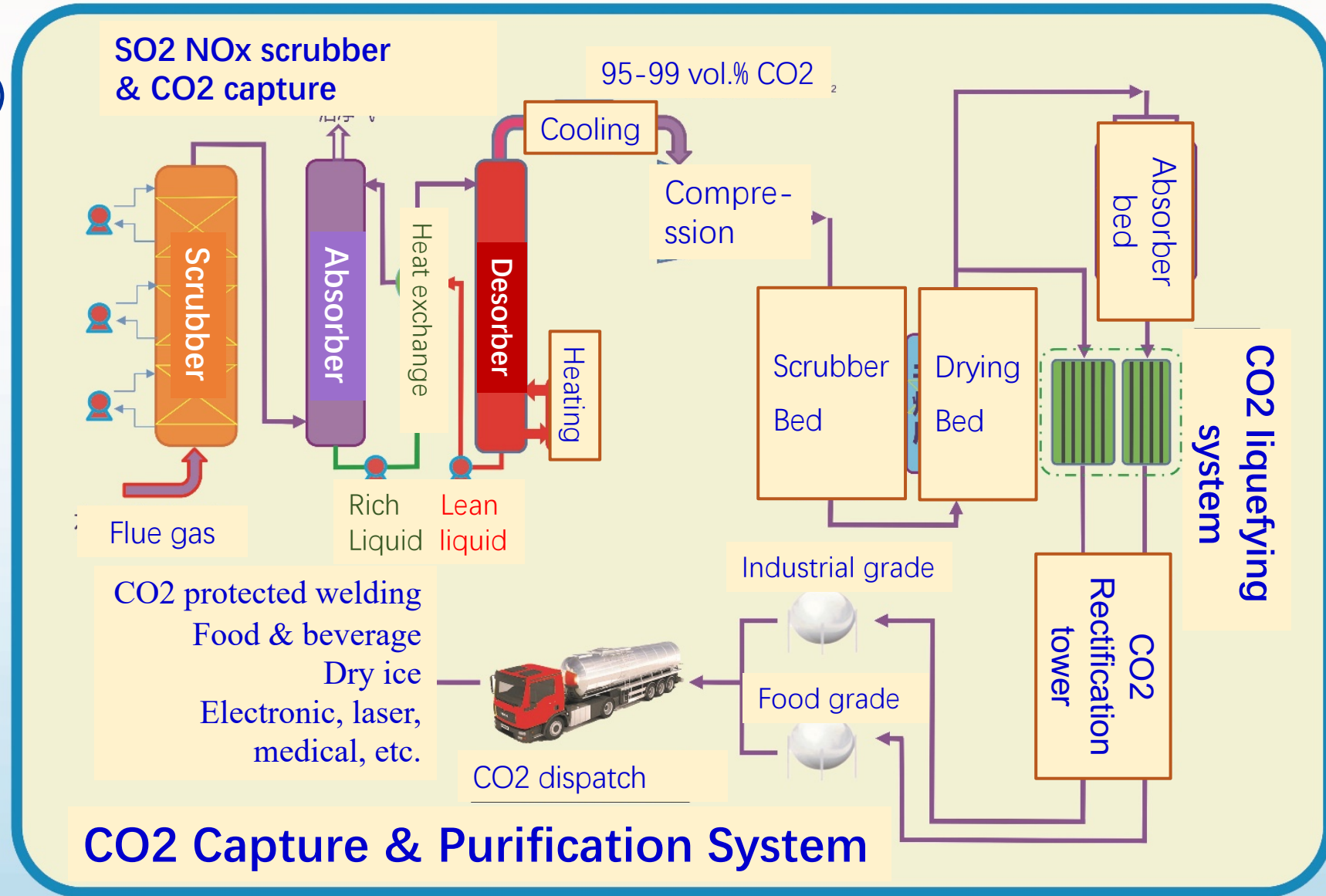
Ming-Hui Chang, Wei-Cheng Chen, et al, Design and Experimental Testing of a 1.9MWth Calcium Looping Pilot Plant, **Energy Procedia 63 ( 2014 ) 2100–8**

## 2. CCUS-Cement

(Post combustion)

Demo Project: Anhui Conch  
(chemical adsorption)

- ✓ 1<sup>st</sup> Trial Production: Oct. 22-29, 2018
- ✓ Kiln capacity: 4500t/d
- ✓ CCS capacity: 50kt/y of CO<sub>2</sub>; industrial and food grades;
- ✓ Type of CO<sub>2</sub> sorbent: AEEA
- ✓ CO<sub>2</sub> capture efficiency: 95%
- ✓ Power consumption: 270kWh/t CO<sub>2</sub>



## 2. CCUS-Cement (Post combustion)

Demo Project: Anhui Conch (chemical adsorption)



### 3. CCUS-Cement (via mineralization)

Demo Project 1: Sinoma, CNBM (CCUS via mineralization)

**Waste 1 + Waste 2**  $\longrightarrow$  **HVAD PCC (precipitated calcium carbonate)**

**Typical composition of the exhaust gas (Waste 1) from kiln**

| Plant | <b>CO<sub>2</sub></b> | O <sub>2</sub> | CO   | N <sub>2</sub> | Dust (g/Nm <sup>3</sup> ) |
|-------|-----------------------|----------------|------|----------------|---------------------------|
| 1     | <b>31.1</b>           | 3.8            | 0.26 | 64.8           | 53.7                      |
| 2     | <b>32.24</b>          | 4.29           | 0.01 | 63.46          | 18.4                      |

**Typical composition of carbide sludge (Waste 2)**

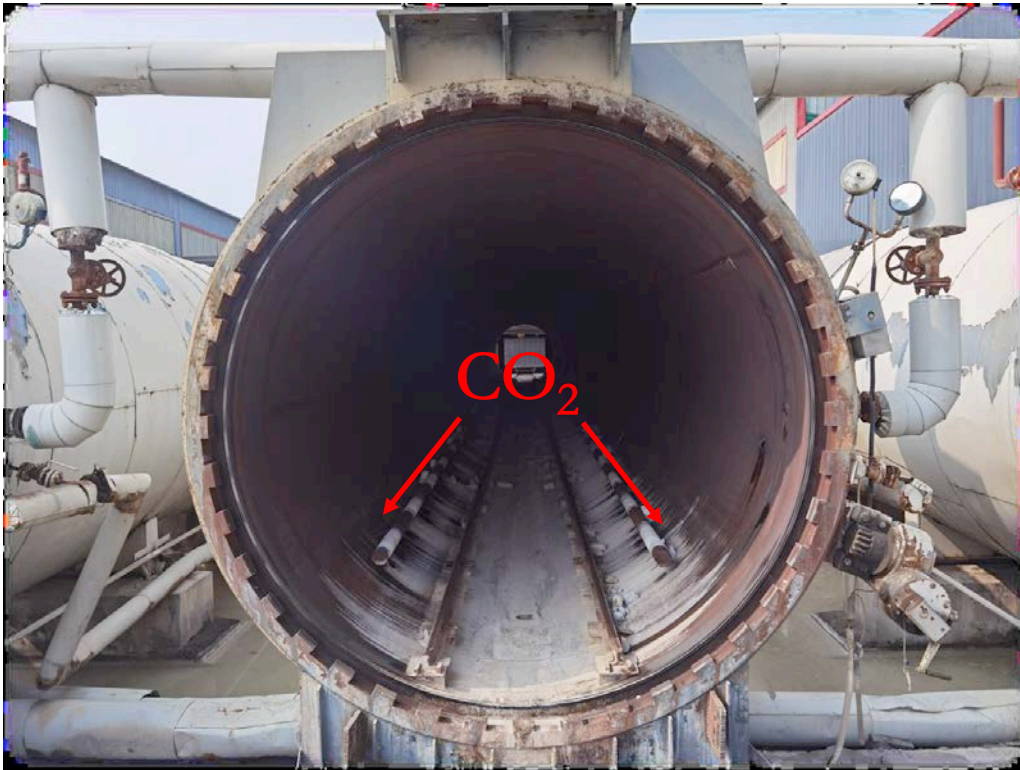
| Plant | Loss  | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | <b>CaO</b>   | MgO  | K <sub>2</sub> O | Na <sub>2</sub> O | SO <sub>3</sub> | Cl <sup>-</sup> |
|-------|-------|------------------|--------------------------------|--------------------------------|--------------|------|------------------|-------------------|-----------------|-----------------|
| 1     | 22.96 | 4.30             | 2.59                           | 0.34                           | <b>68.36</b> | 0.34 | 0.03             | 0.03              | 0.07            | 0.009           |
| 2     | 31.22 | 3.48             | 1.21                           | 0.30                           | <b>62.74</b> | 0.30 | 0.01             | 0.05              | 0.26            | 0.064           |

- **PCC 50 kta industrial feasibility study**
- **PBC 50 kta industrial line in operation** (Barium carbonate)

### 3. CCUS-Cement (via mineralization)

Demo project 2: technical support by Zhejiang University\*

—— Pavers made via CO<sub>2</sub> curing



72-hour trial

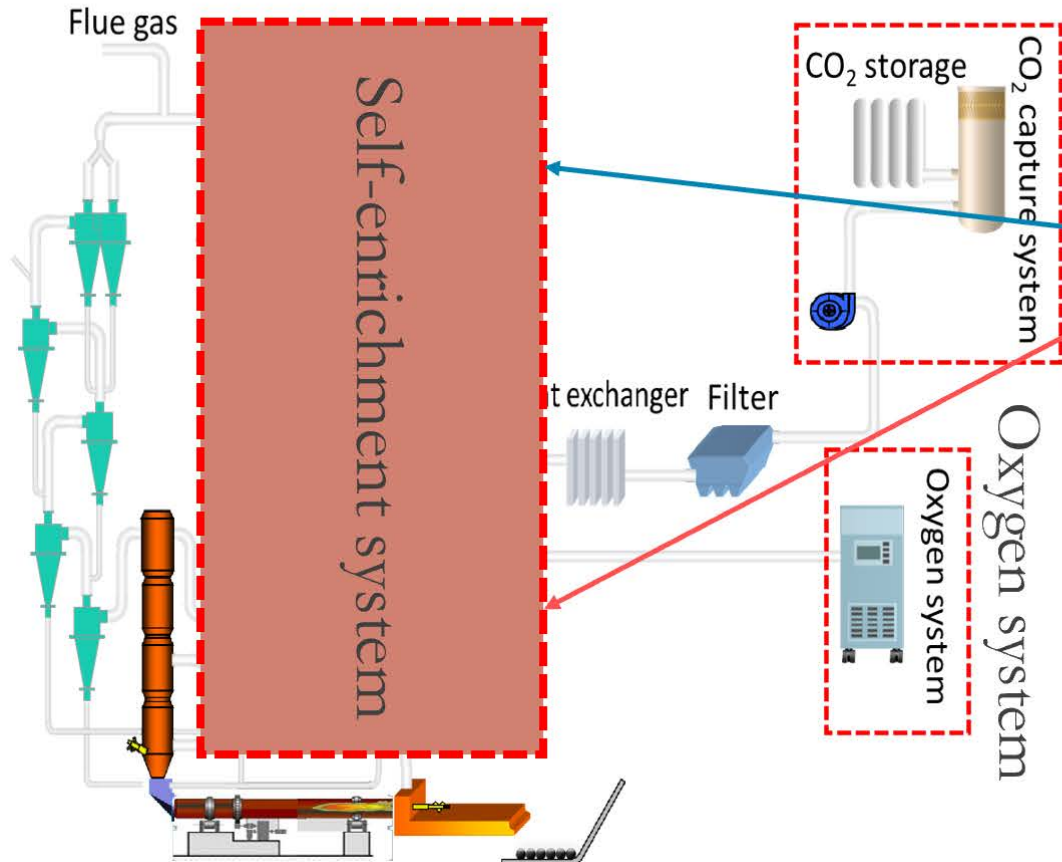
- Use steel slag, bottom ash etc., 1700 t;
- Concrete pavers 1800 t, CO<sub>2</sub> sequestered 50kg/t

\*Prof. Tao Wang, Zhejiang University

## 4. CCUS-Cement (Oxy-fuel & CO<sub>2</sub> enrichment)

Developed by Sinoma, CNBM

Capture system



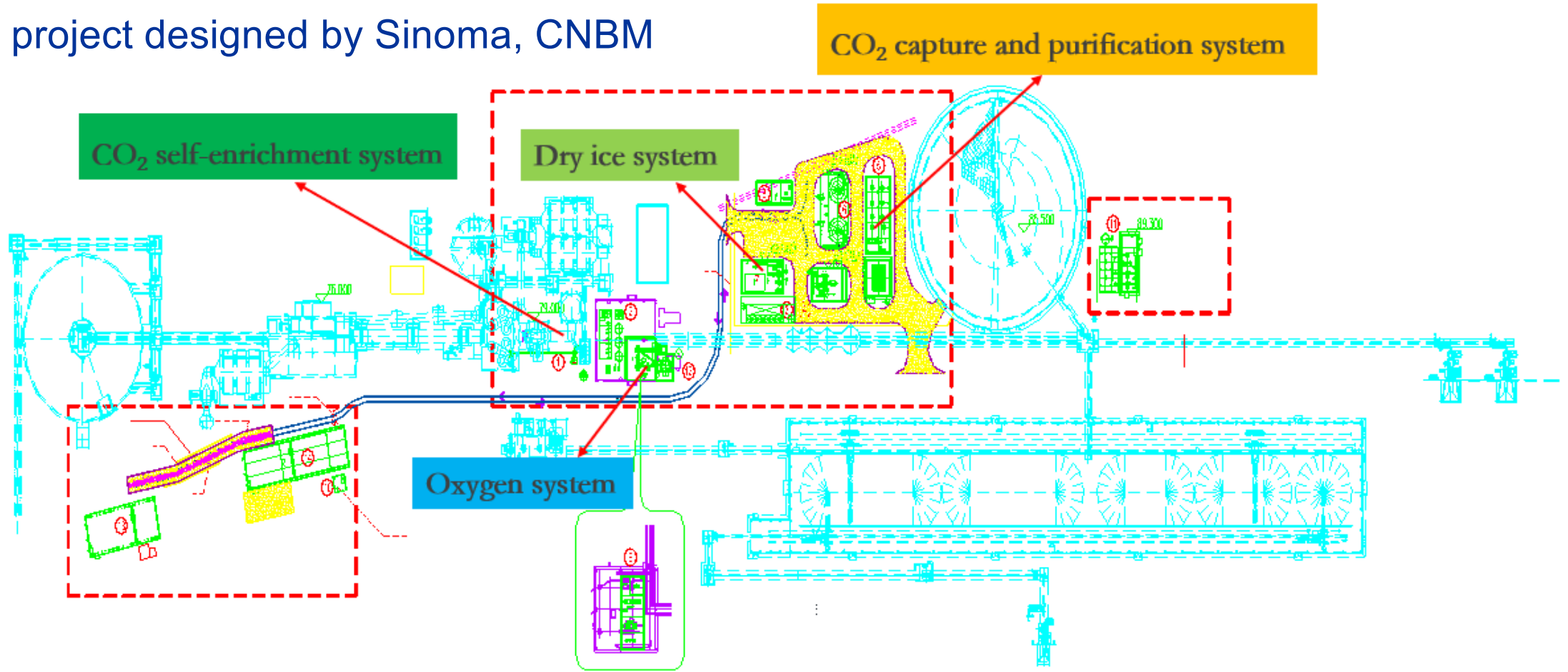
| Position   | CO <sub>2</sub> (%) | O <sub>2</sub> (%) | N <sub>2</sub> (%) | H <sub>2</sub> O (%) |
|------------|---------------------|--------------------|--------------------|----------------------|
| CC1        | 72.37               | 2.31               | 12.88              | 12.44                |
| Calciner B | 75.74               | 2.00               | 11.90              | 10.36                |

- ① CO<sub>2</sub> self-enrichment : **Increase CO<sub>2</sub> content above 75%**
- ② CO<sub>2</sub> capture: Adsorption-Distillation

**CAPEX & OPEX cost is expected to reduce**

#### 4. CCUS-Cement (Oxy-fuel & CO<sub>2</sub> enrichment)

Pilot project designed by Sinoma, CNBM



Pilot project with CO<sub>2</sub> capture capacity of 50,000 t/a has been designed.

## **Part II: Policy & Future Perspective**



### **Demo CCUS projects in China: up to 2019**

- 9 for CCS, 12 for Geo-sequestration and utilization;
- 2 million t of CO<sub>2</sub> sequestered;
- Coal chemical & Power sector;
- Cement sector is taking action;
- Pilot ETS in cement sector has been implemented since 2011;
- .....

### **Challenge and Perspective of CCUS**

- Further R&D to reduce the cost;
- Policy & regulation and standards enhancement;
- Financing and business model
- Cross-sector model & international collaboration;
- .....

## **Government policy on GHG Emission Control & CCUS since 2006**

- 12<sup>th</sup> Five-Year Specialized Planning on National CCUS;
- 13<sup>th</sup> Five-Year National Plan on GHG Emission Control;
- Action Plan (2012—2020) to Cope with Climate Change in Industries;
- Technological Roadmap of China CCUS, eds.2011 & 2019;
- National ETS Market Building Plan (Power Sector, Dec.18, 2017)
- ETS Management Method launched on Dec. 25 2020 & to be enforced from Feb. 1, 2021
- .....

**“China will scale up its Intended Nationally Determined Contribution by adopting vigorous policies and measures. We aim to have CO2 emission peak before 2030 and achieve carbon neutrality before 2060”.**

**—— President XI Jinping, Statement at the General Debate of the 75<sup>th</sup> Session of the United Nations General Assembly. Sept. 22, 2020**

Collaboration & Mutual Success  
For A community with A Shared Future for Mankind



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# Discussion and Q&A

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