Learning from Brevik: Rolling out CCUS at a global scale

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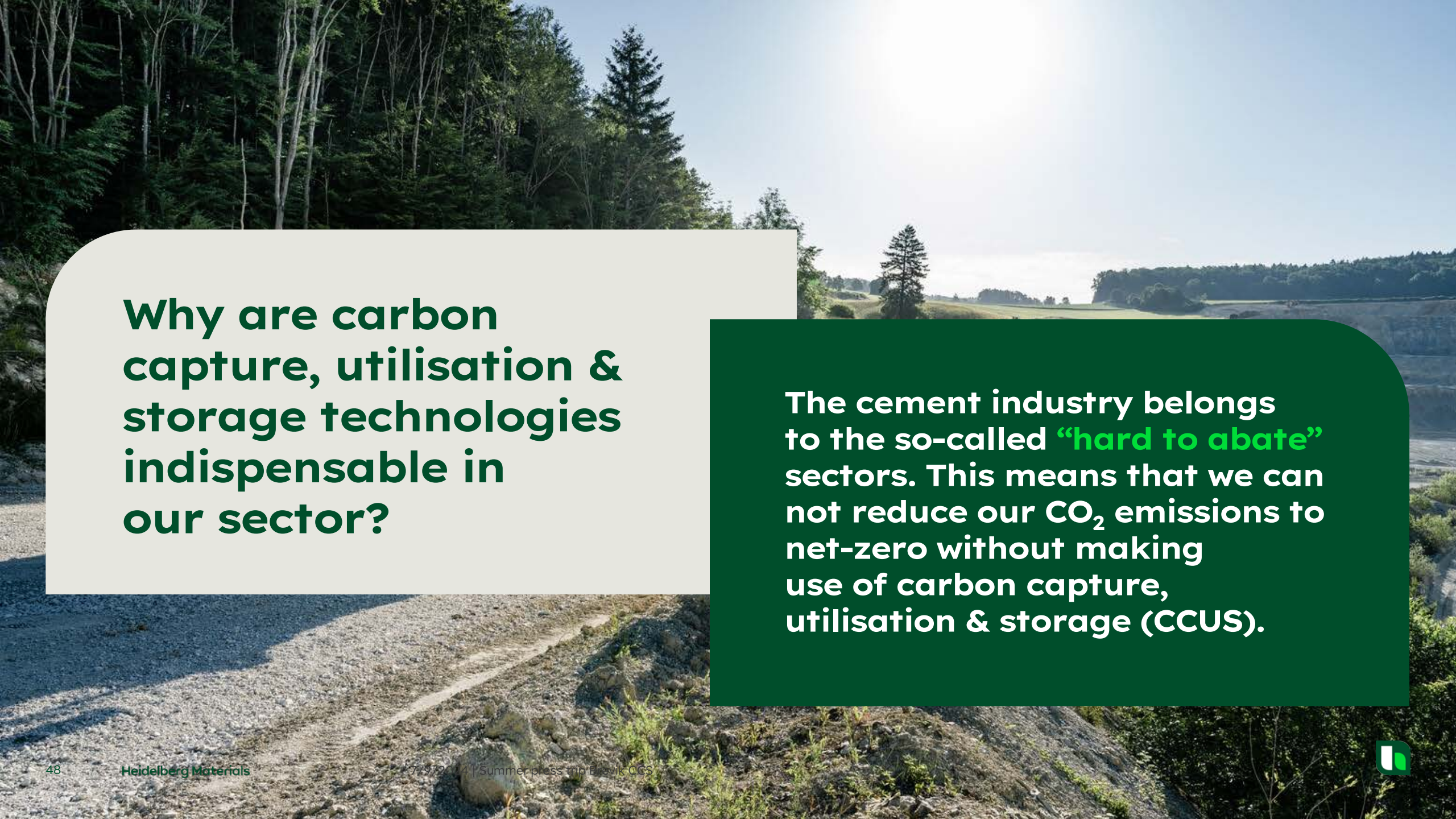
Jan leads the CCUS portfolio development at Heidelberg Materials' operations worldwide. Prior, he was Director Alternative Resources, overseeing strategy around alternative fuels, raw materials, and CO_2 utilisation and conversion.

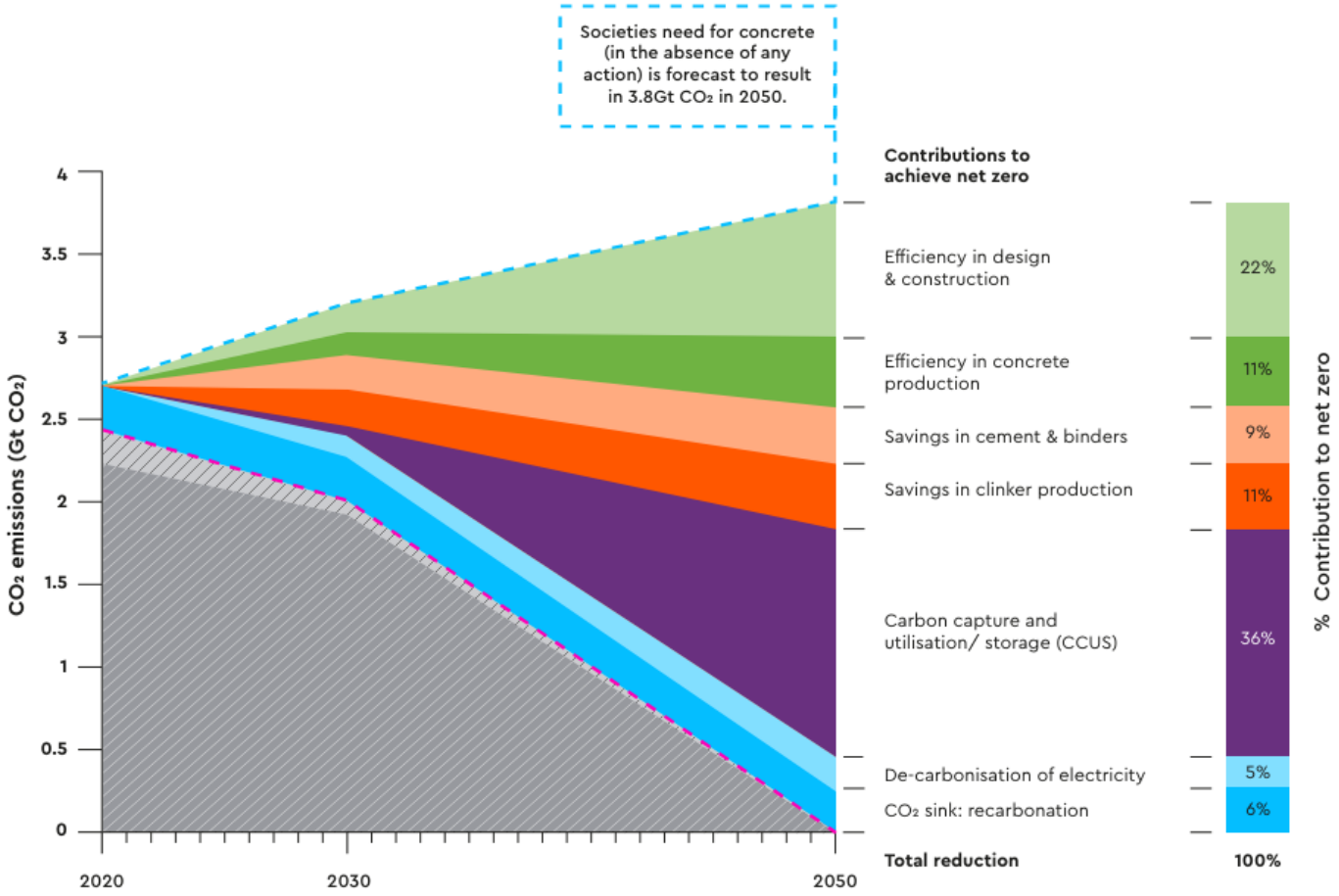
He has 25 years of experience in driving sustainability at Heidelberg Materials.



Why are carbon capture, utilisation & storage technologies indispensable in our sector?

The cement industry belongs to the so-called “hard to abate” sectors. This means that we can not reduce our CO_2 emissions to net-zero without making use of carbon capture, utilisation & storage (CCUS).

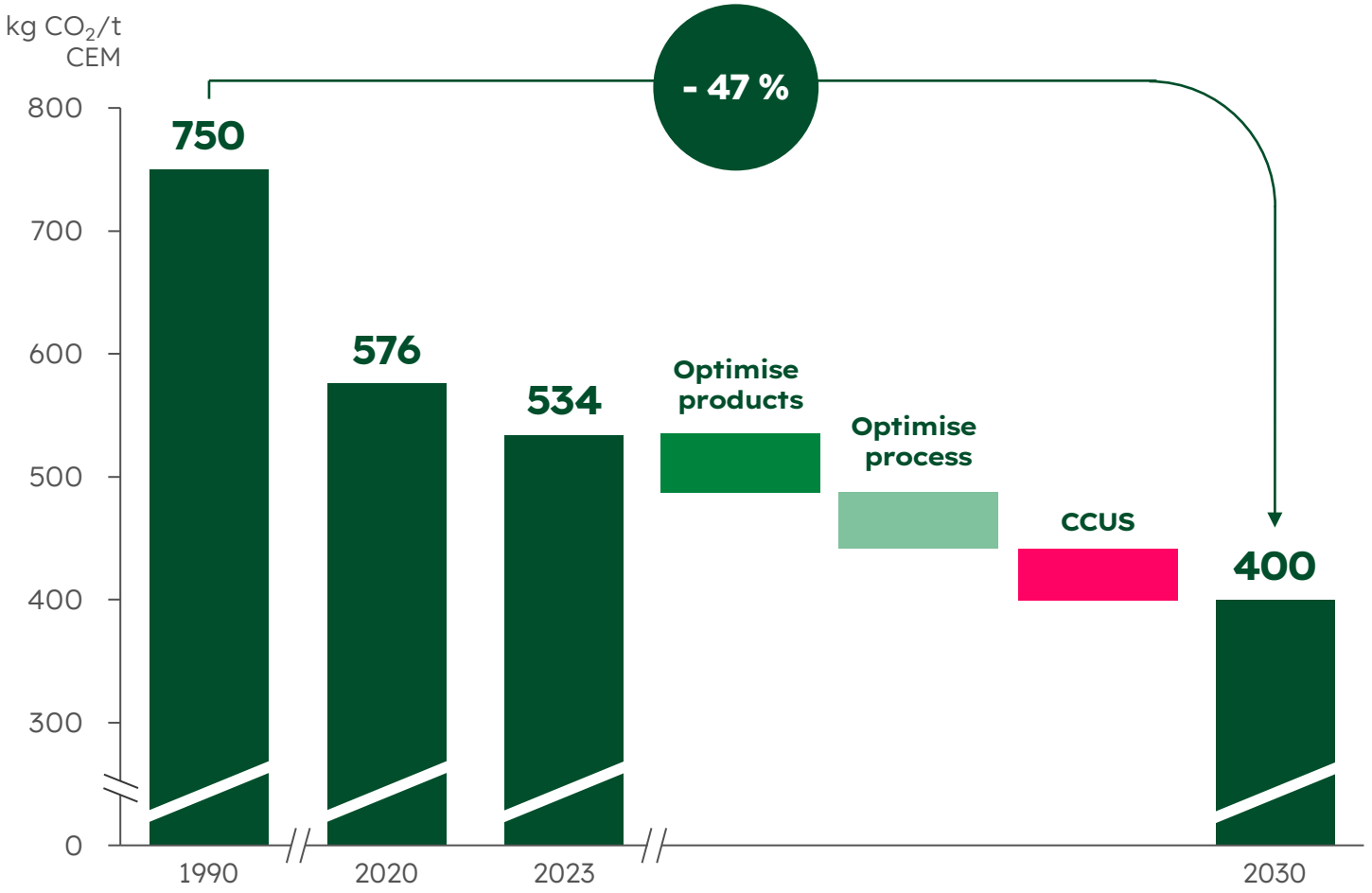
The cement industry has a clear path to net zero



The Net Zero Pathway

Global Cement and Concrete Association

We have set ambitious 2030 targets on the way towards net zero



Levers to reach our 2030 targets

- **Products**
  Clinker incorporation
  <68% Drive circularity
- **Process**
  45% Alternative fuels rate
  20% Biomass fuels rate
- **CCUS**
  10 mt CO_2 captured by 2030 (cumulative)

Building a net-zero future: our 2030 commitment

Capture

10 million tonnes

of CO_2 cumulatively through our CCUS projects

Heidelberg Materials has pledged to cut CO_2 emissions by 10 million tonnes cumulatively with several CCUS projects already underway by 2030.

Our strategic approach: Creating a large portfolio of new initiatives and scaling them up fast.

CCU and CCS are complementary – we need both to reach net zero

CCS
Large-scale
Europe and NAM

CCS
Large-scale
Worldwide

2022 — 2030 — 2050

CCU
Small- and mid-scale
Europe and NAM

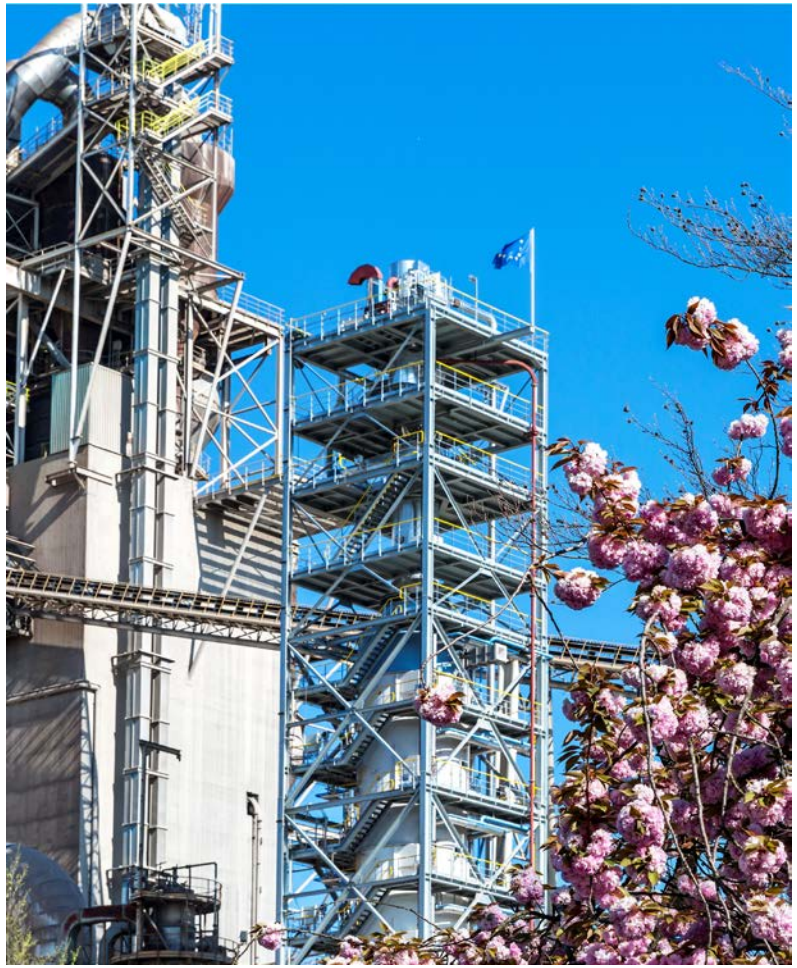
CCU
Large-scale
Worldwide

Both levers, storage and utilisation, are important for Heidelberg Materials.

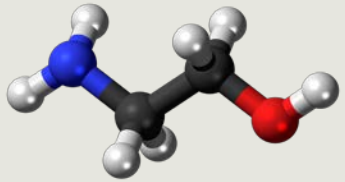
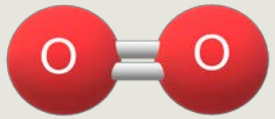
CO_2 can become a resource for fuels, chemicals etc. in the future. Also, it can be used for recarbonation or mineralisation.

The rest will be safely stored in carefully selected, permitted, and strictly controlled sequestration locations.

We are testing new technologies at serious industrial scale



We continuously explore and invest in capture technologies

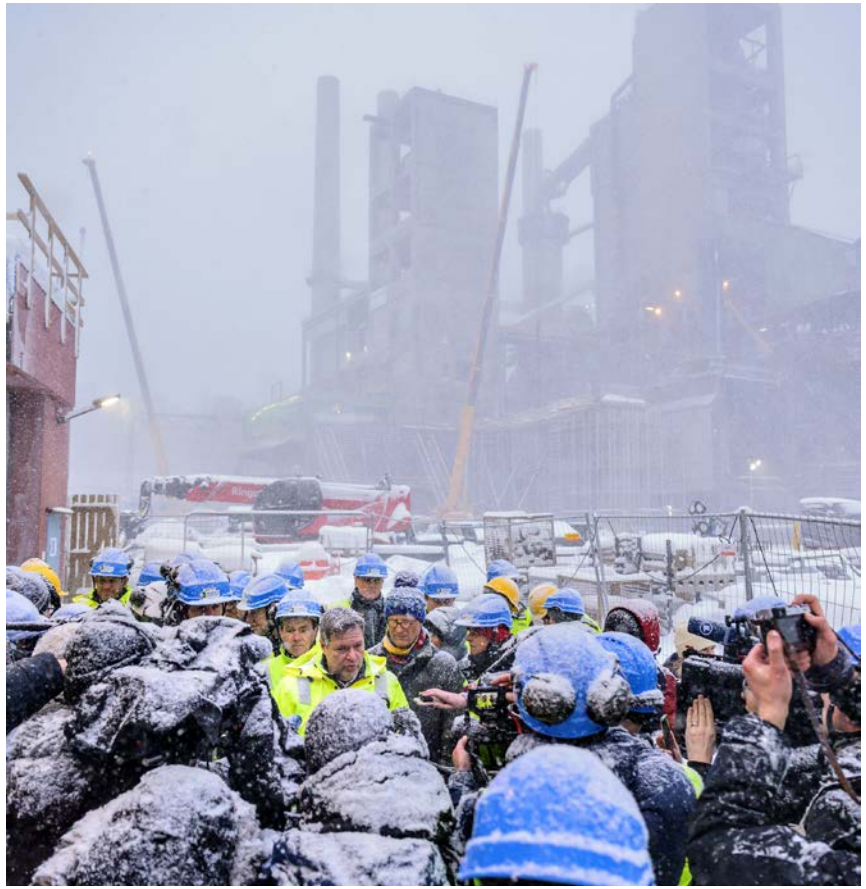
	Amine technology	Oxyfuel based technology[1]	Cryogenic technology	Other new capture technologies
				**LEILAC** • Membrane • MOF[2] • Potassium
Maturity				
Energy use				
Cost efficiency				

- **Diversified portfolio approach, to mature different technologies**
- **Intelligent combination of different technologies**

1 Combination with other technology necessary
2 Metal-organic framework

We are collaborating with all stakeholders as this is essential for success

A broad exchange between industry leaders, scientists, and policy makers is needed to ensure an environment that enables industry transformation.



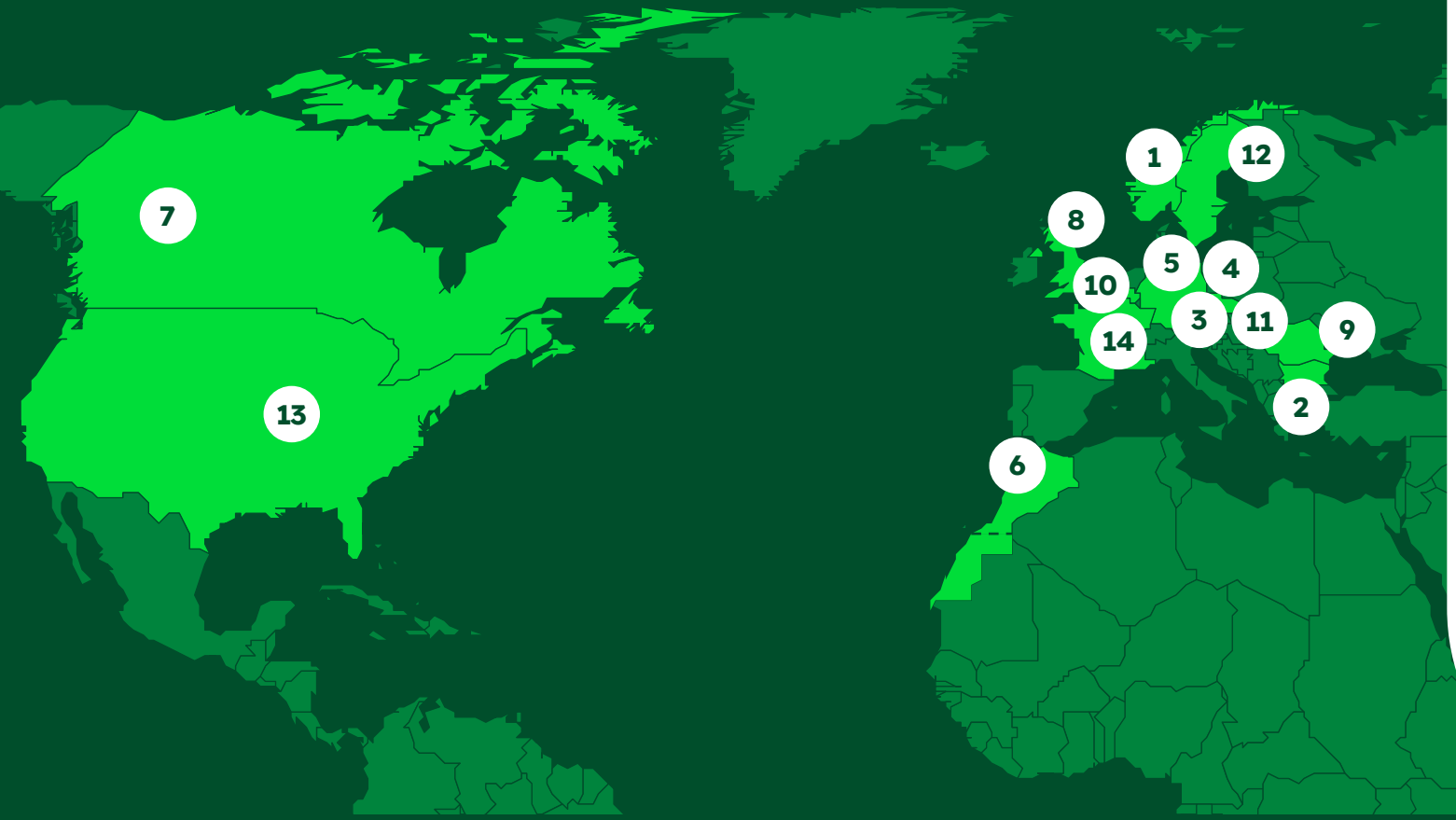
We are assembling the business cases including government funding

Large-scale cost for CCS needs to be driven down, and demand for low-carbon up to net-zero products must be strengthened

Especially important for our sector is green public procurement incentivising the offtake of climate friendly products

But of utmost importance is the need to build up a CO_2 transport infrastructure linking emission sources with storage facilities

Driving CCUS with the most advanced project portfolio in the sector



1 | CCS 2024
Brevik, Norway
400 kt CO_2 p.a.

2 | CC 2024*
Devnya, Bulgaria
OxyCal pilot site

3 | CC 2025
Mergelstetten, Germany
Oxyfuel pilot

4 | CCU 2025
Lengfurt, Germany
70 kt CO_2 p.a.

5 | CC 2026
Ennigerloh, Germany
LEILAC1+2, 100 kt CO_2

6 | CCU 2026
Safi, Morocco
Upscaling capacity

7 | CCUS 2027
Edmonton, Canada
> 1,000 kt CO_2 p.a.

8 | CCS 2028
Padeswood, UK
800 kt CO_2 p.a.

9 | CCUS 2028*
Devnya, Bulgaria
800 kt CO_2 p.a.

10 | CCUS 2029
Antoing, Belgium
800 kt CO_2 p.a.

11 | CCS 2029*
Geseke, Germany
700 kt CO_2 p.a.

12 | CCS 2030
Slite, Sweden
1,800 kt CO_2 p.a.

13 | CCUS 2030
Mitchell, USA
2,000 kt CO_2 p.a.

14 | CCS 2030
Airvault, France
1,000 kt CO_2 p.a.

***EU funded projects**
All dates estimated start of operations, timing dependent on various factors, incl. funding decision

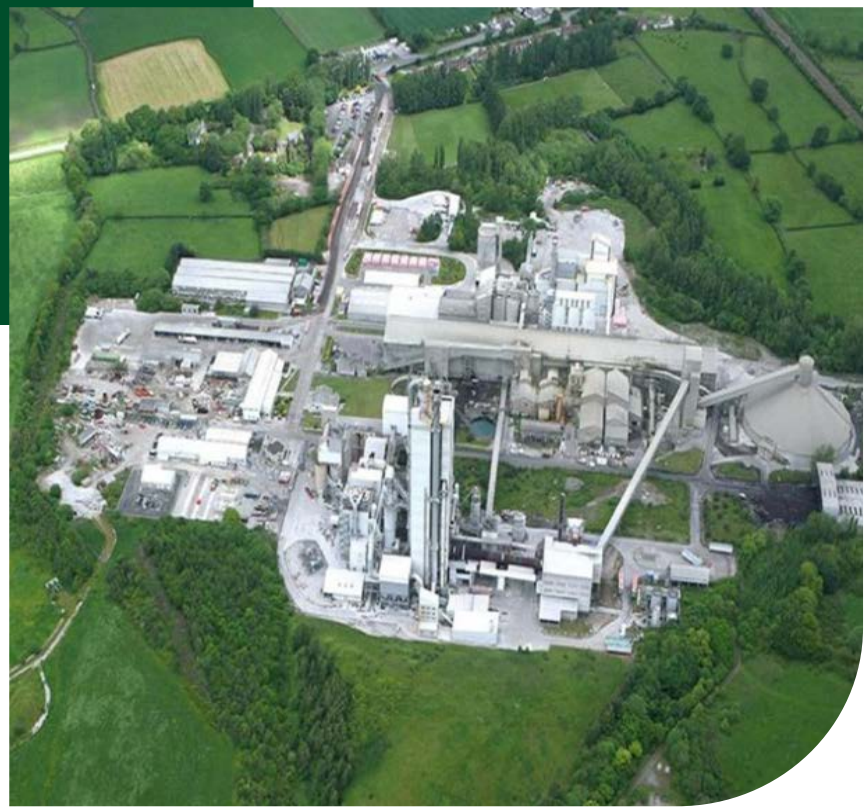
CCU Project 2025: CAP2U

Lengfurt, Germany

Amine technology

Capacity: 70 kt CO_2 p.a
Funding: German Federal Ministry for Economic Affairs and Climate Action
Sum funding: €15 million

CCUS Project 2028: HyNet North West



Padeswood, UK

Amine technology

Capacity: 800 kt CO_2 p.a.

www.padeswoodccs.co.uk

CCUS Project 2029: Anthemis

Antoing, Belgium

Hybrid OxyCal-amine technology

Capacity: 800 kt CO_2 p.a.

www.anthemis-ccs.com

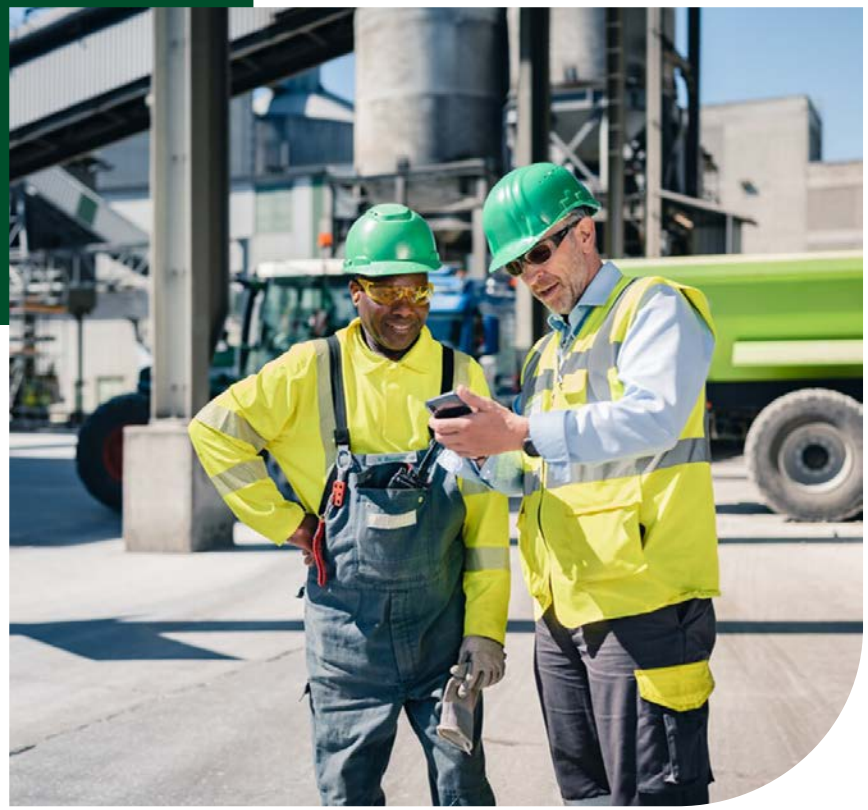
Enabling the full potential of CCUS technologies to support climate action

The swift development of national and cross-border CO_2 transport and storage networks **is a necessary precondition for its wider deployment.**

Our recommendations

- Significantly **increase the EU's CO_2 storage capacity,** including onshore storage for plants located at inland locations.
- Secure a sufficient geographical coverage by **coordinating EU and national CO_2 infrastructure and storage planning**.
- **Include carbon removals under the EU ETS framework**, in the medium term, as the recognition of these technical sinks is also critical for achieving a net-zero status in the EU.
- **Acknowledge CO_2 reduction benefits of CCU applications** in accounting rules, based on a stringent verification and environmental assessment. Thereby, clearly distinguish between unavoidable process emissions from industrial sources and avoidable fossil CO_2.

Without CCUS, we can’t get to net zero



Key take aways

A wide range of measures **is applied by cement industry to get to net zero**

- CCUS is one of these measures, **and without it we can’t get to net zero**
- Heidelberg Materials is driving **CCUS projects around the globe and continuing R&D as well as commercialisation by** evoZero®
- **Collaboration, funding and** pipeline infrastructure **is required to reach our common targets**

Thank You.

Heidelberg Materials