We drive deep decarbonisation

2022 Capital Markets Day – 24 May
Jan Theulen
Director Technologies & Partnerships
Accelerating carbon capture is a key lever of driving decarbonisation.

- 47% CO₂

Optimise products
Optimise process
CCUS

kg CO₂/t CEM

1990 2020 2021 2030
750 576 565 400
The unavoidable process emissions of our clinker manufacturing require CCUS.

Captured and utilised (CCU) or stored (CCS)

Reduced through waste-derived fuels and more efficient energy use

⅔ of CO₂ emissions from limestone

⅓ of CO₂ emissions from fuels
We have a large portfolio of new technologies and are scaling them up fast.
We focus on resource- and cost-efficient capture technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Maturity</th>
<th>Energy use</th>
<th>Cost efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amine technology (Post combustion capture)</td>
<td>![Maturity Icon]</td>
<td>![Energy Use Icon]</td>
<td>![Cost Efficiency Icon]</td>
</tr>
<tr>
<td>Oxyfuel technology</td>
<td>![Maturity Icon]</td>
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</tr>
<tr>
<td>LEILAC technology (Direct separation)</td>
<td>![Maturity Icon]</td>
<td>![Energy Use Icon]</td>
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</table>
We are an early mover and scaling up fast

WE DRIVE DEEP DECARBONISATION

Amine Brevik, Norway
LEILAC 1 Belgium
Oxyfuel Germany
LEILAC 2 Germany

2014  2018  2024  ~ 2028  ?
WE DRIVE DEEP DECARBONISATION

We are an early mover and scaling up fast

Amine Brevik, Norway
LEILAC 1 Belgium
Oxyfuel Germany
LEILAC 2 Germany

2014
2018
2024
~ 2028
?

Amine Norway 0.4 mt p.a.
We are an early mover and scaling up fast

WE DRIVE DEEP DECARBONISATION

Amine Norway
0.4 mt p.a.

LEILAC 1
Belgium

Oxyfuel
Germany

LEILAC 2
Germany

Oxyfuel Eastern
Europe 0.8 mt p.a.

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2014 2018 2024 ~2028 ?

Amine Brevik, Norway
LEILAC 1 Belgium
Oxyfuel Germany
LEILAC 2 Germany

Demo Full Scale
**W E  D R I V E  D E E P  D E C A R B O N I S AT I O N**

We are an early mover and scaling up fast

Amine Norway

0.4 mt p.a.

**Demo**

2014

LEILAC 1
Belgium

2018

Oxyfuel
Germany

2024

LEILAC 2
Germany

**Full Scale**

~ 2028

Oxyfuel Eastern Europe 0.8 mt p.a.

2014

Amine Brevik, Norway

2018

LEILAC 1
Belgium

2024

Oxyfuel
Germany

~ 2028

Oxyfuel Eastern Europe 0.8 mt p.a.
Brevik CCS, Norway

In Brevik we are building the world’s first CCS plant in the cement sector on an industrial scale.

**Timeline:** Capture unit operational in 2024

**Storage:** Northern Lights

400,000t

CO₂ reduction p.a.
We are rapidly progressing on many large-scale CCUS projects globally.
We are developing CCUS projects with solid technologies and leading partners (I)

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**Case Study**

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<th>Scanning</th>
<th>Initiation</th>
<th>Feasibility</th>
<th>Realisation</th>
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<tbody>
<tr>
<td>Accessible CO₂ storage</td>
<td>Team up with partners</td>
<td>Executing Pre-FEED</td>
<td>FEED and construction CCUS chain</td>
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<tr>
<td>Stakeholder acceptance</td>
<td>Check techno-economics</td>
<td>Secure storage</td>
<td>Prepare operational team</td>
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<tr>
<td>Governmental support</td>
<td>Building up local capacity</td>
<td>Create business case</td>
<td>Realise customer value</td>
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**Alberta**

- Edmonton-Alberta CCUS has been developed over the last 4 years and is on track to be the first NAM CCS plant

**Case Study**

- Lehigh Cement and Enbridge to collaborate on North American carbon sequestering solution

**2026**

- 800,000t CO₂ reduction p.a.
We are developing CCUS projects with solid technologies and leading partners (II)

We Drive Deep Decarbonisation

Case study

Bulgaria

**Scanning**
- Accessible CO₂ storage
- Stakeholder acceptance
- Governmental support

**Initiation**
- Team up with partners
- Check techno-economics
- Building up local capacity

**Feasibility**
- Executing Pre-FEED
- Secure storage
- Create business case

**Realisation**
- FEED and construction CCUS chain
- Prepare operational team
- Realise customer value

Devnya-Bulgaria CCUS fast-tracked with only 2 years development and will be the first CCUS plant in Eastern Europe

2028
800,000t
CO₂ reduction p.a.
**WE DRIVE DEEP DECARBONISATION**

First projects where we utilise the CO₂ captured in our plants (CCU)

<table>
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<th>CO₂ flows</th>
<th>Processes</th>
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<td>Cement / Concrete</td>
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<tr>
<td>Mineralisation</td>
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<td>Other materials</td>
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First projects where we utilise the CO$_2$ captured in our plants (CCU)

- Cement / Concrete
- Mineralisation
- Other materials
- Conversion with H$_2$
- Biological conversion

High focus of HC; previous presentation of Group R&D

Carbonation to face-bricks
First projects where we utilise the CO₂ captured in our plants (CCU)

WE DRIVE DEEP DECARBONISATION

- Cement / Concrete
- Mineralisation
- Other materials
- Conversion with H₂
- Biological conversion

High focus of HC; previous presentation of Group R&D
Carbonation to face-bricks
E-fuels trial as part of CI4C
Micro-algae for fish and animal feed

Safi Morocco 0.5 ha in operation since 2019
CCU and CCS are complementary – we need both to reach net zero

**WE DRIVE DEEP DECARBONISATION**

Large-scale Worldwide

Large-scale Europe and NAM

Small- and mid-scale Europe and NAM

2022

2030

2050
As the early mover, we will capture 10 mt of CO$_2$ with our already started CCUS projects by 2030.
Driving CCUS with extensive and most advanced project portfolio in the sector

Our mature CCUS projects

- **CCUS 2026**
  - Edmonton – Alberta
  - Capacity: 800 kt CO₂ p.a.

- **HyNet North West**
  - Padeswood – UK
  - Capacity: 800 kt CO₂ p.a.

- **Carbobrick**
  - Lixhe – Belgium
  - Capacity: 12 kt CO₂ p.a.

- **CCU 2019**
  - Capacity: 50 t CO₂ p.a.

- **CCUS 2019**
  - LEILAC 1: finalised
  - LEILAC 2: engineering

- **CCS 2028**
  - Brevik – Norway
  - Capacity: 400 kt CO₂ p.a.

- **CCU 2026**
  - Slite – Sweden
  - Capacity: 1.8 mt CO₂ p.a.

- **CC 2024**
  - Two large scale CCS projects in Eastern Europe

- **CCS 2024**
  - Devnya – Bulgaria
  - Capacity: 800 kt CO₂ p.a.

- **CCU 2019**
  - Oxyfuel demo – Germany

- **CCS 2030**
  - CCS ~2030

- **CCUS 2028**
  - CCS 2028

- **LEILAC 1: finalised**
  - CCS 2019

- **CCS 2028**
  - CCS 2026

- **CCUS 2026**
  - CCUS 2028

- **WE DRIVE DEEP DECARBONISATION**

- **Driving CCUS with extensive and most advanced project portfolio in the sector**

- **Our mature CCUS projects**

- **LEILAC 2: engineering**

- **Oxyfuel demo – Germany**

- **CCS 2024**

- **CCU 2019**

- **CCUS 2026**

- **Brevik – Norway**
  - Capacity: 400 kt CO₂ p.a.

- **Slite – Sweden**
  - Capacity: 1.8 mt CO₂ p.a.

- **Devnya – Bulgaria**
  - Capacity: 800 kt CO₂ p.a.
1. We have a large portfolio of new technologies and are scaling them up fast.

2. We are rapidly progressing on many large-scale CCUS projects globally.

3. As the early mover, we will capture 10 mt of CO$_2$ with our already started CCUS projects by 2030.
We are HeidelbergCement. Leader in deep decarbonisation.