We drive sustainability through innovation

2022 Capital Markets Day – 24 May
Dr Wolfgang Dienemann
Director Global Research & Development
Optimising our products through innovation is a key lever to drive sustainability.

Thereby, we transform construction and meet our customers’ need for sustainable products and solutions.
We advance the formulation of cement all the way to carbon-free.
Researching clinker replacements is key to reduce CO₂ footprint of cement

Important considerations for supplementary cementitious material (SCM)

- Locally available materials
- Pozzolanic or hydraulic properties
- Recycled materials and waste materials from other industries
- Sufficient reserves
- Cost efficient logistics

Products

<68%
clinker incorporation and drive circularity
WE DRIVE SUSTAINABILITY THROUGH INNOVATION

We explore new formulations with established materials

Natural pozzolan in Iceland

Prospects
– Bringing the historical use to a new industrial dimension

USP
– Superior quality due to fast cooling (glacier):
  – High reactivity
  – Denser structure
  – Low water demand

Timing
– Secured access to 100 mt reserve of pozzolan
– Plant capacity of 1 mt p.a. (starting 2025/26)
We use a wide range of materials for clinker replacement

Calcined clay

Prospects
– Systematically screening potential clay sources worldwide

USP
– Up to 50% clinker replacement when combining calcined clay and limestone

Timing
– Recently announced JV in Ghana will build the world’s largest flash calciner
– Further projects in the pipeline e.g. in Africa – timeline: 2023/2024
We collaborate closely with partners from steel and other industries

**Future steel and metal slags**

**Prospects**
- Steel industry also in transformational process

**USP**
- Enable use of future waste streams from iron production as early mover

**Timing**
- Several projects underway with industry partners
- State-funded (BMBF) project “SAVECO2” with ThyssenKrupp with a budget of €2.2 m
We are implementing ground-breaking recycling and CO$_2$ mineralisation technologies.
WE DRIVE SUSTAINABILITY THROUGH INNOVATION

We close the loop of materials and CO₂ in the concrete lifecycle
We identified optimal technologies for advanced recycling and scaling them up

Low-pressure grinding allows efficient **separation of demolished** concrete into:

- Sand
- Aggregates/gravel
- Recycled concrete paste (RCP)

**Recycled aggregates and sand** can replace up to **100%** of natural virgin material.

**Putting innovation into action:**

- Pilot in Germany commissioned in Q3 2021
- Poland follows end 2022 to advance technologies
We make multiple use of RCP advantages and pioneer its carbonation

<table>
<thead>
<tr>
<th>Giving new life to used concrete through a CO₂-negative process</th>
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<tr>
<td><strong>We use RCP for clinker production</strong></td>
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<tr>
<td>− Replace limestone in raw meal</td>
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<td>− Calcium oxide in RCP is 80 % CO₂-free</td>
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<td>− Reduces need for virgin materials</td>
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<td><strong>We use RCP as filler</strong></td>
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<tr>
<td>− Replacing limestone</td>
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<td>− Improved circularity</td>
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<tr>
<td>− Low-cost solution</td>
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<td><strong>We use RCP to store CO₂ permanently</strong></td>
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<td>− Carbonated RCP acts as a pozzolan</td>
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<td>− World’s 1st industrial-scale pilot</td>
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<td>− Secured 5 patents</td>
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We use both as clinker replacement
We can build on our agile R&D team and trustful collaborations with partners.
ReConcrete-360° wins German Innovation Award for Climate & Environment 2022

Category: "Process Innovations for Climate Protection"
for an innovative ReConcrete-360° concept
1. We advance the formulation of cement all the way to carbon-free.

2. We are implementing ground-breaking recycling and CO$_2$ mineralisation technologies.

3. We can build on our agile R&D team and trustful collaborations with partners.
We are HeidelbergCement.
Leader in sustainable innovation.