CEMCAP is a Horizon 2020 project that will prepare the grounds for cost- and resource-effective CCS in European cement industry.

CEMCAP is positioned to:
- Utilize competence and knowledge from ongoing and concluded CCS projects for power industry.
- Complement the Norcem CCS project by testing and evaluating additional post-combustion capture technologies.
- Strengthen and advance the ongoing ECRA CCS project for cement industry (component testing for oxyfuel).

Key figures:
Duration: May 2015–October 2018
Budget: 10,030 kEUR
EC contribution: 8,779 kEUR
Swiss government funding: 704 kEUR
Industrial funding: 547 kEUR
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Making CO₂ capture retrofitable to cement plants

- CO₂ emissions from the cement production process constitute ~5% of global anthropogenic CO₂ emissions.
- CO₂ generation is an inherent part of the cement production process where CaCO₃ is converted to CaO and CO₂.
- The only viable option to significantly reduce GHG emissions from the cement industry is (CCS).
- Cement plant lifetime is 30-50 years or more. CEMCAP therefore investigates technologies for CO₂ capture retrofit.

The CEMCAP framework document provides a common and consistent basis for analytical and experimental research in the project. The framework document will be made public by the end of 2017.

Above: CEMCAP – iterating between experimental and analytical research.
Below: CO₂ capture technologies investigated in CEMCAP – characteristics as anticipated at project startup.

<table>
<thead>
<tr>
<th>CO₂ capture principle</th>
<th>Post combustion</th>
<th>Membrane-assisted CO₂ liquefaction</th>
<th>Calcium looping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oxyfuel</strong></td>
<td>Exhaust passes through a cold NH₄-water mixture, which absorbs CO₂. CO₂ is released as heat is added to the solution in a subsequent vessel.</td>
<td>A polymeric membrane is used to increase exhaust CO₂ concentration. CO₂ is separated through condensation after compression and cooling.</td>
<td>CaO particles react with CO₂ to form CaCO₃. CO₂ is released in a subsequent vessel through the addition of heat.</td>
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<tr>
<td><strong>Chilled ammonia</strong></td>
<td>Retrofit possible through modification of burner and clinker cooler.</td>
<td>Retrofit appears simple, minor modifications required for heat integration.</td>
<td>No modifications of cement plant. SOₓ, NOₓ, H₂O removal required upstream of capture unit.</td>
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<td><strong>Calcium looping</strong></td>
<td>CaCO₃/CaO integration: Waste from capture process (CaO) is cement plant raw material.</td>
<td></td>
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</tr>
</tbody>
</table>

Required cement plant modifications
- Retrofit possible through modification of burner and clinker cooler.
- Retrofit appears simple, minor modifications required for heat integration.
- No modifications of cement plant. SOₓ, NOₓ, H₂O removal required upstream of capture unit.
- CaCO₃/CaO integration: Waste from capture process (CaO) is cement plant raw material.

Clinker quality
- Maintained quality must be confirmed.
- Unchanged.
- Unchanged.
- Clinker quality likely to be maintained.

CO₂ purity and capture rate
- CO₂ purification unit (CPU) needed. High capture rate and CO₂ purity possible (trade-off against power consumption).
- Very high CO₂ purity, can also capture NOₓ, SOₓ. High capture rate possible.
- High CO₂ purity (impurities present). Trade-off between power consumption and CO₂ purity and capture rate.
- Rather high CO₂ purity (minor/moderate CO₂ impurities present). High capture rate.

The CEMCAP consortium consists of:
- Cement producers: Norcem, Italcementi, HeidelbergCement
- Technology providers: GE Carbon Capture, GE Power Sweden, IKN, ThyssenKrupp Industrial Solutions
- RD&I providers: SINTEF Energy Research, ECRA, TNO, ETH, IFK/University of Stuttgart, Politecnico di Milano, CSIC, VDZ

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