**Overall Roadmap**

**cement industry decarbonisation of the Roadmap for the**

<table>
<thead>
<tr>
<th>Transformation pathway</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fossil fuels (Phase-out)</strong></td>
<td>Fossil fuels only if absolutely necessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase share of waste-based fuels (only processed, non-recyclable waste)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct use of renewable electricity for process heat (bivalent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green hydrogen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainable biomass (from energy crop cultivation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>New concretes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Concrete efficient construction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Differentiated, CO₂ and resource-optimised use of cement/concrete according to application requirements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot-/demonstration plants</td>
<td>Conversion / construction of carbon capture (full scale) at cement plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCU through mineralisation: development / expansion of decentralised utilisation structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot-/demonstration plants</td>
<td>CCU (chemicals/fuels) at selected sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demo CCS chain up to storage</td>
<td>CO₂ storage in offshore storage sites (Norway, Netherlands, possibly UK)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of supraregional CO₂ infrastructure (connecting cement plants with users and seaports)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Drivers**

- Increasing CO₂ price
- Digitisation
- Development towards a circular economy - including recycling of demolished concrete and concrete components
- Development of CO₂ storage sites and construction of CO₂ transport infrastructures in other European countries
- (Possible) future carbon demand of the chemical/fuel industry

**Barriers**

- Lack of economic viability compared to conventional construction / production and imports
- Limited availability and high costs of renewable energy carriers
- Limited availability of suitable input materials
- Challenges of integrating NCC into construction practice
- Today’s legal framework
- Lack of CO₂ infrastructure
- Low social acceptance (especially locally) for pipeline infrastructures

**Fields of Action**

- Legal framework
- Creation of level-playing field
- Preservation of level-playing field
- Integrated, cross-sectoral energy strategy
- Niches for / promotion of CO₂-efficient construction methods
- Integration of new cements / binders / concretes / construction technologies in building practice
- Development of a comprehensive circular economy in the construction industry
- Planning of CO₂ infrastructure
- Construction and ongoing planning of the CO₂ transport infrastructure
- Social dialogue on CO₂ infrastructure and local participation processes
- R&D (direct electrification, use of H₂, new cements and concretes, other options for permanent CO₂ bonding)

**Vision 2050**

- Significant reduction in fossil CO₂ quantities from the provision of process heat
- Minimising the generation of process-related CO₂ through clinker efficiency
- CCUS (only) for CO₂ quantities that cannot be avoided in any other way
- Permanent binding / storage of captured CO₂ as far as possible
- Utilising CO₂ as a carbon source where appropriate
- Climate-positive contributions from biogenic fuels in combination with CCUS
- Contributing to a circular economy as far as possible