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Paving the way for carbon neutral concrete production:

Cement recycling as a CCU technology

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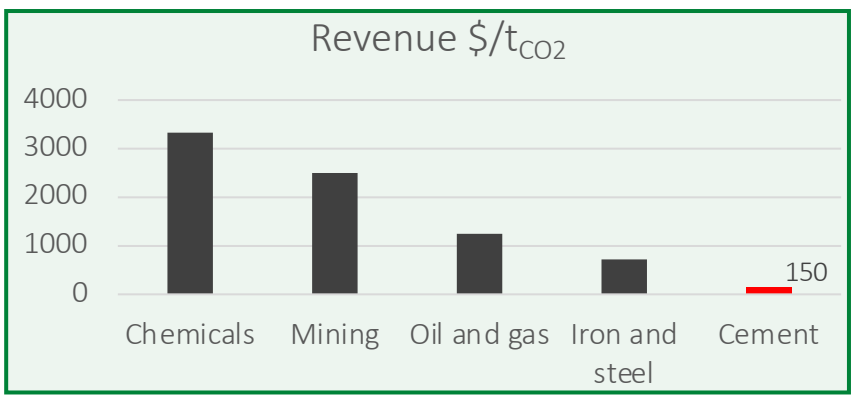
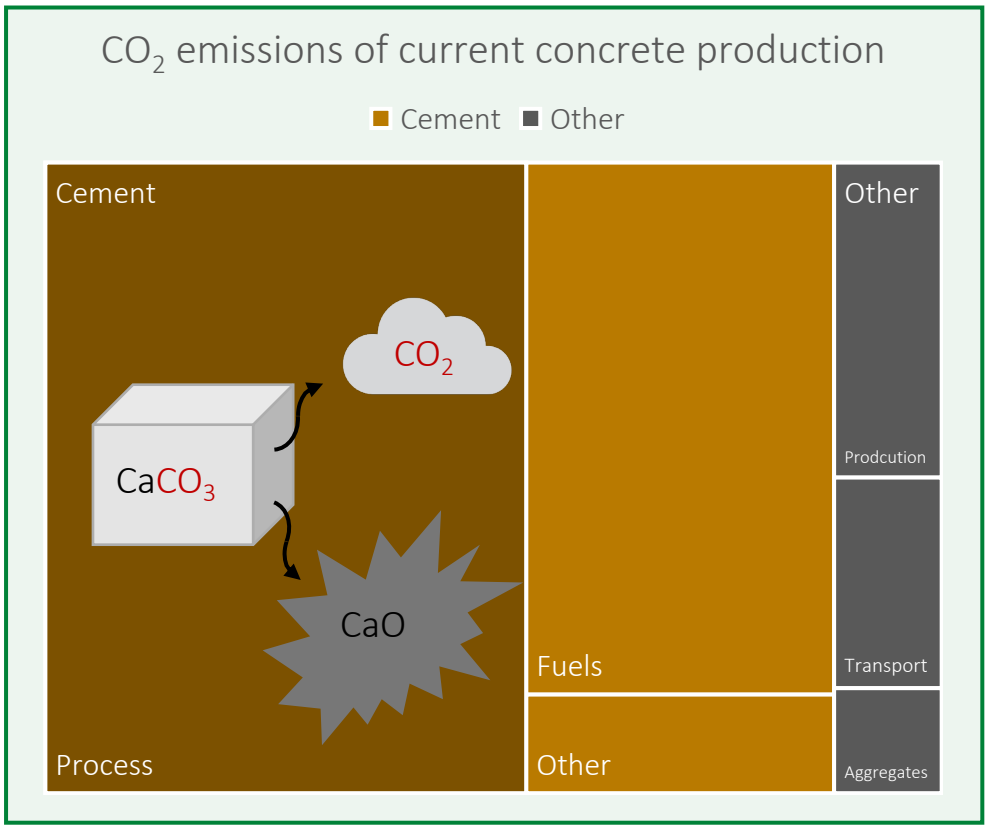
Huge economical and technical challenges to reduce CO_2 emissions

– Most of concrete CO_2 emissions originate from cement, resp. clinker production

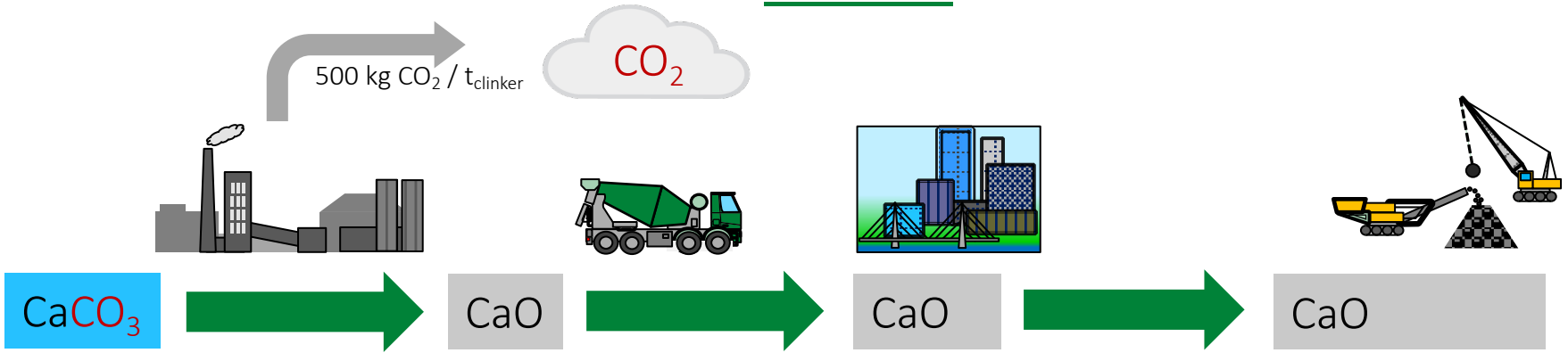
– About 500 kg $CO_2/t_{clinker}$ originates from limestone (=process emissions)

– Process emission cannot be avoided at scale for reasonable costs





Concrete at end of its service life is a large source of decarbonated CaO



Limestone

Stable on Earth's surface
Abundant Ca source

Clinker & Cement

CaO bound in silicate and aluminates

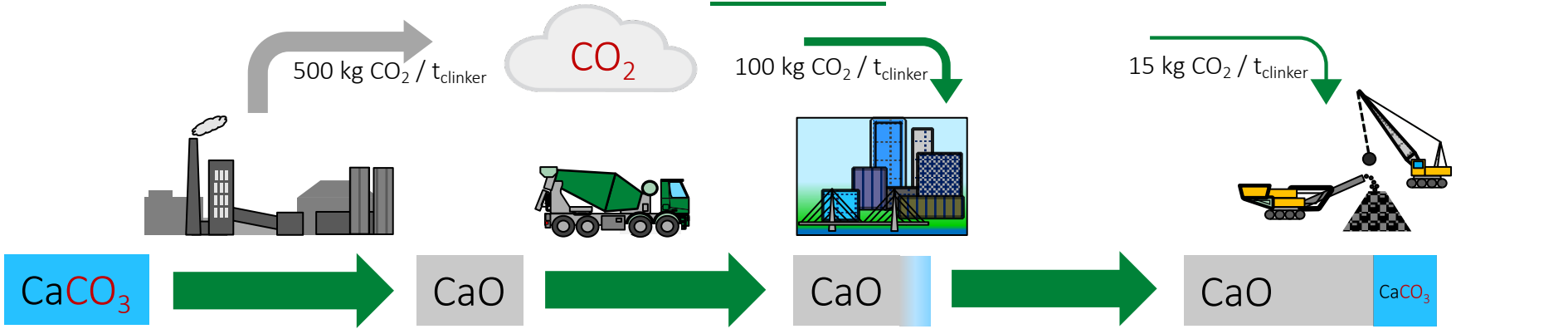
Concrete

CaO bound in hydrates
$Ca(OH)_2$, CaO_x-SiO_2-H_2O, …

Demolished concrete

CaO carbonate to~23 %
Remaining CaO in hydrates

CaO in concrete spontaneously binds CO_2 when in contact with air



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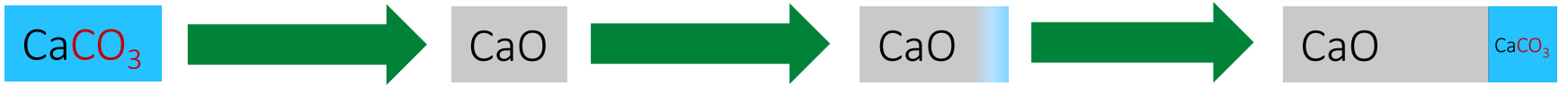

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Recycled sand and aggregates

Selective separation

Recycled concrete paste (RCP)

Rich in CaO-bearing hydrates
~77 % CaO is CO_2-free

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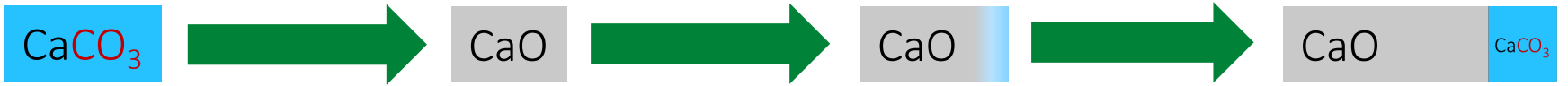

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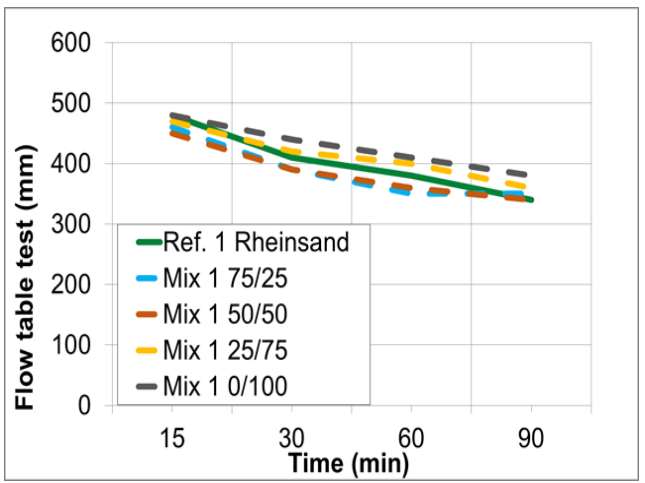

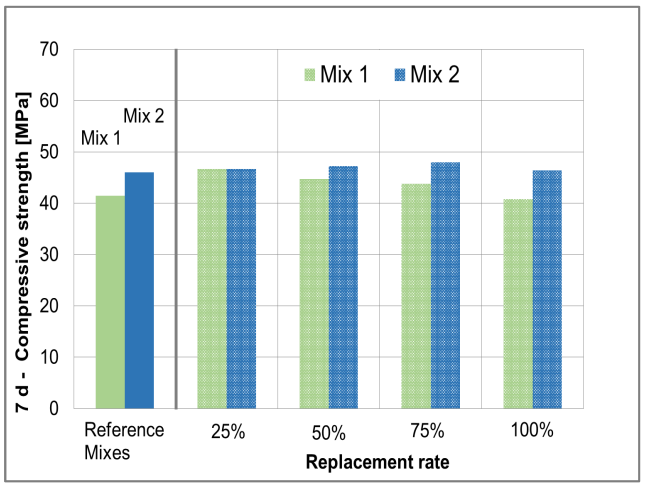

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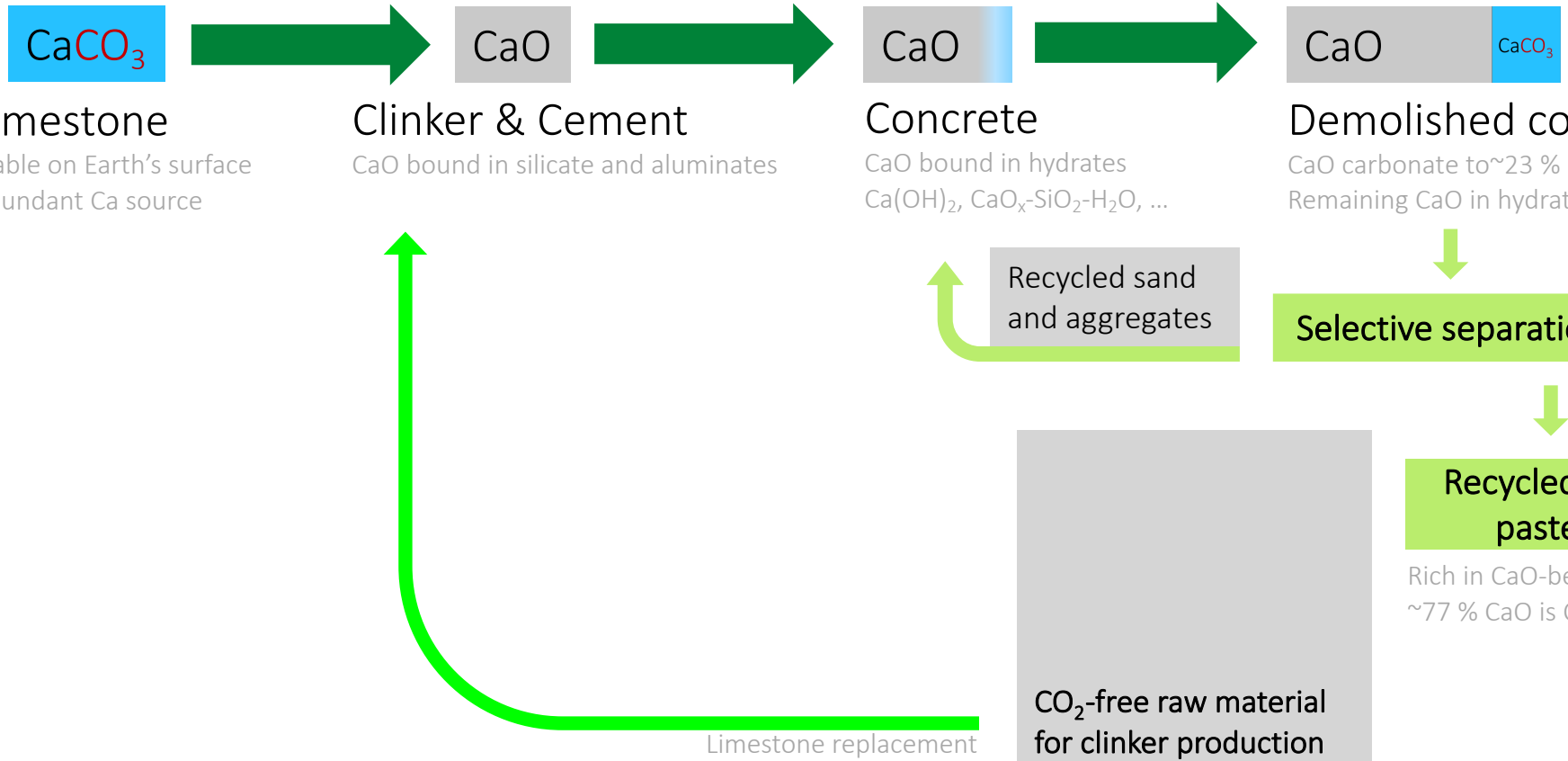
Recycled concrete paste can be used in clinker and cement production



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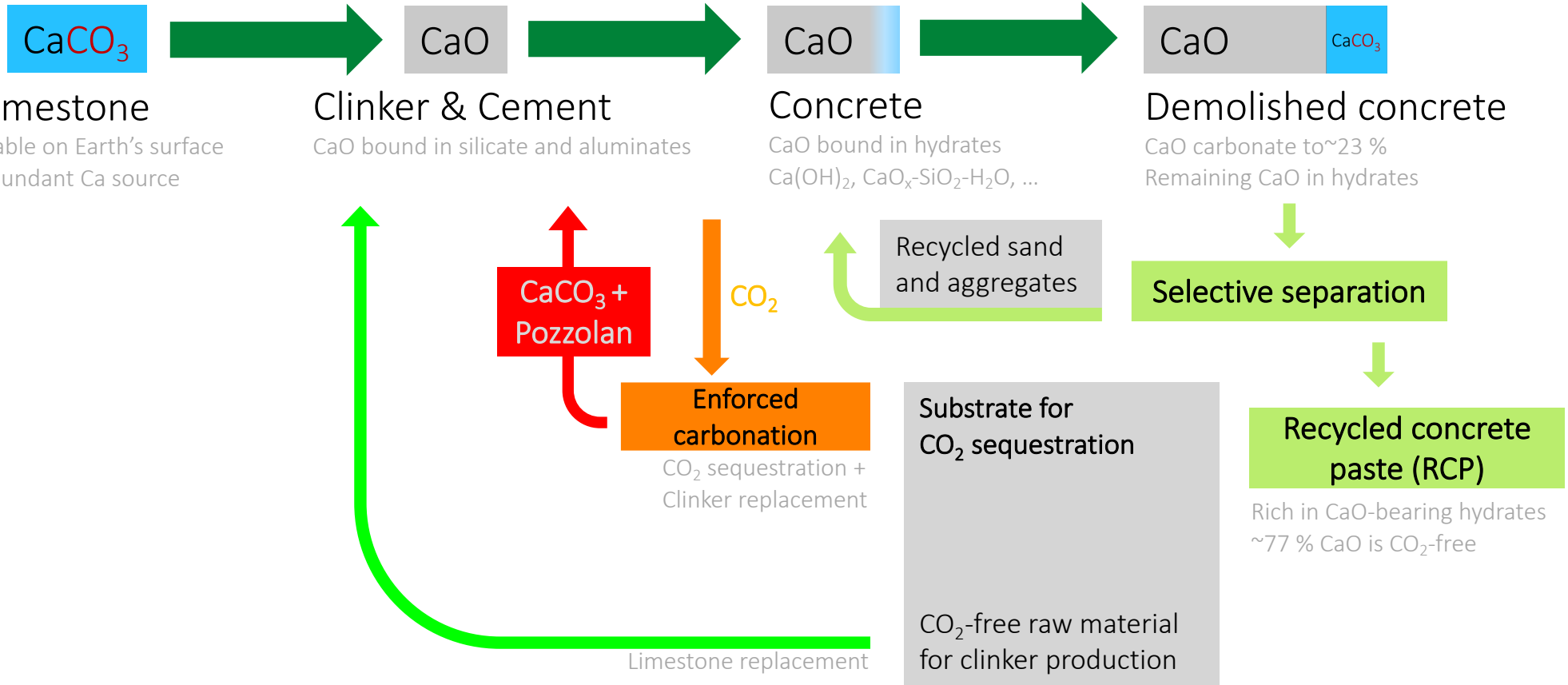

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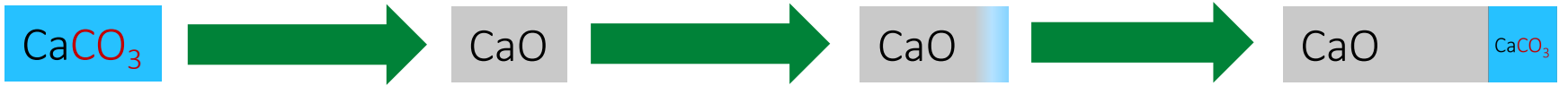

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- ✓ Promoting circular economy
- ✓ Independent of other industries
- ✓ Cost-competitive to other CCUS
- ☒ **Technology not yet available**
- ☒ **New materials vs. standards**

$CaCO_3$ + Pozzolan

CO_2

Enforced carbonation
CO_2 sequestration +
Clinker replacement

Recycled sand and aggregates

Selective separation

Recycled concrete paste (RCP)
Rich in CaO-bearing hydrates
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Limestone replacement

Substrate for CO_2 sequestration

CO_2-free raw material for clinker production

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