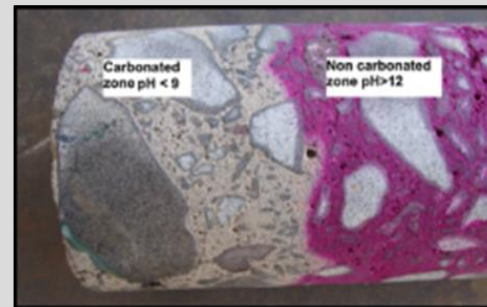


HeidelbergCement's engagement and projects in recarbonation of concrete

Rob van der Meer

Director EU Public Affairs

CO2Value Europe, 19 September 2019



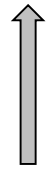
Cement manufacturing explained in 1 minute

1,6 ton limestone
+ 0,1 ton coal



1 ton cement
+ 0,8 ton CO₂

Flue gas with
20% CO₂

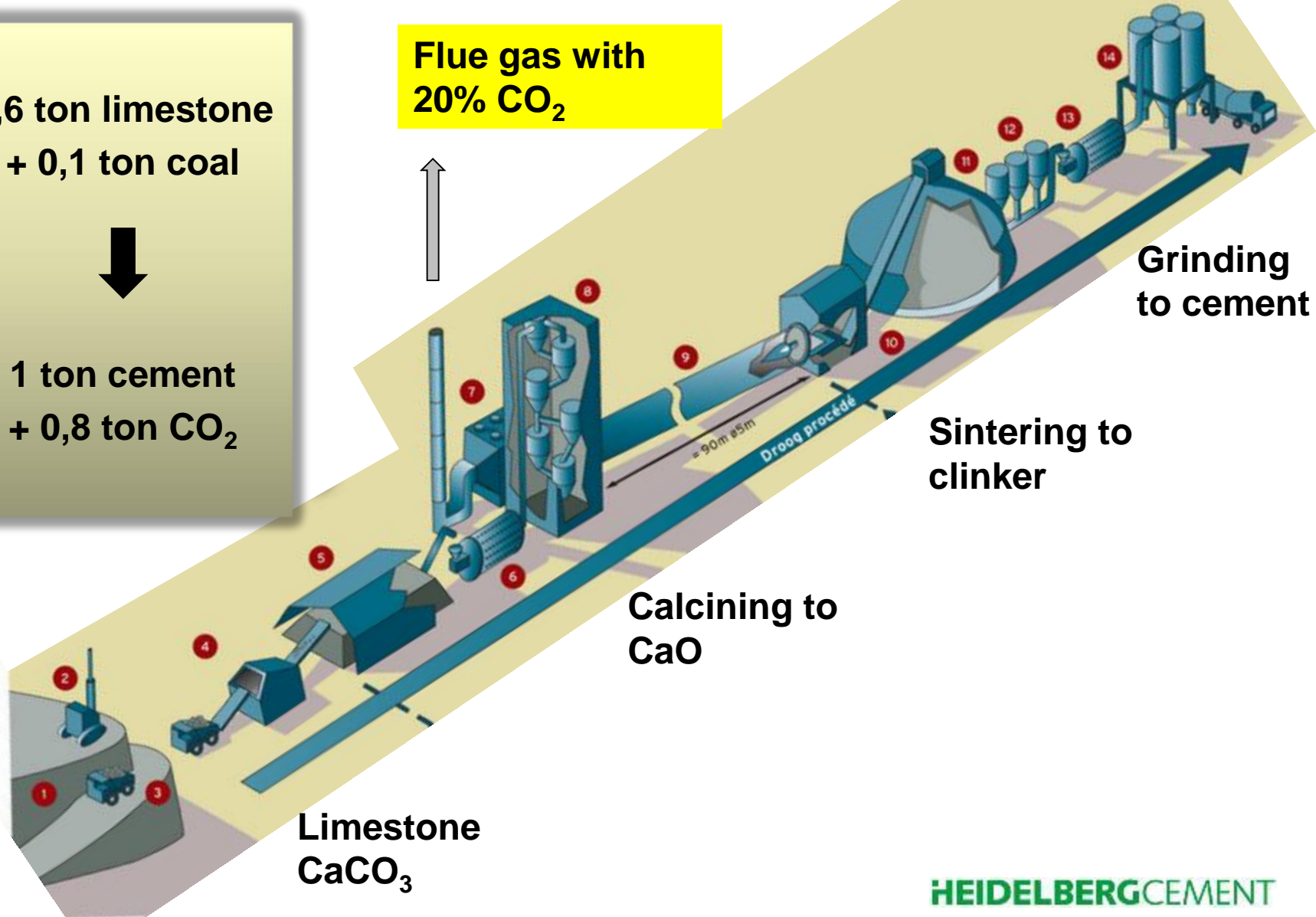


Grinding
to cement

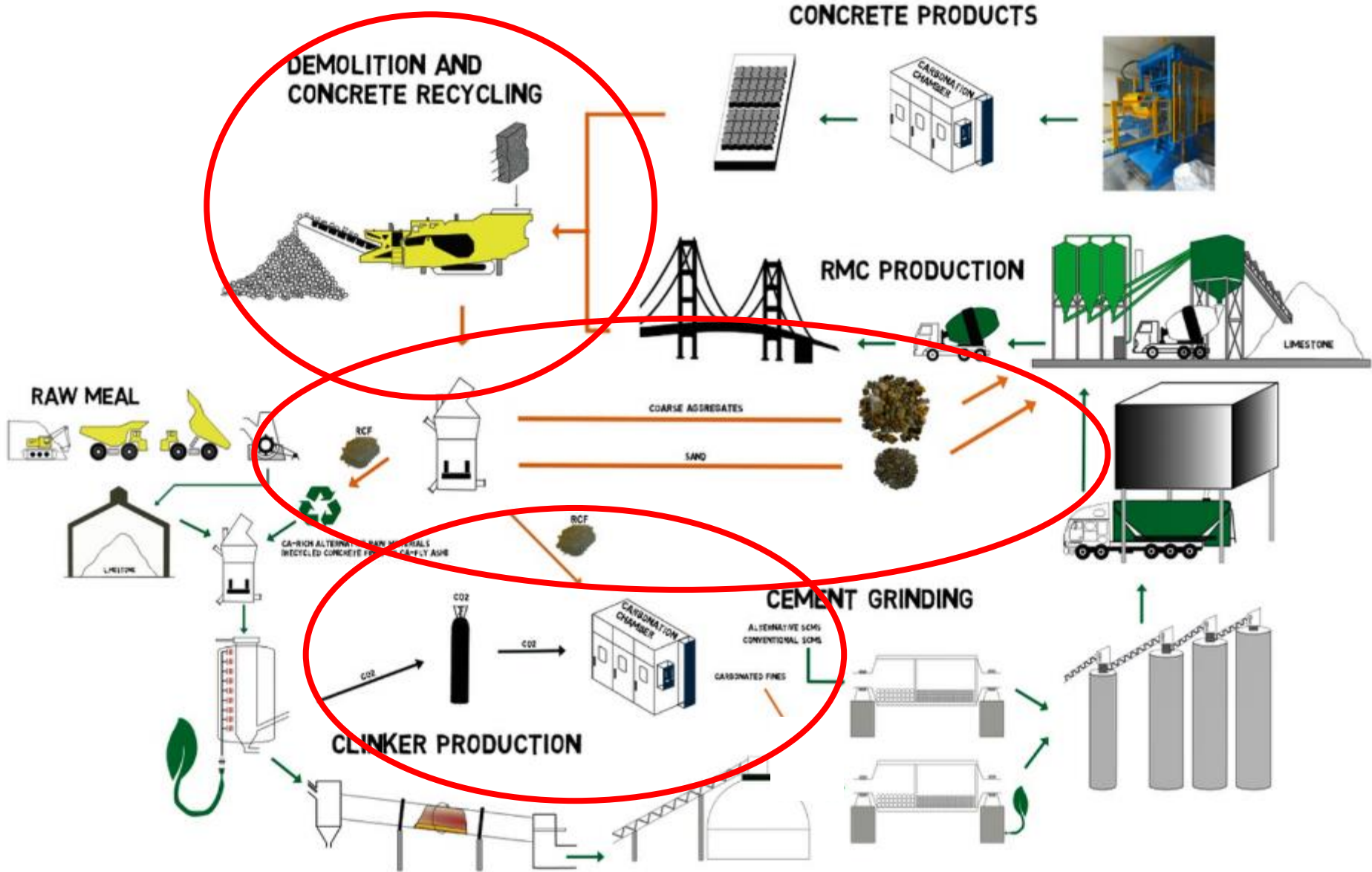
Sintering
to
clinker

Calcining
to
CaO

Limestone
CaCO₃

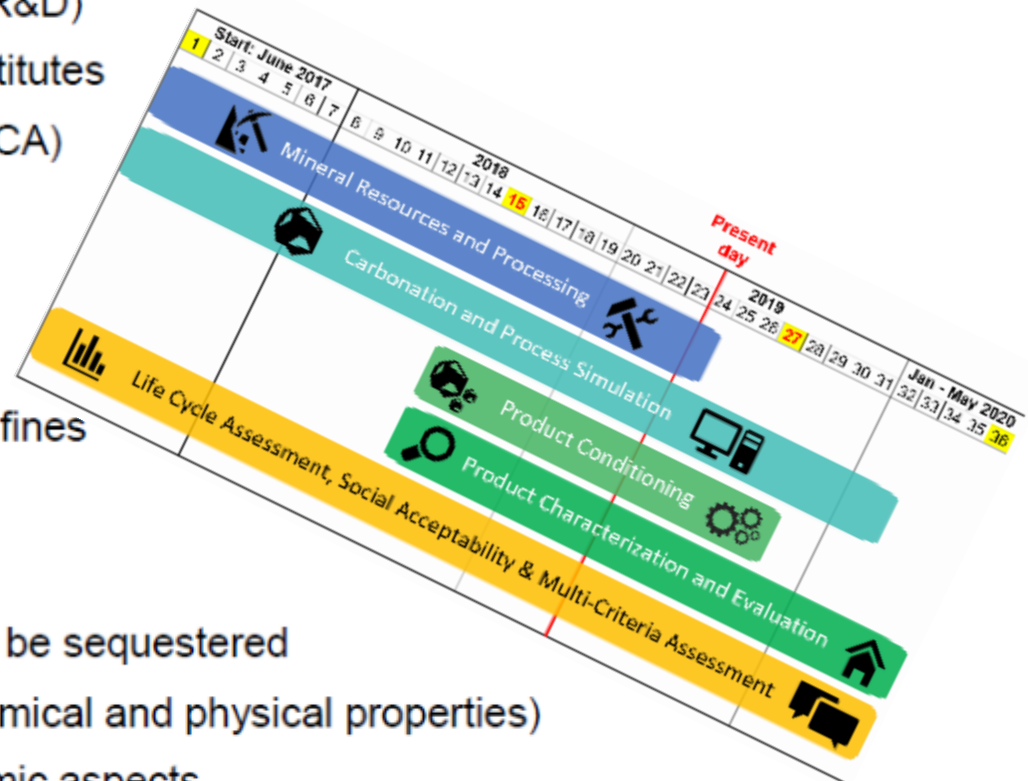


HeidelbergCement Vision 2050



Using natural minerals and by-products for carbonation: CO2MIN

- BMBF-funded program (3 m€) with next project partners
 - HeidelbergCement (HTC Global R&D)
 - RWTH Aachen present with 5 institutes
 - IASS Potsdam (Stakeholders + LCA)
- Minerals to be investigated:
 - Natural: basalt, olivine
 - By-products: steel-slag, concrete fines
- Focus points:
 - How much and how fast can CO₂ be sequestered
 - Value of generated products (chemical and physical properties)
 - Energy-balance, LCA and economic aspects



Re-carbonation in concrete

■ Theoretical re-carbonation quantity

Material	CO_2^{theor} (kg/kg)
Quick lime	0.785
CEM I	0.5
CEM I fully hydrated	0.35
Slag (typical)	0.3

Max CO_2 uptake linked to CaO + MgO % in material

CEM I maximum binds **0.5 kg CO_2 /kg cement**

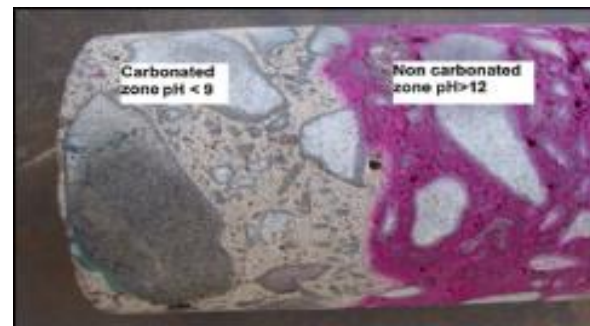
This equals to all CO_2 released by limestone during calcination!

■ Re-carbonation speed in mm/year^{0.5}

Concrete strength (cylinder=)	< 15 MPa	15 to 20 MPa
Parameters	Value of k-factor, in mm/ye	
Civil engineering structures		
Exposed to rain		2,7
Sheltered from rain		6,6
In ground ^a		1,1
Buildings		
<u>Outdoor</u>		
Exposed to rain	5,5	2,7
Sheltered from rain	11	6,6
<u>Indoor in dry climate ^c</u>		
With cover ^b	11,6	6,9
Without	16,5	9,9





Carbonation penetration 'only' 1-16 mm/year^{0.5} at:

- atmospheric conditions (P, T, humidity)
- ambient air: 0.04% CO_2



Re-carbonation in fresh concrete

Quantitative example: NL – hollow floor structures

Vloerproducten	Woningbouw (overspanning 5-6 m.)	Overige (kantoren etc.) (overspanning 6-14 m.)
Breedplaatvloer 	5,5	0,5
Kanaalplaatvloer 	2,5	2,0
Ribben vloer 	1,0	1,0
Combinatievloer 	1,5	0,1
Diversen	0,2	0,9
TOTAAL	10,7	4,5

Tabel 5.1. De markt van prefabvloeren (in $m^2 \times 10^6$), gemiddelde over de periode 1995 – 2000; Ref. [22].

Market size hollow floor NL

- 4.5 million m^2 floor / year
- 4% of cement use in NL

Re-carbonation potential

- “Canal”-floor 36%
- Massive floor 5%

NL impact potential: - 1.5% !

Re-carbonation in fresh concrete

■ Objective:

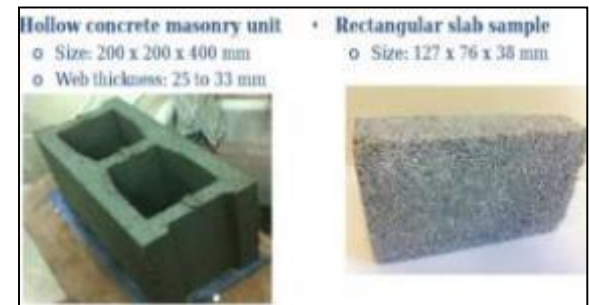
Investigate potential of accelerating re-carbonation of cement in concrete by design optimization and curing casted concrete products in a CO₂-rich atmosphere.

■ Key success factors

- Performance of concrete product during its lifetime
- Analyse largest benefit towards climate change
 - Natural carbonation during lifetime
 - Accelerated carbonation at production in workshop
- Adapt product design to CO₂-uptake potential
- Collaboration in the supply chain

■ Unique aspects for CCU

- Applying known technologies and equipment
- Existing markets, no regulation barriers
- Limited need for (green) electricity



Recarbonation of concrete fines: what is needed ?

■ Technology

- Energy-efficient crushing/separation
- Start-ups are active
- Large equipment manufacturers are also focussing on it



■ Logistics

- Transport from fines to the cementplant
- Or transport of CO2 to recycling site



■ Regulation

- Ban on landfilling of concrete
- Promote complete recycling including the concrete fines

CO₂ a challenge and an opportunity.....



Contacts:

Rob van der Meer
Group Communications & IR
rob.vandermeer@heidelbergcement.com
+32 475652950