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The European Cement Association

CO2 Fast Carb

June, 24th - 2019

Laury Barnes-Davin
R&D Corporate Director
Vicat Group

- ! Technical feasibility → Easy technology
- ! Economical feasibility → Insertion in existing value chain
- ✓ Carbon feedstock for aggregates
- ✓ Creation of new jobs
- ✓ Recycling and reduction of waste
- ✓ Carbon capture and storage / permanent storage

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Stockage de CO_2 par carbonatation du béton recyclé

PROJECT SUPPORTED BY THE FRENCH MINISTRY IN CHARGE OF ECOLOGY

- A project with a dual ambition within the Act on energy transition for green growth. Two objectives of the Act are compliant with our project:
  - Cut greenhouse gas emissions to contribute to the target of a 40% decrease in EU emissions by 2030 (compared with 1990 levels), with the goal to obtain buildings with low carbon footprint throughout their life cycle,
  - Cut waste going into landfills by 50% by 2050, promote circular economy integrating the recycling of materials with an objective for the construction sector to recover 70% of its waste by 2020.
- The positive use of a natural phenomenon i.e. the carbonation of concrete, that we usually want to limit.
- "CO_2 sequestration in cement-based materials can be thought as the most burden free and realistic alternative for the sequestration of CO_2" (Jang et al., 2016

Utilization of a natural phenomenon

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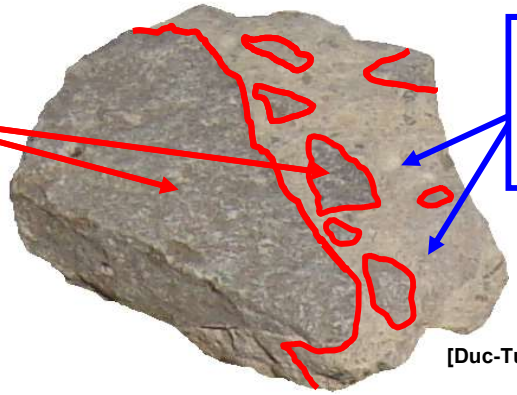
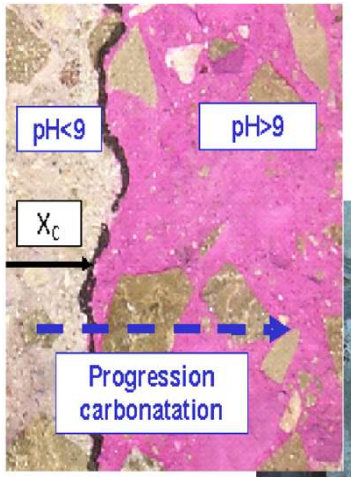
Natural aggregate



Cement paste

[Duc-Tung Dao, 2012]



Recycled Concrete Aggregate (RCA)

Natural carbonation during life cycle 15-20%CO_2 captured ➡

⬅ Forced and accelerated carbonation >50%CO_2 captured

Ministère de la Transition écologique et solidaire

IFSTTAR

IREX Institut pour la recherche appliquée et l'expérimentation en génie civil

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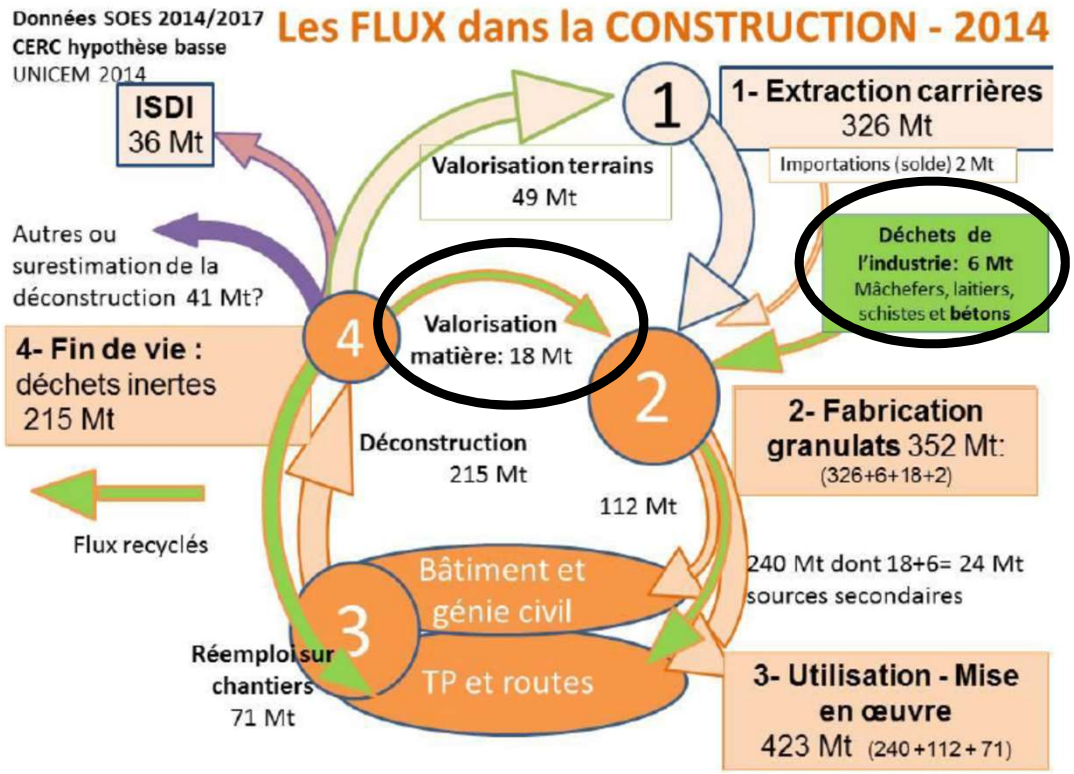
An existing Value Chain

Present application of the natural process to the Lavallée project in France.
Recycling of 100 000T of concrete (for roads and buildings)
But a (small) part will be carbonated and used on site.



In the continuity of other projects

PROJET NATIONAL RECYBETON
Le RECYclage complet des BÉTONs

Interreg North-West Europe
SeRaMCo

Fast Carb

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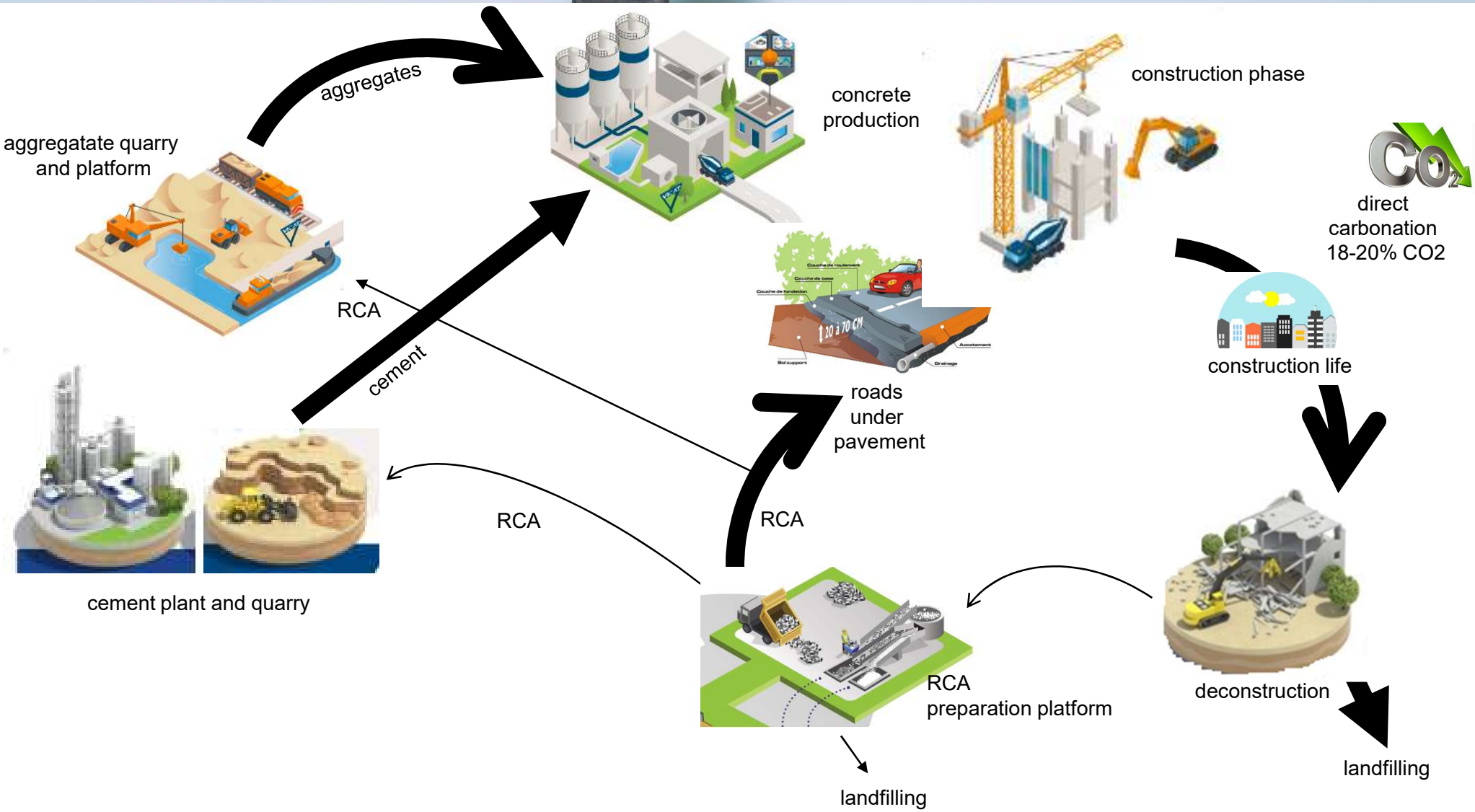
VALUE CHAIN



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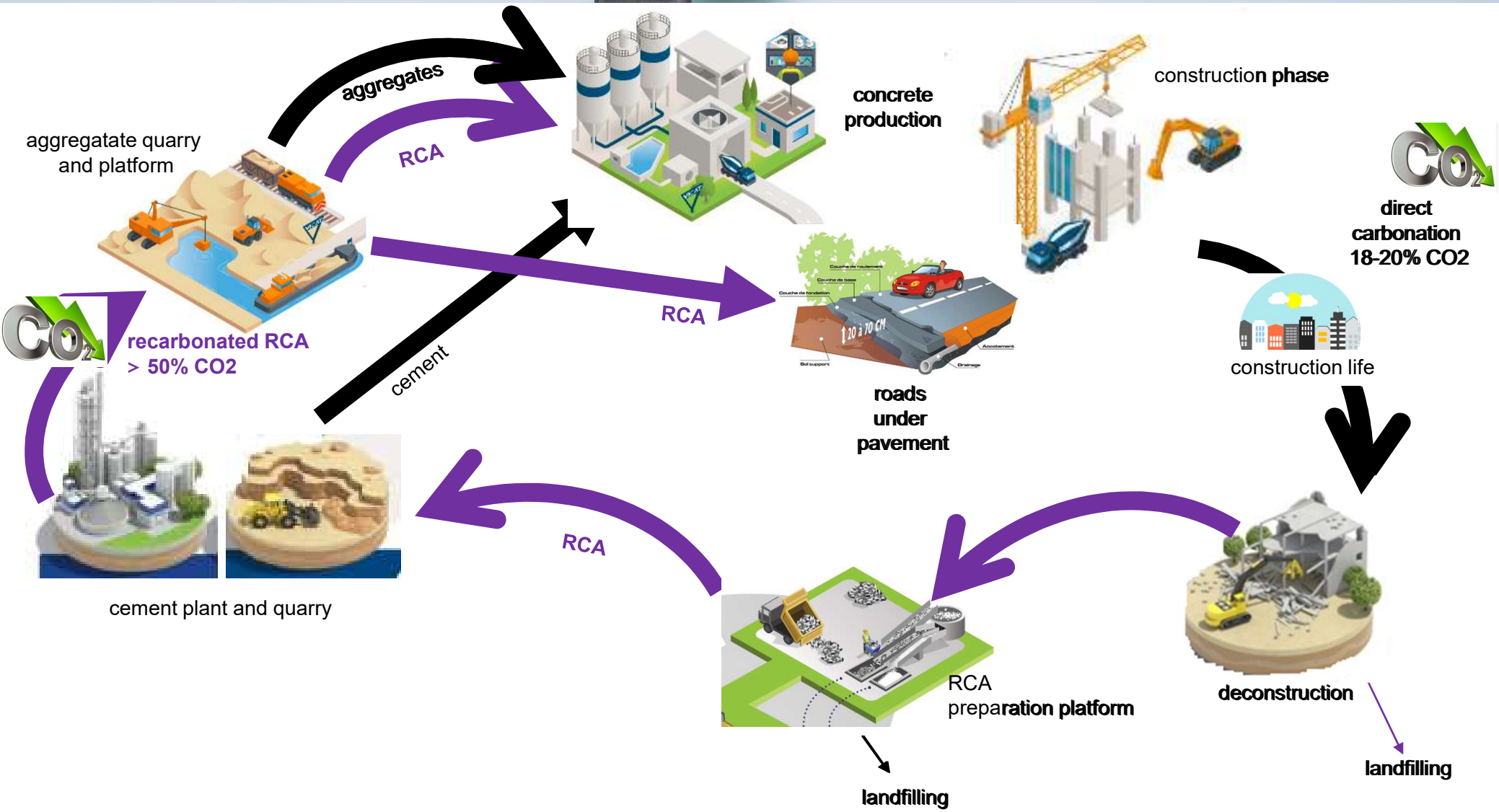
VALUE CHAIN



OBJECTIVES OF THE FASTCARB PROJECT

- Know how to model the phenomenon to optimize it in relation to the main parameters: saturation, temperature, total / partial pressure, size of the RCA, duration of the treatment…
  - Laboratory experimentation
  - Benchmark of models
  - Estimation of the natural carbonation of a building
- Transition to an industrial level
  - Technical feasibility
  - Application to prefabricated concretes and ready-mix concretes
  - Environmental and economic study: where does the cursor go??

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PRIVATE AND PUBLIC PARTNERS

Fast Carb

22 PARTENAIRES

ATILH · CEMEX · CERIB Expertise concrète · Ciments Calcia · Clamens · CSTB le futur en construction · École des Ponts ParisTech · Université Paris-Est · Marne la Vallée · EQIOM Groupe CRH · ESTP Paris · FFB · GeM Institut de Recherche en Génie Civil et Mécanique · iCUBE · IFSTTAR · IREX · LafargeHolcim · LaSIE · Ministère de la Transition Écologique et Solidaire · nicolas-jacquemet.com · SNBPE · UNPG · VICAT

5 european cement producers already involved → **High replicability**

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FASTCARB BUDGET (2017 TO 2020) : 3M€

- PARTNERS PARTICIPATION 300,0 K€
- ADD PARTICIPATION OF ATILH 52,5 K€
- FRENCH MINISTRY : 800,0 K€
- CONTRIBUTION IN KIND : 1 882,5 K€

TRL WILL IMPROVE FROM 3 TO 6/7

TO ACCELERATE (2020 TO 2025) : NEED PUBLIC FUNDINGS AND REGULATION ADAPTATION

- 3M€ MORE TO ACCELRATE SEMI-INDUSTRIAL TRIALS
- ESTIMATED 30M€ TO REACH TRL9
  - 15M€ industrial unit: for first installations
  - 15M€ to create waste treatment platforms,
  - To integrate low carbon transport in the value chain such as hydrogen powered lorries
- TO PUSH NATIONAL REGULATION FOR RECARBONATED RCA UTILISATION IN CONSTRUCTION

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Carbonation during Life Cycle – Bibliography

Study	Gajda & Miller	Jacobsen & Jahren	Nordic Innovation Centre				Clear & De Saulles	Galán et. al.
Year	2000-2001	2002	2005				2007	2009
Country	USA	Norway	Denmark	Norway	Sweden	Iceland	UK	Spain
Life cycle	-	8 - 11 (14-19)	30 (51)	21 (36)	20 (34)	18 (31)	22 ± 4 (37 ± 7)	
Service life	4.4 (7.5)	-	13 (22)	10 (17)	11 (19)	15 (26)	-	2 (3)

CO_2 taken up by carbonation as % of total emissions from clinker production
(figures in brackets is % of calcination emissions)
Time span: 70-100 years

Study	Andersson et. al.	Engelsen & Justnes	Vermeulen	Fitzpatrick et. al.	Leemann et. al.	Xi et. al.
Year	2013	2014	2017	2015	2018	2016
Country	Sweden	Norway	Netherlands	Ireland	Switzerland	Global
Life cycle	17 (27)	18 (29)	23 (37)			28 (44)
Service life	14 (23)	15 (24)	19 (30)	10 (16)	10 (16)	

CO_2 taken up by carbonation as % of total emissions from clinker production
(figures in brackets is % of calcination emissions)
Time span: 50-100 years
Netherlands figure includes CO_2 uptake in slag

~15-20% of CO_2 is recaptured during building life cycle

Uptake in demolition and recycle phase **much lower** than early studies!