Emission Reductions in the Cement Sector – Progress to date and implications for policy

Karsten Neuhoff, Bruno Vanderborght, Arjan van Rooij, Phlilippe Quirion, Misato Sato,

Roland Ismer, Manuel Haussner, Ralf Martin, Oliver Sator , Andrzej Ancygier, Ayse

Tugba Atasoy, Benedikt Mack, Anne Schopp, Stefan Schleicher, Jean-Pierre Ponssard

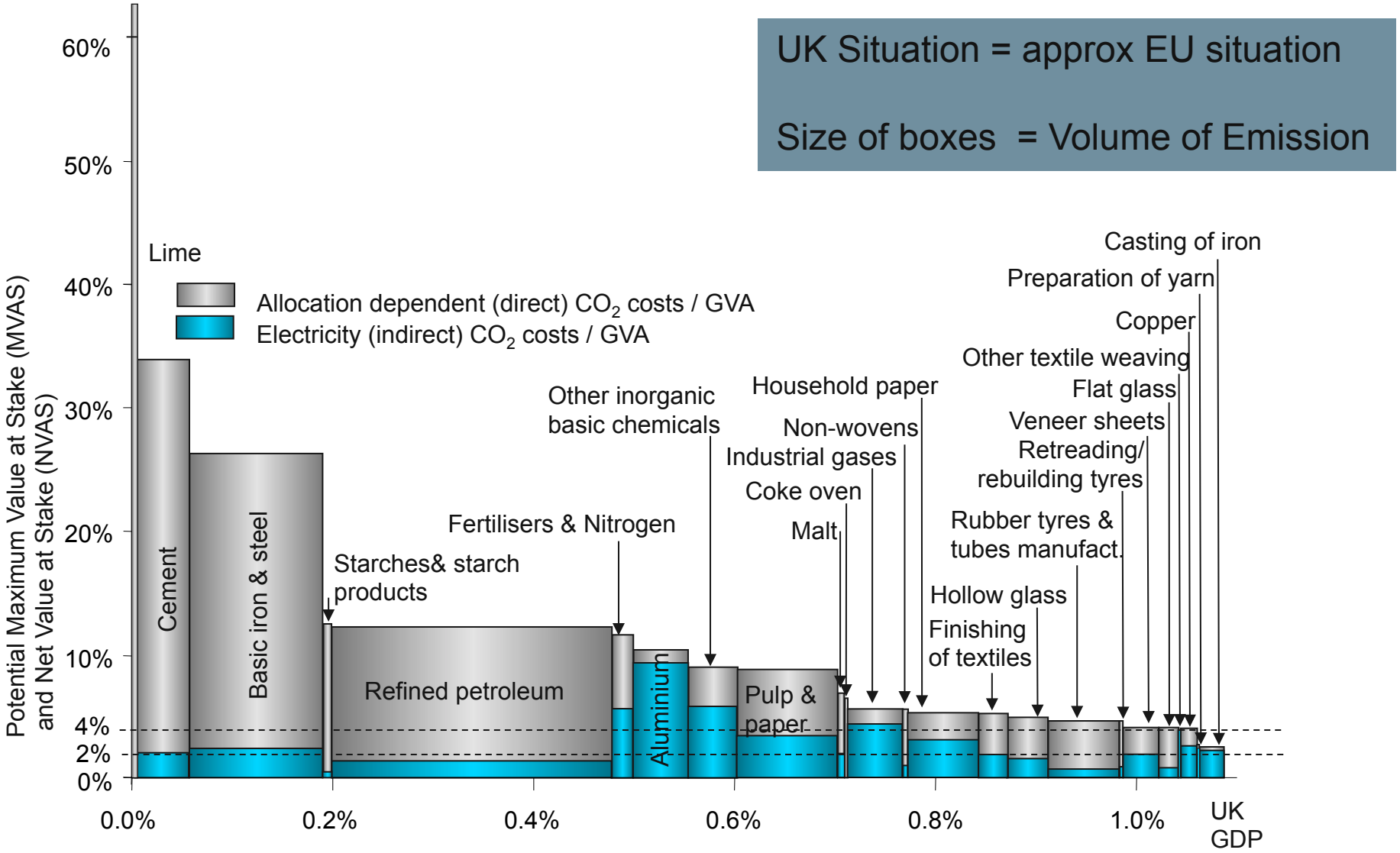
COP 19 Side event, Warsaw ,18.11.2013

1 Why cement – and mitigation opportunities in Cement

2 Realization of individual mitigation opportunities

3 Policy requirements emerging from analysis

1 Why do we focus on energy intensive industries?



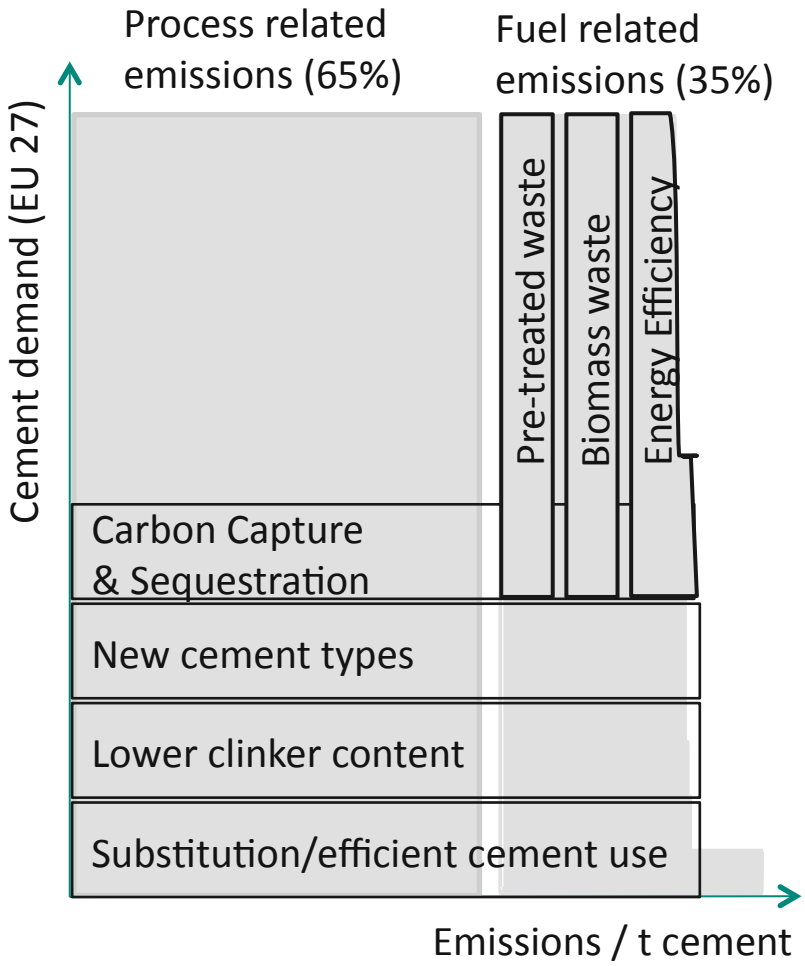
Climate Strategies

Assumption 20 Euro/t Carbon Price

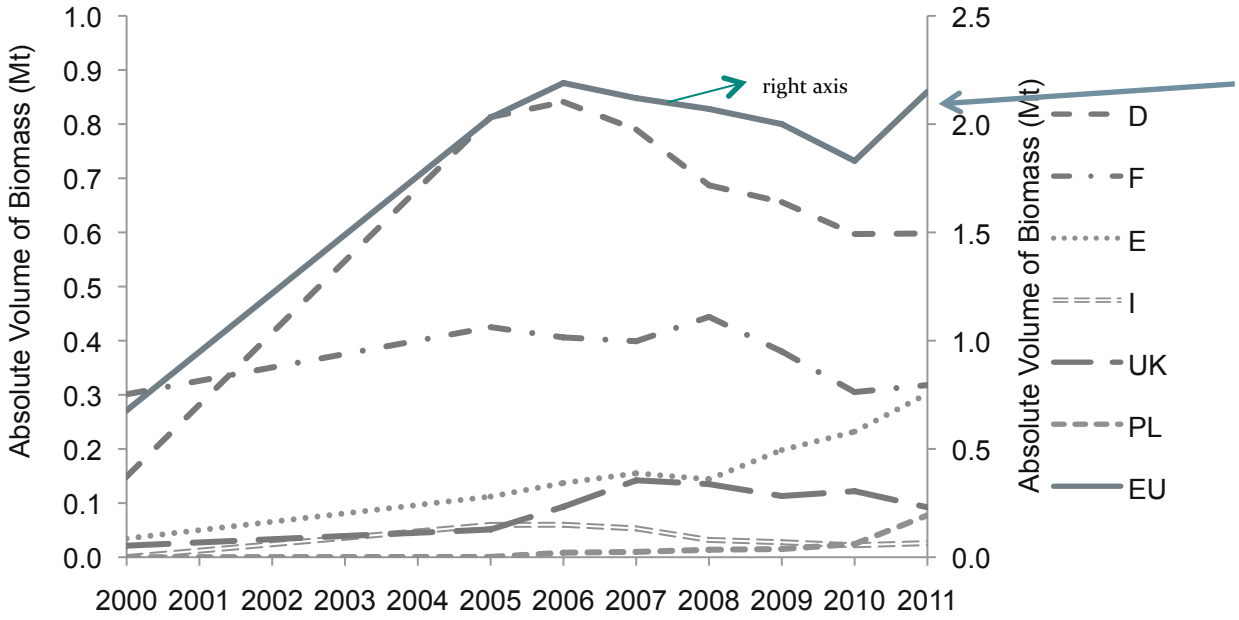
DIW BERLIN

1 Mitigation opportunities in cement

Illustration



2 Emission savings through use of bio-mass (waste)



Source: CSI GNR: Indicator 314

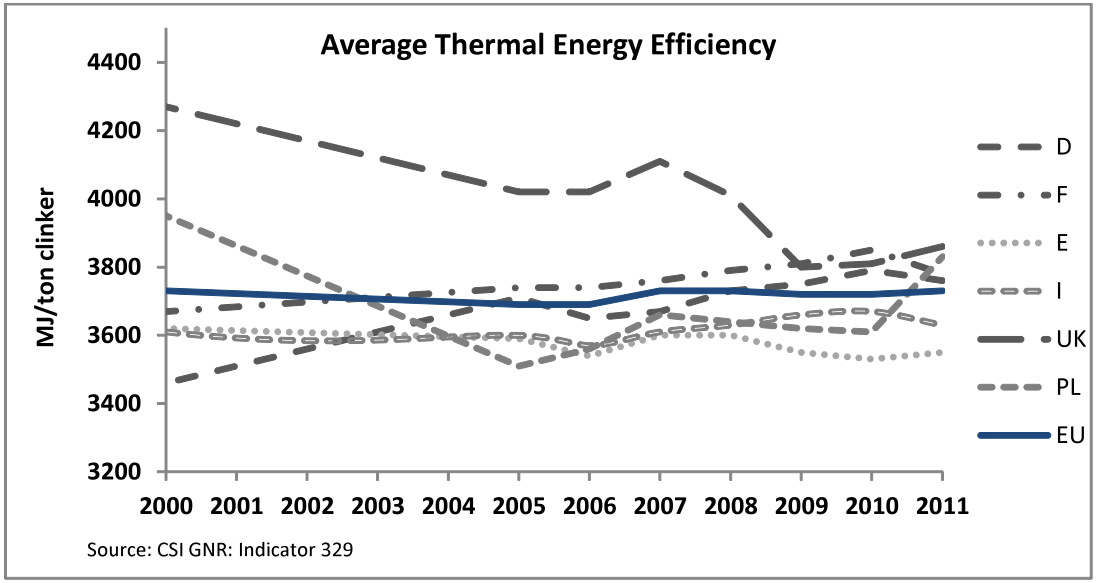
9% of thermal energy from bio-mass (waste)

~ savings of about 3.3 Mt CO2

- Save of fuel cost (10 €/t clinker) + hedge on fuel price
- RE support for biomass in heat& power not available in cement

  -> only 10% wood (large share in Spain, check RE provision)
- Primarily waste products, 50% animal meal & fat, 17% sewage sludge
- Save CO2 opportunity (!) cost (1,5€ /t clinker at 10 €/tCO2)

2 Emissions savings through efficiency improvements



- Main savings potential: Replace (semi-) wet kilns

% Clinker produced	Semi-Wet Kiln (9% more energy)	Wet Kiln (50% more energy)
2000	12%	6% (19 installations)
2005	9%	5% (13 installations)
2011	7% (30 kilns)	5% (11 installations)

- Slow progress, kiln conversions, Pl pre, UK post 2005
- Potential 0.5 Mt CO2 savings / year

2 Cross-cutting responses

EU ETS has attracted top management attention on need to reduce CO2

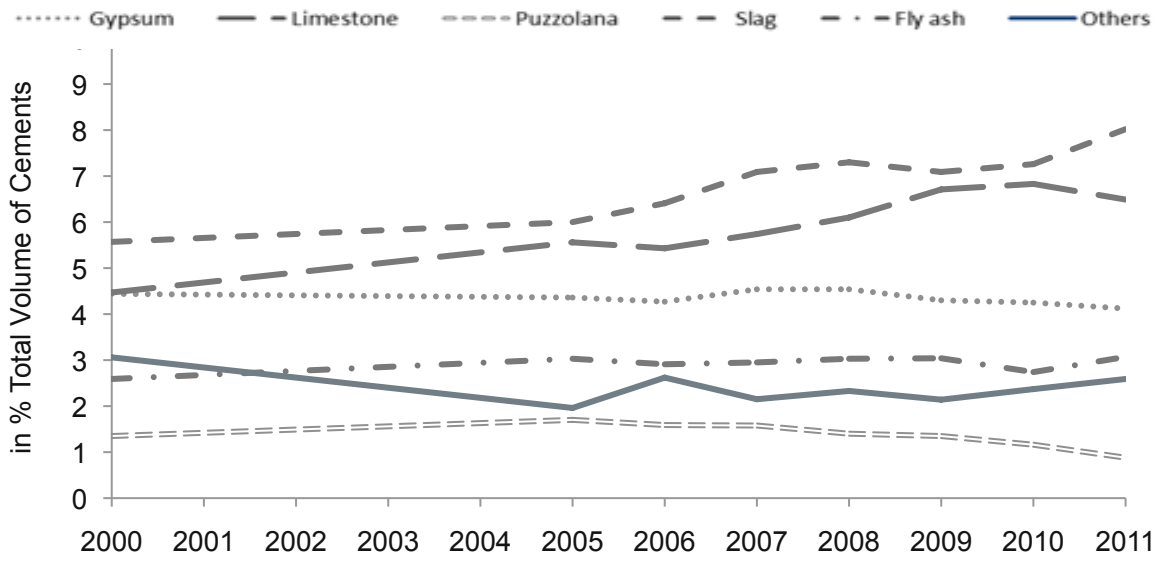
- Emission reductions now part of the strategy of most cement companies
- Emission target equally important to carbon price for some firms/decisions

Overall economic situation (surplus capacity) dominates investment picture

Uncertainty about future development of EU ETS slows down decision making

- What sector on leakage list, what provisions post 2020, what price level?
- What will impact development in the future?
- Differs from other input uncertainty as it only impacts Europe
- If system does not fully meet policy needs, what reforms to expect?

2 Substitution of clinker with other materials

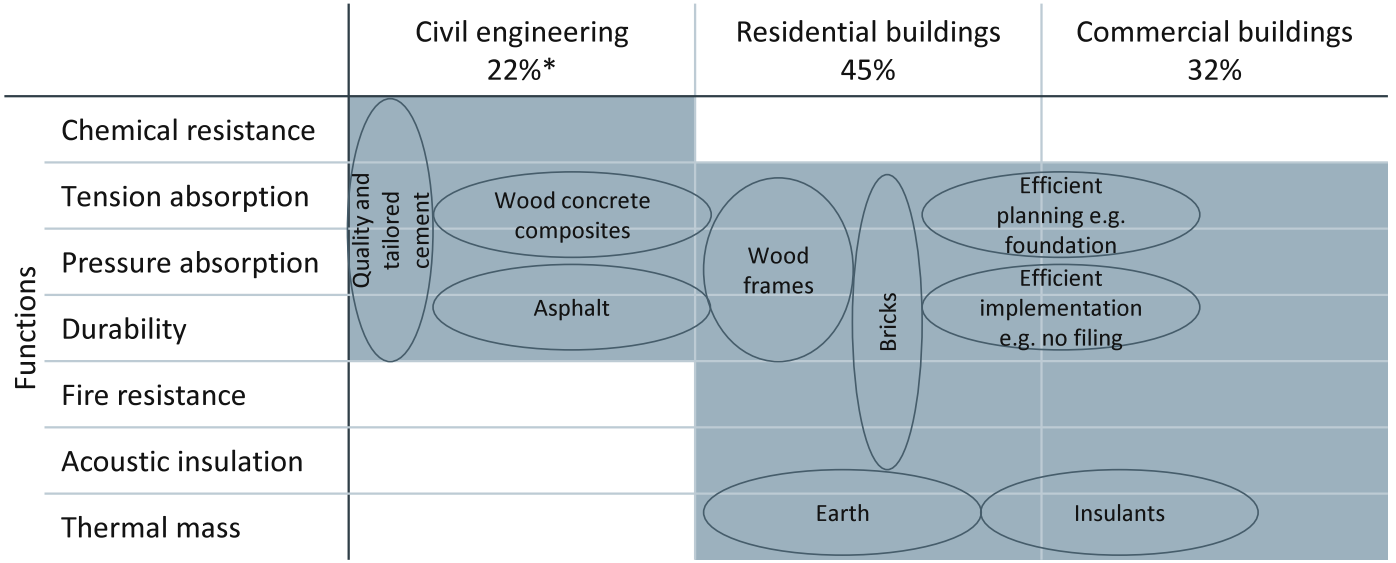


Source: CSI GNR: Indicator 3219

- CEM with 25-30% substitution saves 2€ /t cement (at 10 €/tCO2)
- Drawbacks: (i) Dependence on other companies (ii) Surplus clinker capacity
- Result: Slag largely utilized, fly-ash to less than 50% for cement production
- Needs market acceptance for cement with different features
- Attempts with CO2 labelling, but product quality & price dominate acceptance
- Adjusting norms and standards might be able to achieve more rapid change

2 Efficient cement use and substitute building materials

- Top down estimate: 20%-35%
  - Based on 40 €/t CO2 carbon price ~ 50% cement price increase
  - Price elasticity -0,5 to -1 : Cour & Møllgaard (2002) -0.3; Roller & Steen (2006) -0.5 – 1.5; Jans & Rosenbaum (1997) -0.8; Ryan (2005) -3
- Bottom up illustration of opportunities



*Turnover shares based on European Cement Association

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2 Development of alternatives to cement

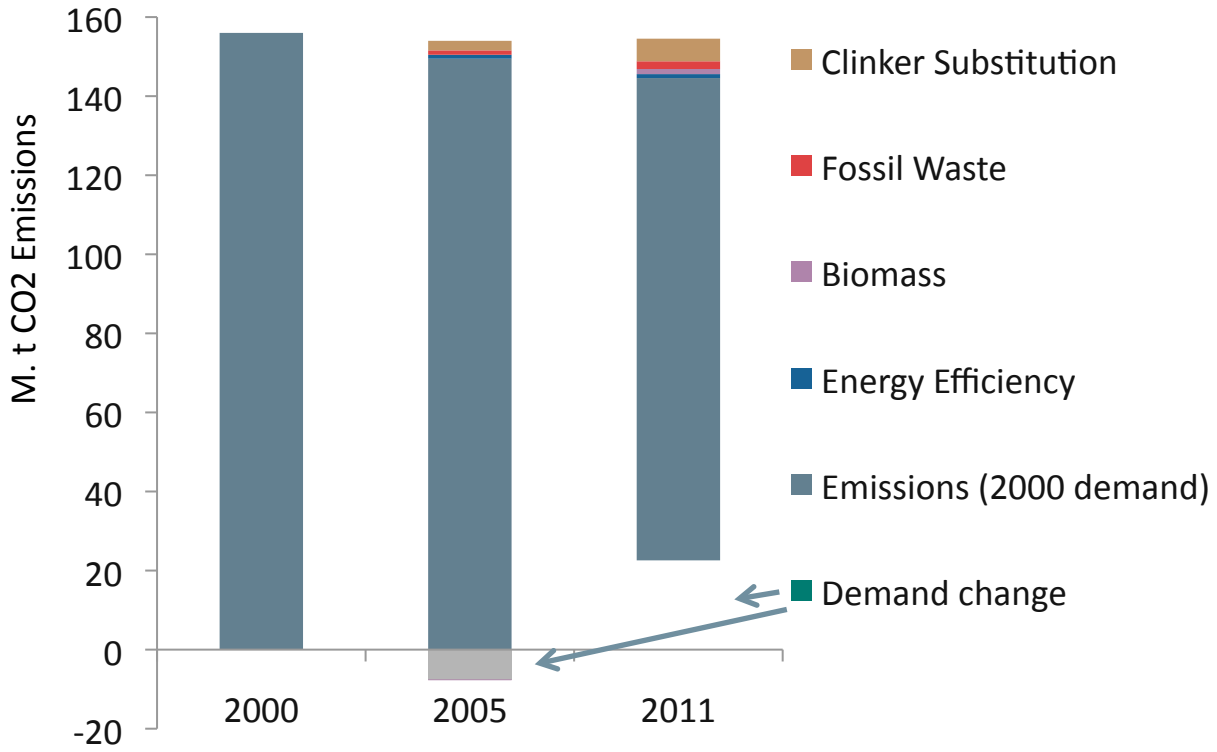
- Cement companies are moving cautiously on low-carbon cement options

New production techniques	Magnesium silicates rather than limestone	Calcium sulfo-aluminate belite binders	Dolomite rock	Geopolymer	Sialites	Belite-Calcium sulfoaluminate
Celitement (Schwenk/ KIT)	Novacem (UK)	Calera				
	Calix					
	TecEco					

Challenge:

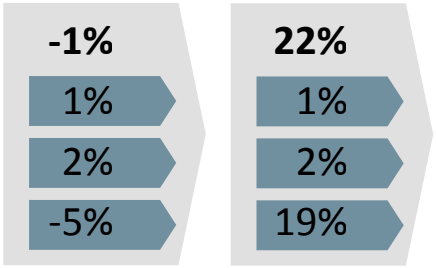
- Customers are conservative and market does not demand alternatives
- Each alternative to cement will only meet some characteristics of cement
- Do incumbent companies anticipate market opportunity or competition?

3 Progress on emission reductions in cement sector



Emission reduction

- Reductions at clinker production
- Substitution of clinker
- Change of demand



3 Summary: Policy requirements emerging from analysis

		Progress 2005-2011	Secure robust carbon	Reduce distortions	Turn opportunity	Reflect carbon cost in	Innovation support	Removing regulatory
Reduce thermal emissions	Waste incineration	1%	**X**					X
	Biomass	1%	X					**X**
	Asset rationalization	-		**X**				
	Efficiency investment	0%	X	X	X			
	Carbon capture &storage	*0%*	*X*	*X*			*X*	X
Reduce clinker use	Clinker replacement	2%	X			**X**		X
	New cement types	0%	X			**X**	X	X
	Efficient use and Substitutes	0%	X			**X**	X	X

Savings potential
- ?
- < 10%
- > 10%

** Not explored in study*

3 Options to ensure effective carbon price in presence of leakage concerns

Performance of policy options compared to today (+ improvement - inferior)	Reduce distortions from free allocation	Turn opportunity costs in real costs	Reflect carbon price in product price	
Benchmark allocation linked to activity level				→ Current situation
Output based allocation (with fixed cap)	+		-	→ Lags incentive for efficient use and substitution
Output based alloc. & inclusion of consumption	+	+	+	→ New option to consider
Auction and border leveling	+	+	+	→ Difficult politics
Auction and converging carbon price levels	+	+	+	→ Desired future

4 Creating enabling environment

- Norms and standards need adjustment to allow for changes in clinker content, efficient use, alternative building materials
- Investment in innovative techniques and products depends on confidence that adjustment will be possible
- Carbon price makes adjustment economically viable
- Further work required to understand specific adjustments and appropriate process

5 Summary

- ETS created visibility for emission targets & captured management attention
- Carbon price essential for portfolio of mitigation options, ETS needed, but it needs reform to support investments and unlock more mitigation options
  - Strength of cap / price
  - Allowance allocation provision erode incentives for mitigation action
  - Opportunity cost often insufficient for corporate choices
  - Insufficient confidence that carbon price in cement price
- Complementing need for innovation support (funding and regulation)