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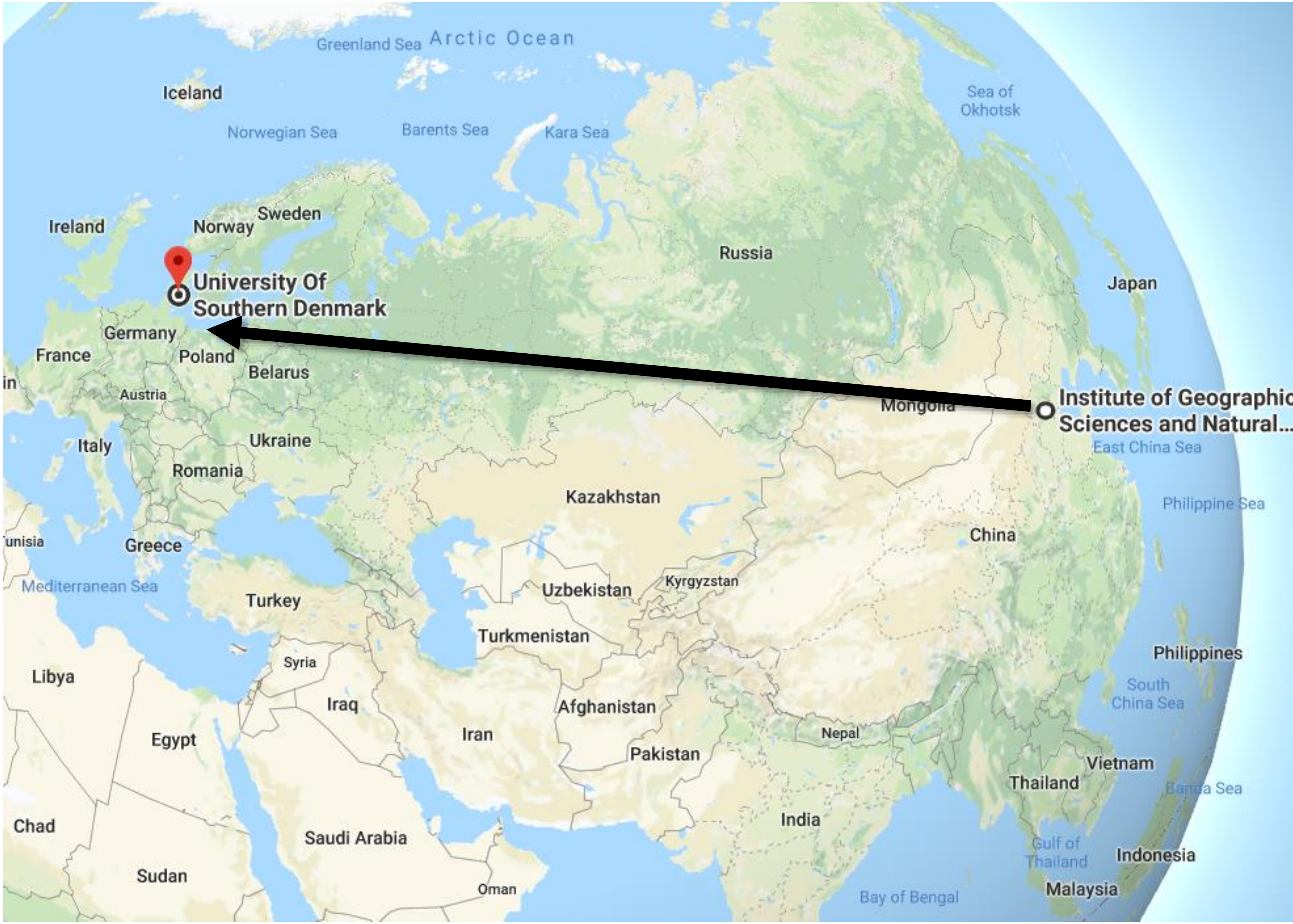
Concrete pathways toward a low-carbon cement industry in China

Zhi CAO

E-mail: zca@kbm.sdu.dk

Center for Life Cycle Engineering

University of Southern Denmark



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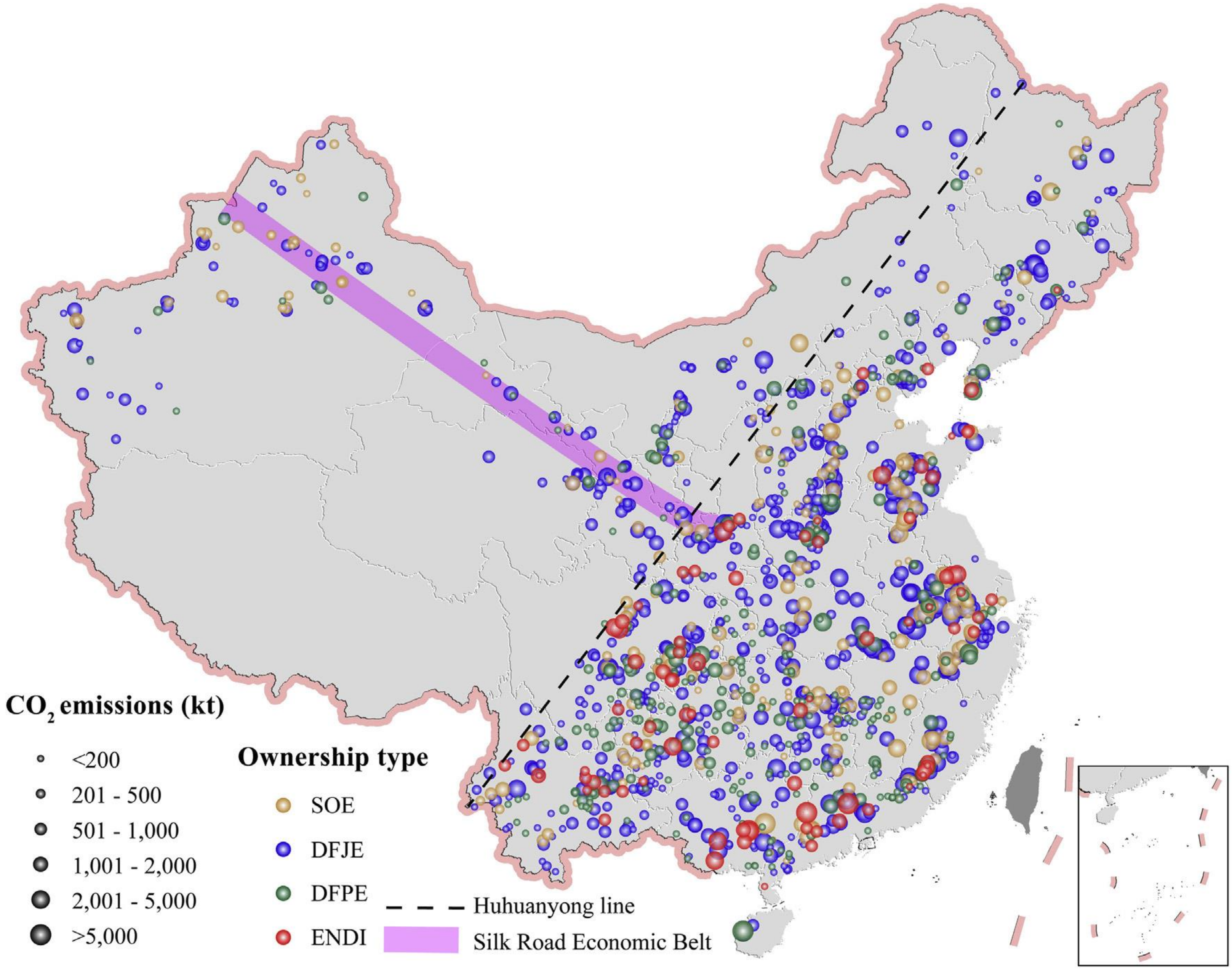
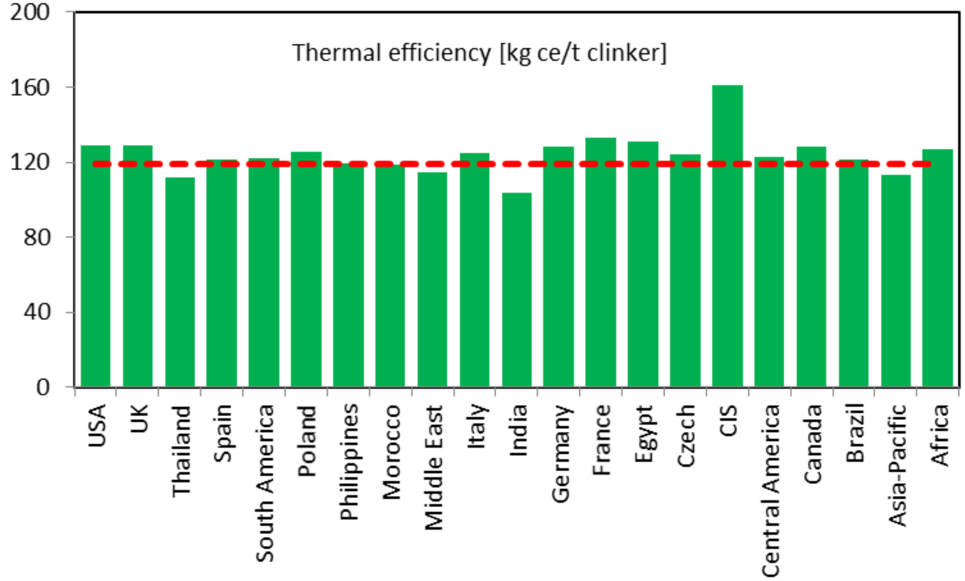
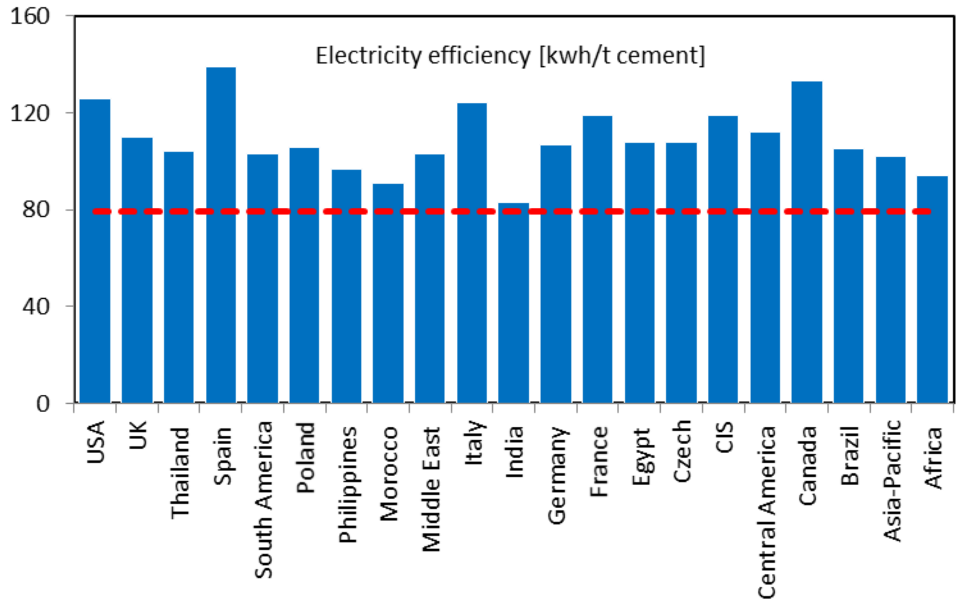
Academic mobility



Spatial distribution of cement production facilities in China

Source: Cai et al., 2016





- Limited room for energy efficiency improvement
- Dry process rotary kiln is widely adopted: >90% of cement production facilities in place

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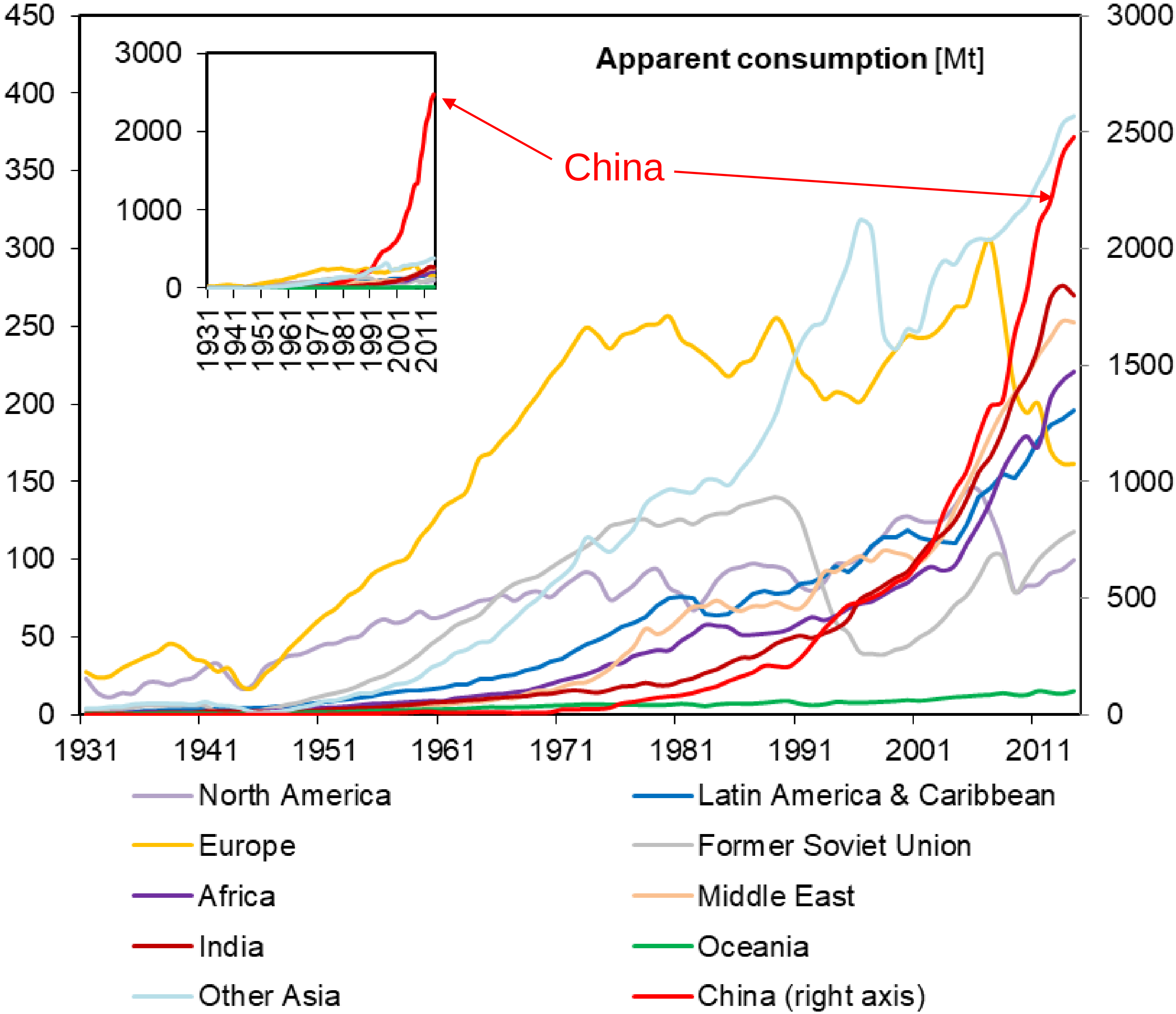
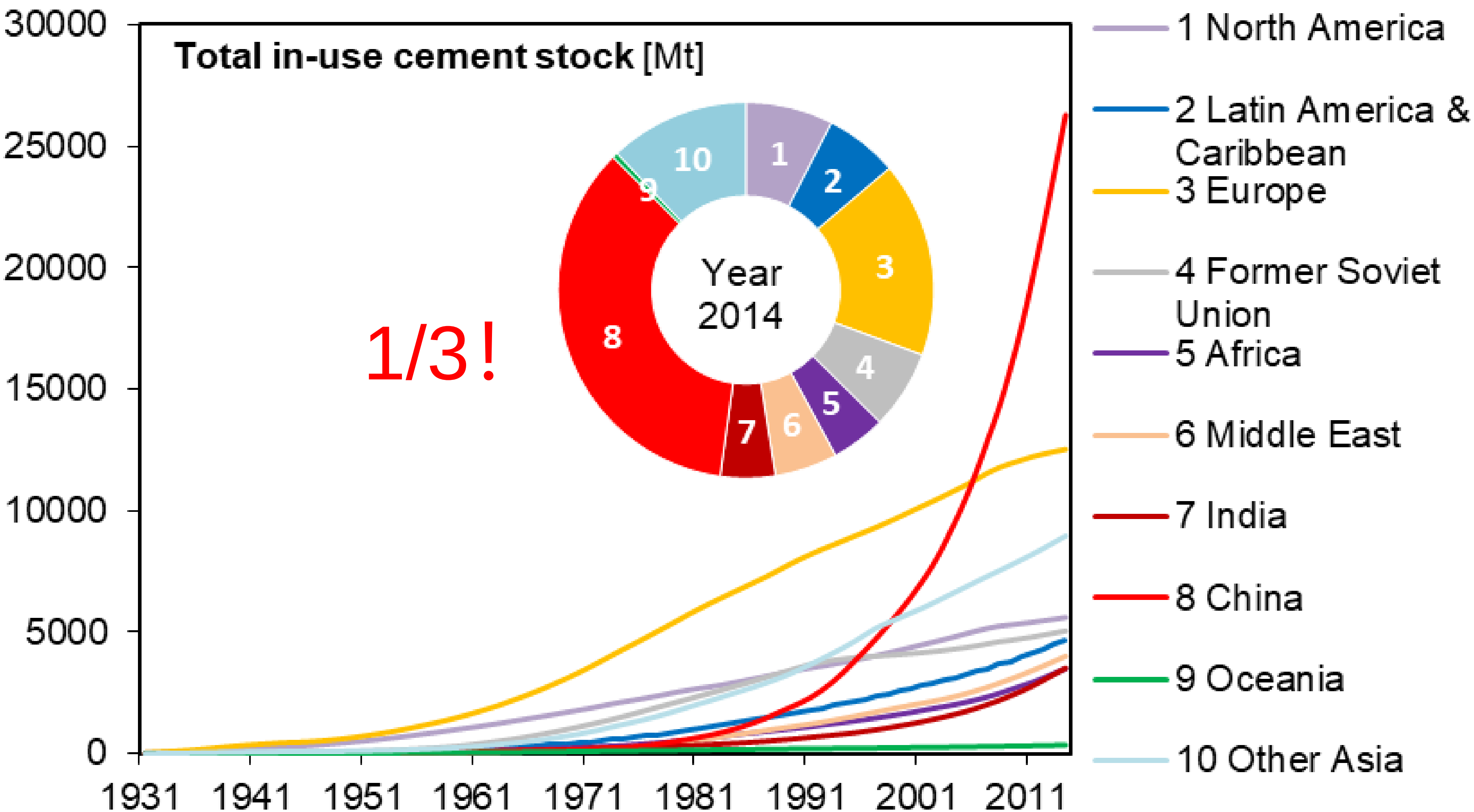
Energy efficiency of cement production facilities in China

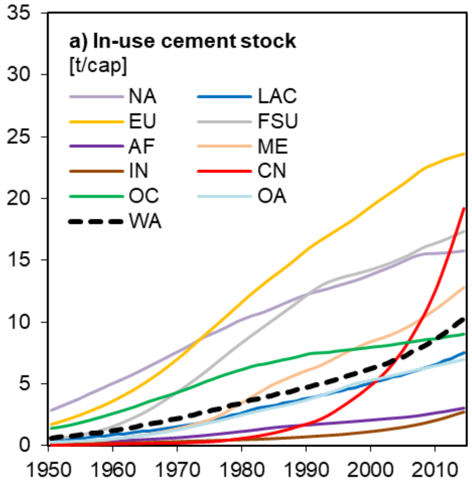
Source: CSI, 2014

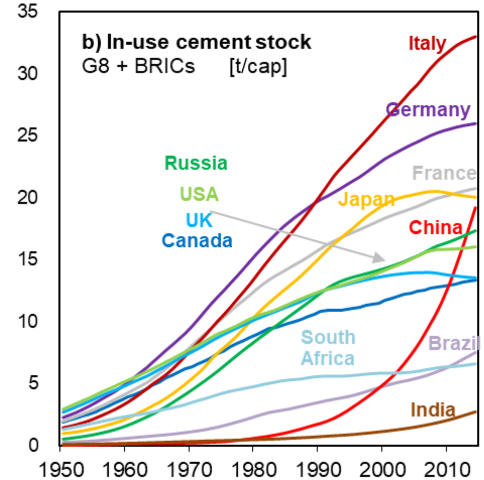


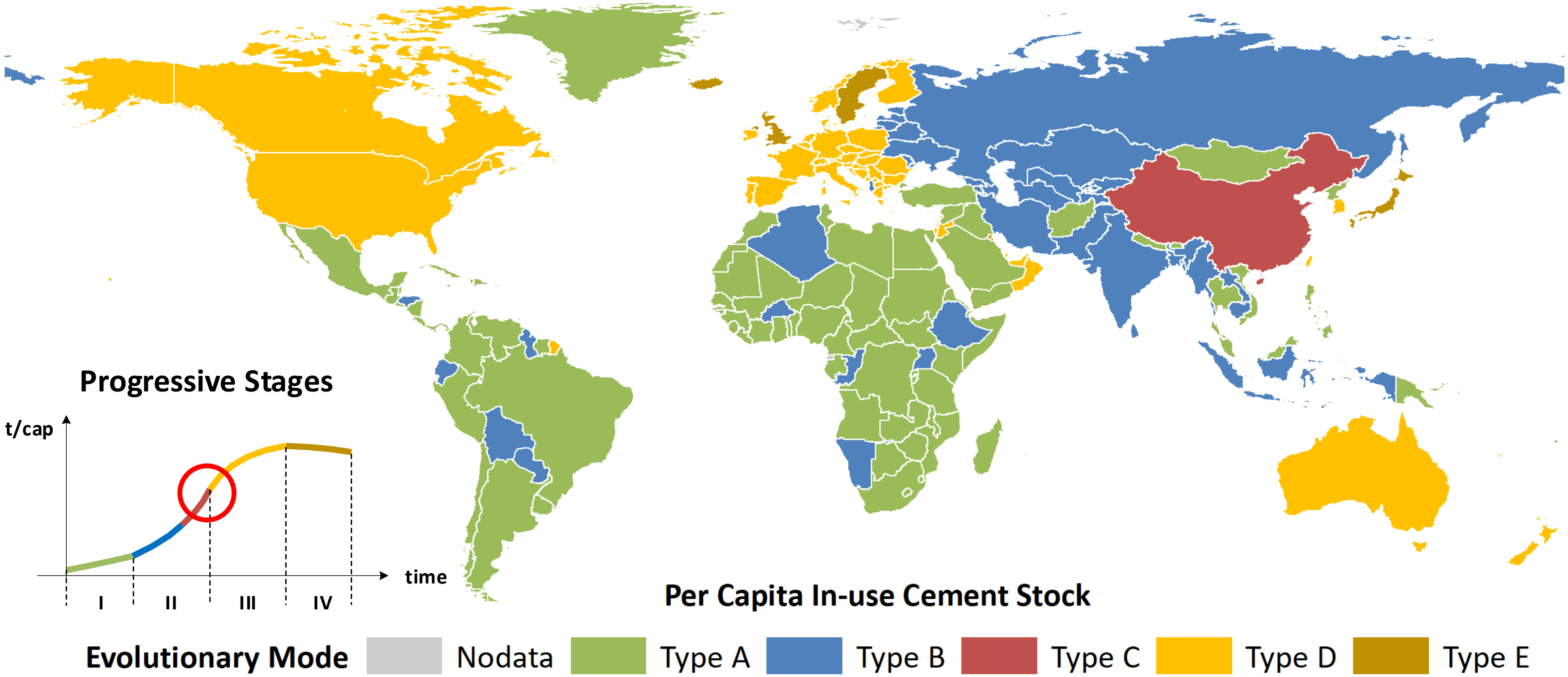
Apparent consumption of cement from 1931 to 2014
Source: Cao et al., 2017



Historical patterns of cement stocks
Source: Cao et al., 2017





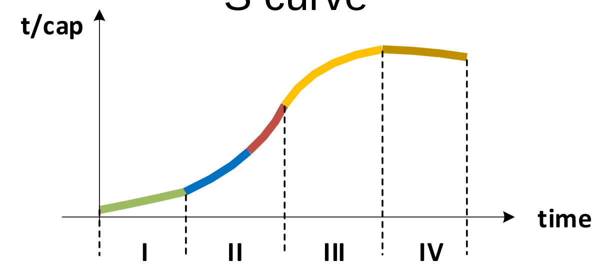


Historical patterns of cement stocks

Source: Cao et al., 2017

	Per capita cement stock [t/capita]	Residential [t/capita]	Non-residential [t/capita]	Civil engineering [t/capita]
Argentina	8.0	3.5	2.9	1.6
Austrilia	12.0	5.2	4.3	2.5
Austria	33.6	14.6	12.1	6.9
Canada	13.3	5.8	4.8	2.7
France	20.7	9.0	7.5	4.2
Germany	26.0	11.3	9.4	5.3
Greece	33.2	14.4	12.0	6.8
Hungary	18.8	8.1	6.8	3.8
Italy	33.0	14.3	11.9	6.7
Japan	20.0	8.7	7.2	4.1
South Korea	27.5	11.9	9.9	5.6
The Netherlands	18.6	8.1	6.7	3.8
Poland	19.7	8.5	7.1	4.0
Portugal	28.9	12.6	10.5	5.9
Saudi Arabia	24.2	10.5	8.7	4.9
Spain	29.5	12.8	10.7	6.0
Switzerland	31.8	13.8	11.5	6.5
United Arab Emirates	28.1	12.2	10.2	5.7
UK	13.5	5.9	4.9	2.8
USA	16.0	7.0	5.8	3.3
Former Yugoslavia	17.6	7.6	6.4	3.6
Czechoslovakia	26.3	11.4	9.5	5.4
Belgium-Luxembourg	27.9	12.1	10.1	5.7
China	19.2	8.3	6.9	3.9

S curve



Scenarios of per capita cement stock:

- China: 19.2 t/cap (2014)
- High: 33.6 t/cap (2050)
- Medium: 30.5 t/cap (2050)
- Low: 27.5 t/cap (2050)

Scenarios of population: UN World Population Prospects (High-Medium-Low)

Scenarios of lifetime:

- Constant
- ~30 yrs → 50 yrs

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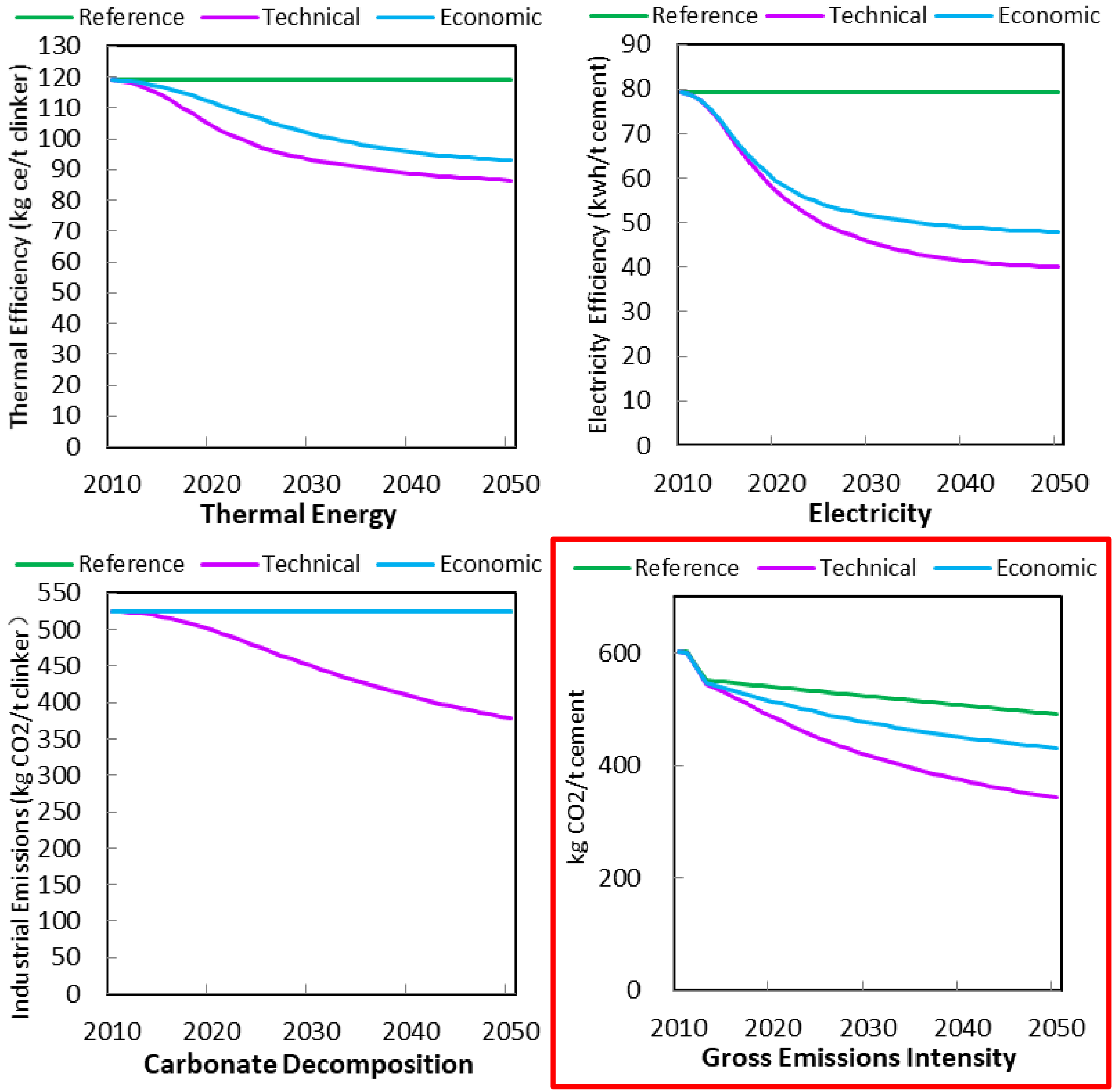
How much cement stock does China need in the future?

Source: Cao et al., 2017



Potentials for energy efficiency improvement in cement industry

Source: Cao et al., 2017

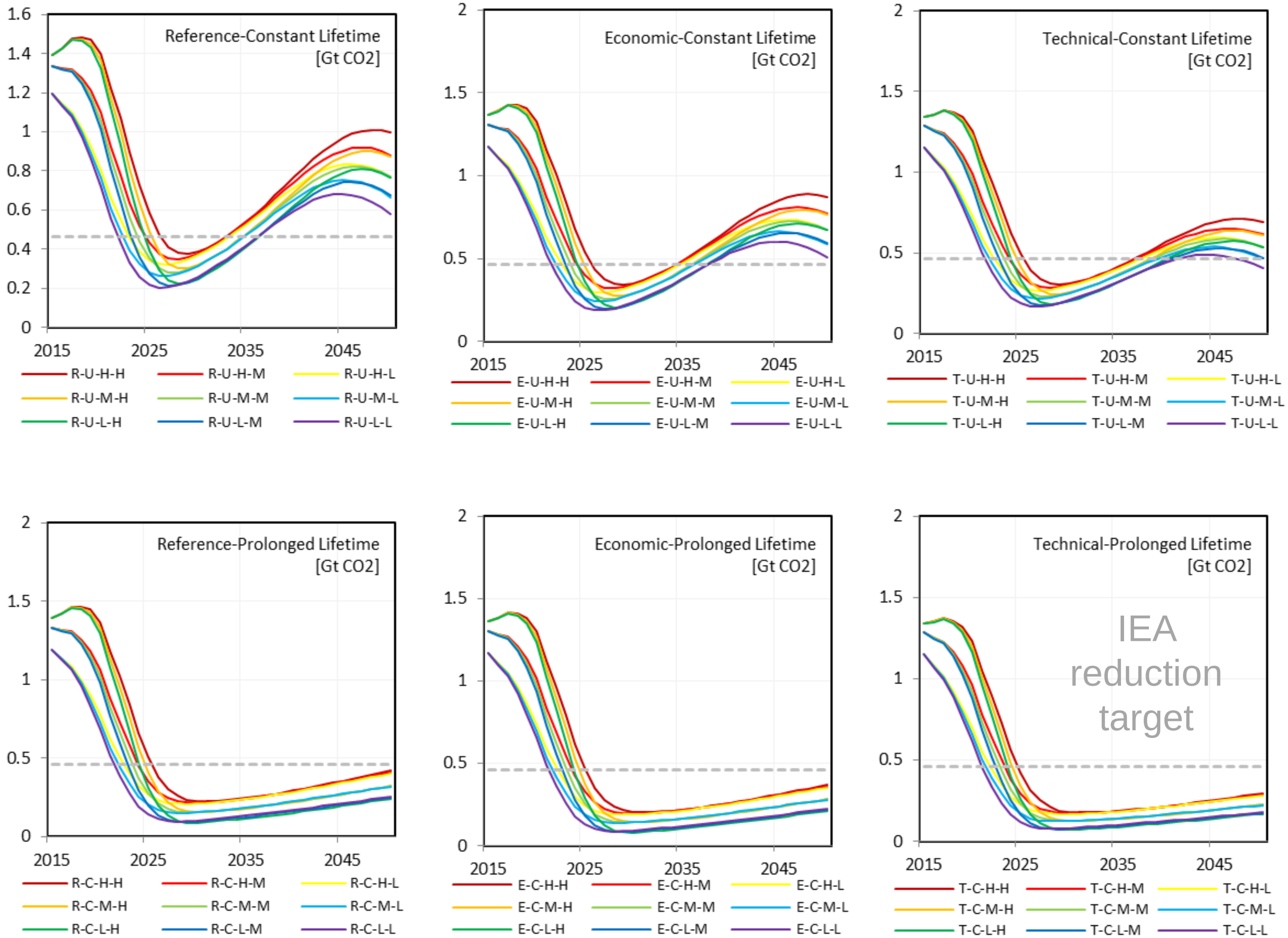
Reference

Economically feasible

Technically feasible

Lifetime Kept constant

Lifetime Prolonged



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Pathways toward a low-carbon cement industry in China

Source: Cao et al., 2017

Concluding Remarks

- Cement industry is a major CO_2 emitter in China, due to the massive cement demand; however, energy efficiency improvement measures alone could not achieve the reduction target;

- Grand amounts of cement (stocks) are already in place in China;

- Prolonging lifetime of cement products (e.g., buildings, structure, bridges, and roads) can fundamentally reduce CO_2 emissions from cement industry.


C&DW Management

Recycling

Reuse

Thank You

QUESTIONS, COMMENTS OR REMARKS?