Industry Technology Roadmaps: a focus on Cement

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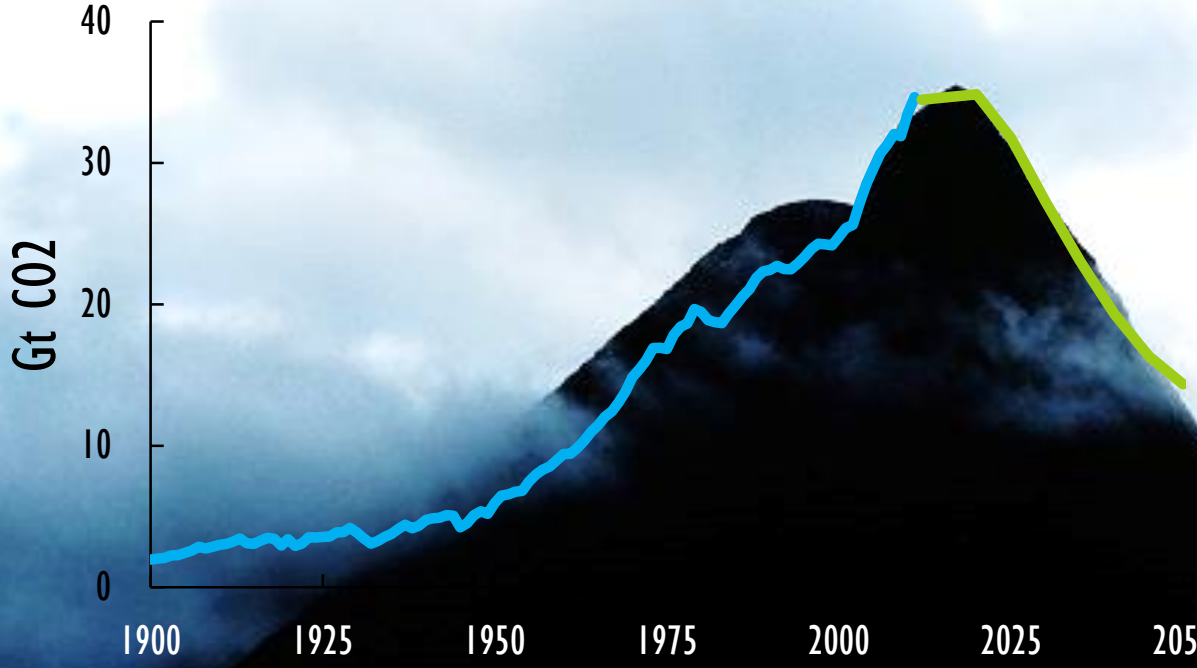
COP 23, 12 November 2017

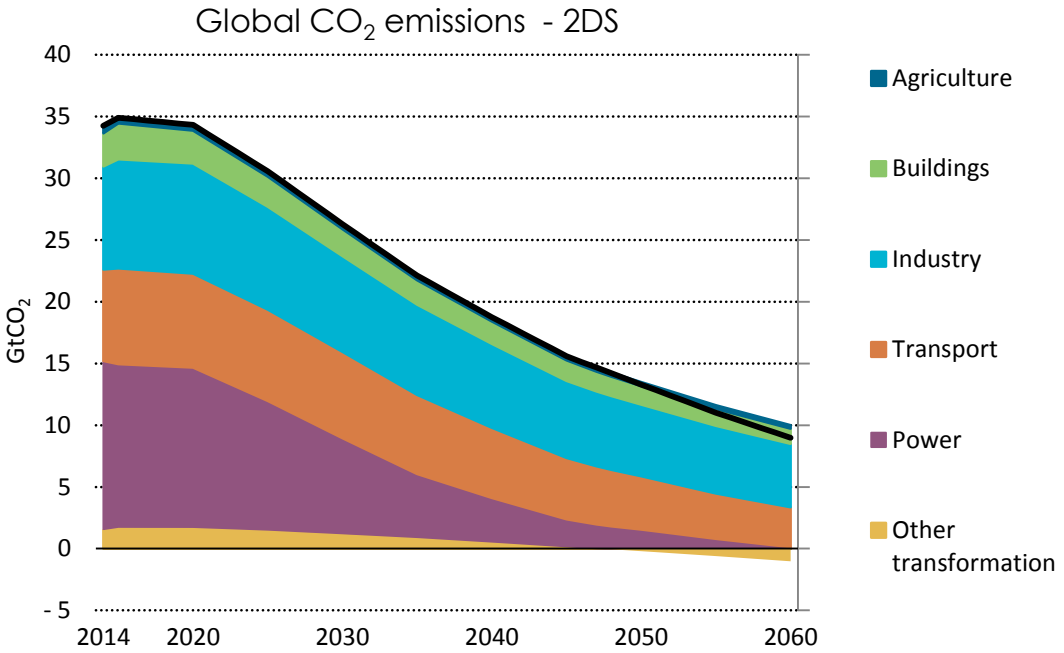
The global challenge: Climbing down the mountain

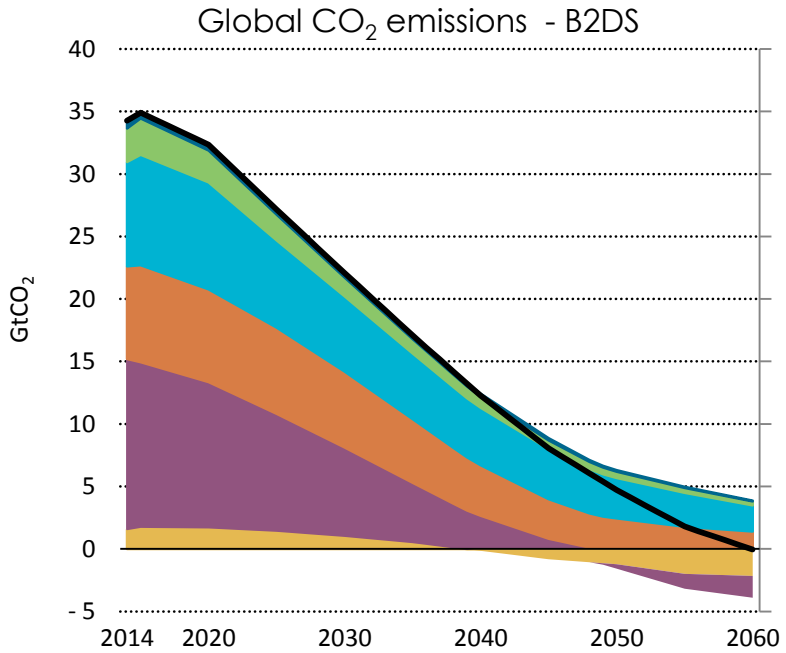


"Getting to the top is optional.

Getting down is mandatory."
Ed Viesturs

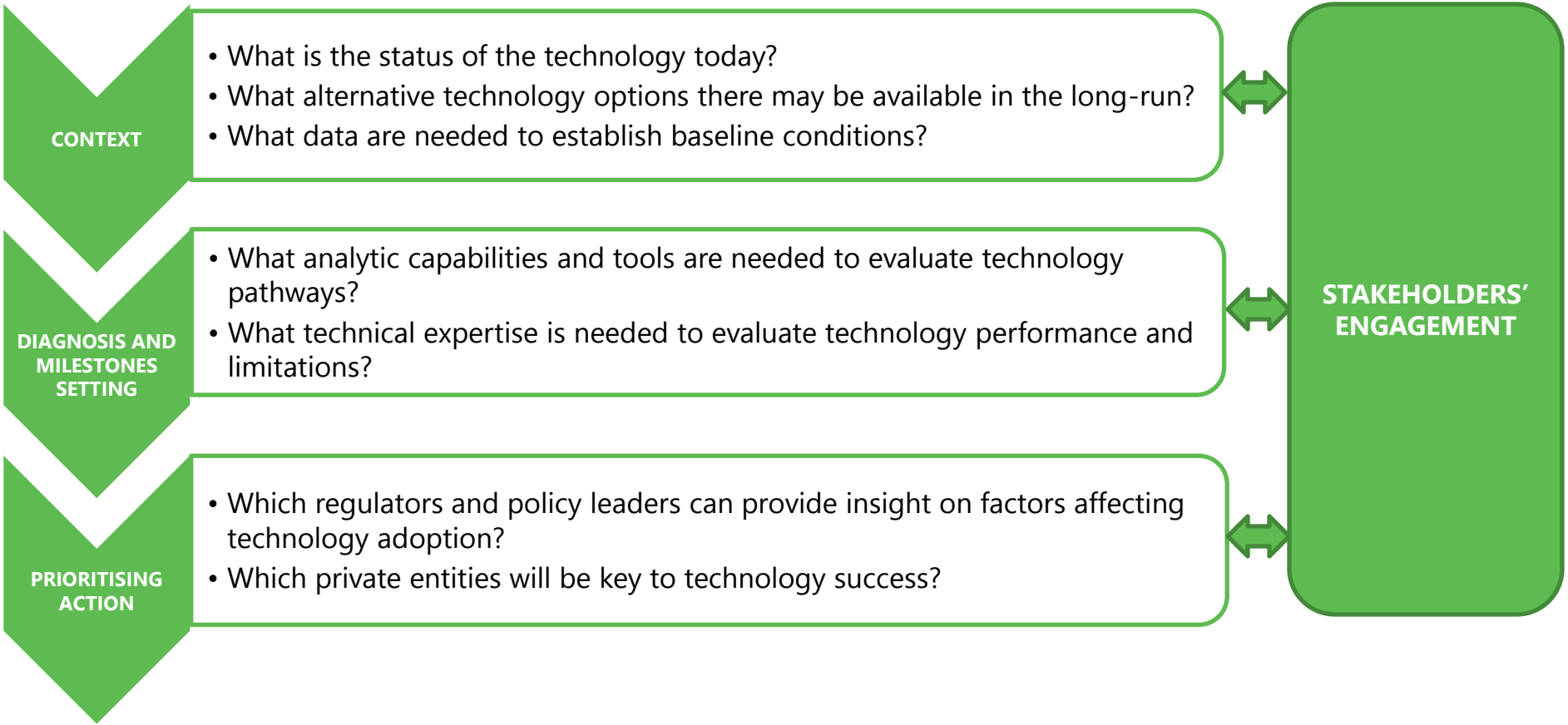
What's the size of the climate challenge?



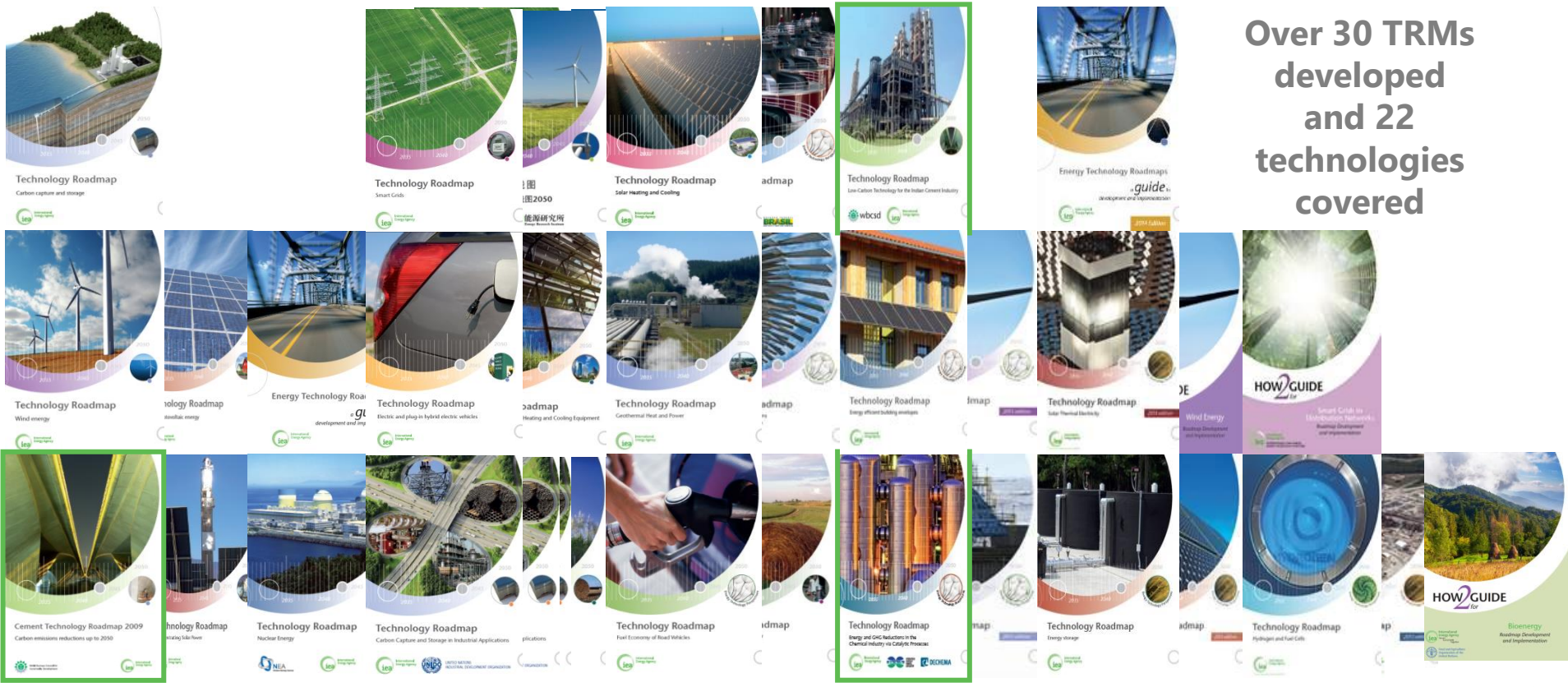


Remaining CO_2 emissions from industry and transport in the 2DS by 2060 need to be compensated with negative emissions to achieve net-zero energy sector by 2060 in the B2DS

How do we get there? – Technology Roadmaps



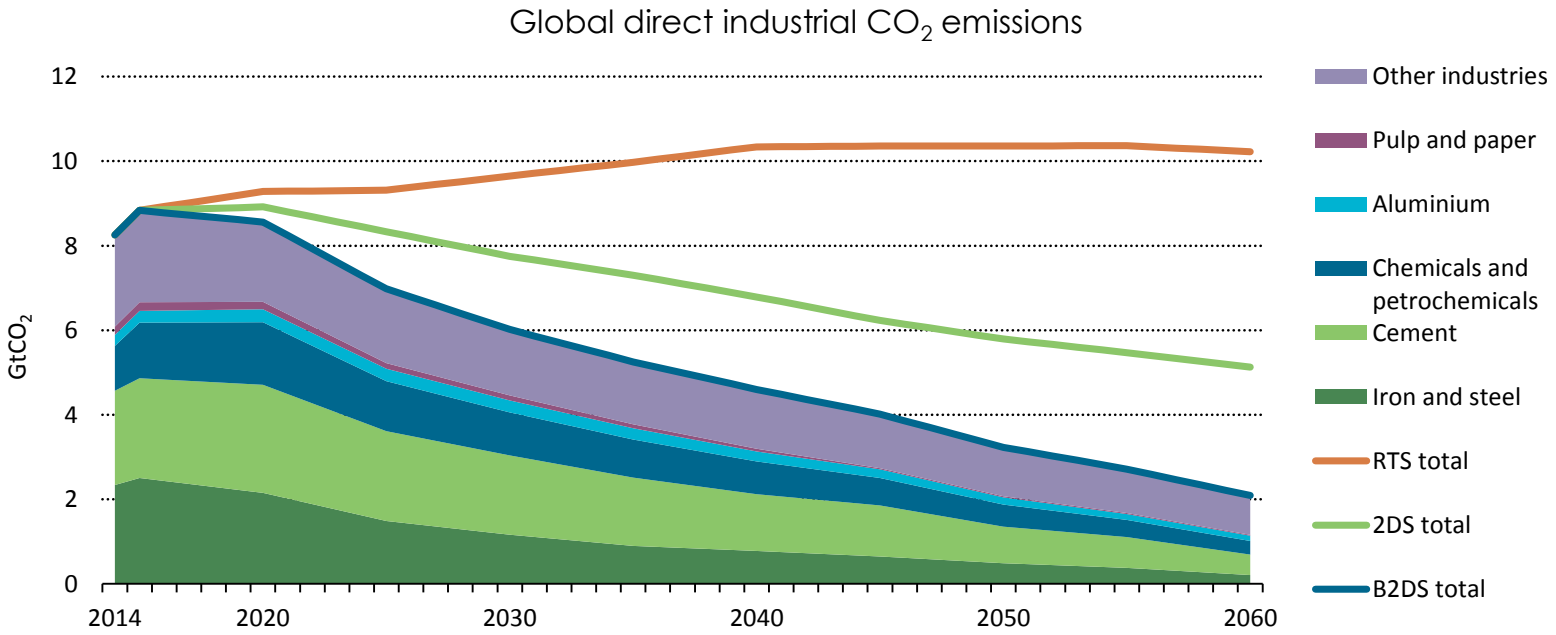
IEA Technology Roadmaps: a living library



Over 30 TRMs developed and 22 technologies covered

2009 2010 2011 2012 2013 2014 2015 2017

The challenge of the sustainable transformation of industry

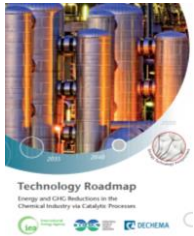


Significant transformations would be needed in all industrial sectors to achieve a 40% and 75% reduction of direct CO_2 emissions by 2060 compared to current levels

Source: IEA Energy Technology Perspectives, 2017

Industry-related IEA Technology Roadmaps

GLOBAL CHEMICALS

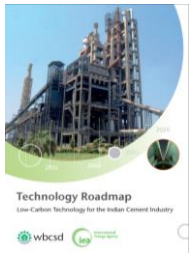


GLOBAL CEMENT ROADMAP UPDATE

GLOBAL IRON & STEEL ROADMAP

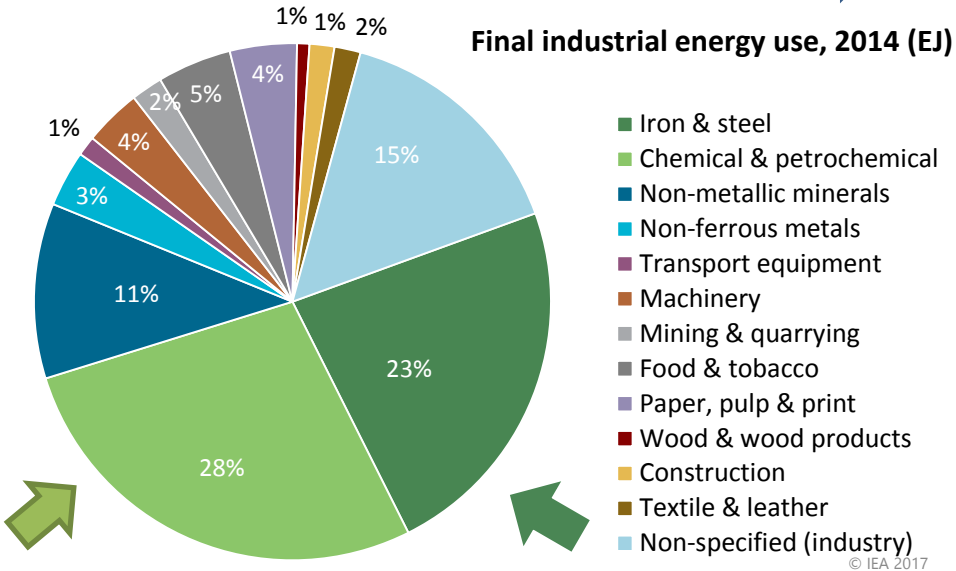
2009 — 2013 — 2018 — 2019

GLOBAL CEMENT



REGIONAL CEMENT

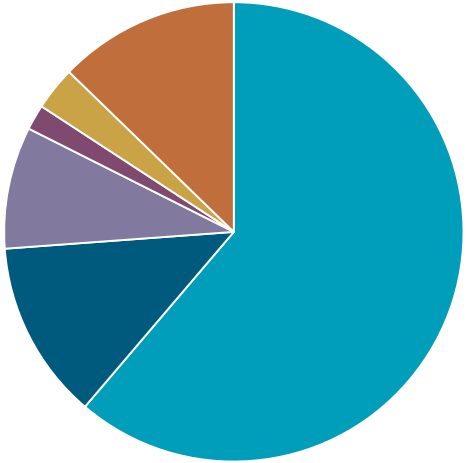
Final industrial energy use, 2014 (EJ)



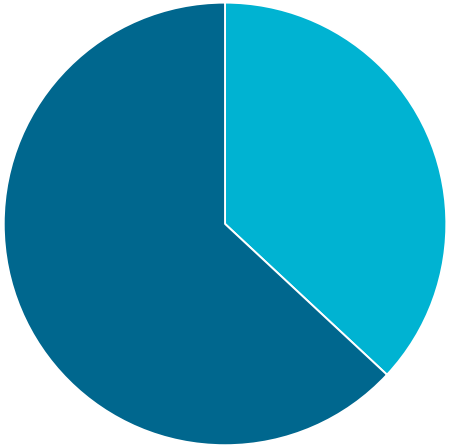
Cement sector opportunities and challenges

Global cement sector indicators, 2014

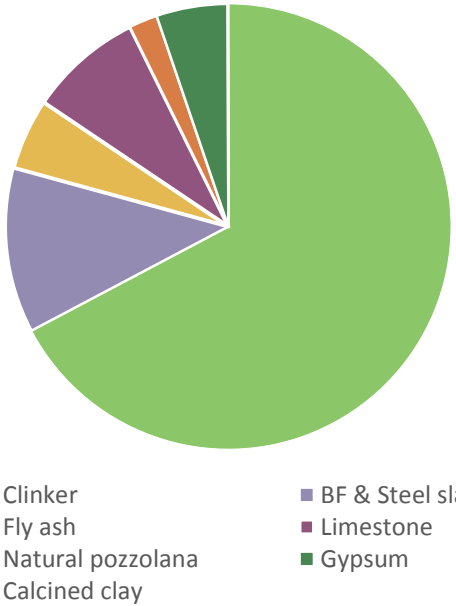
Final energy use
(3rd industrial energy user)
(2nd industrial coal use)



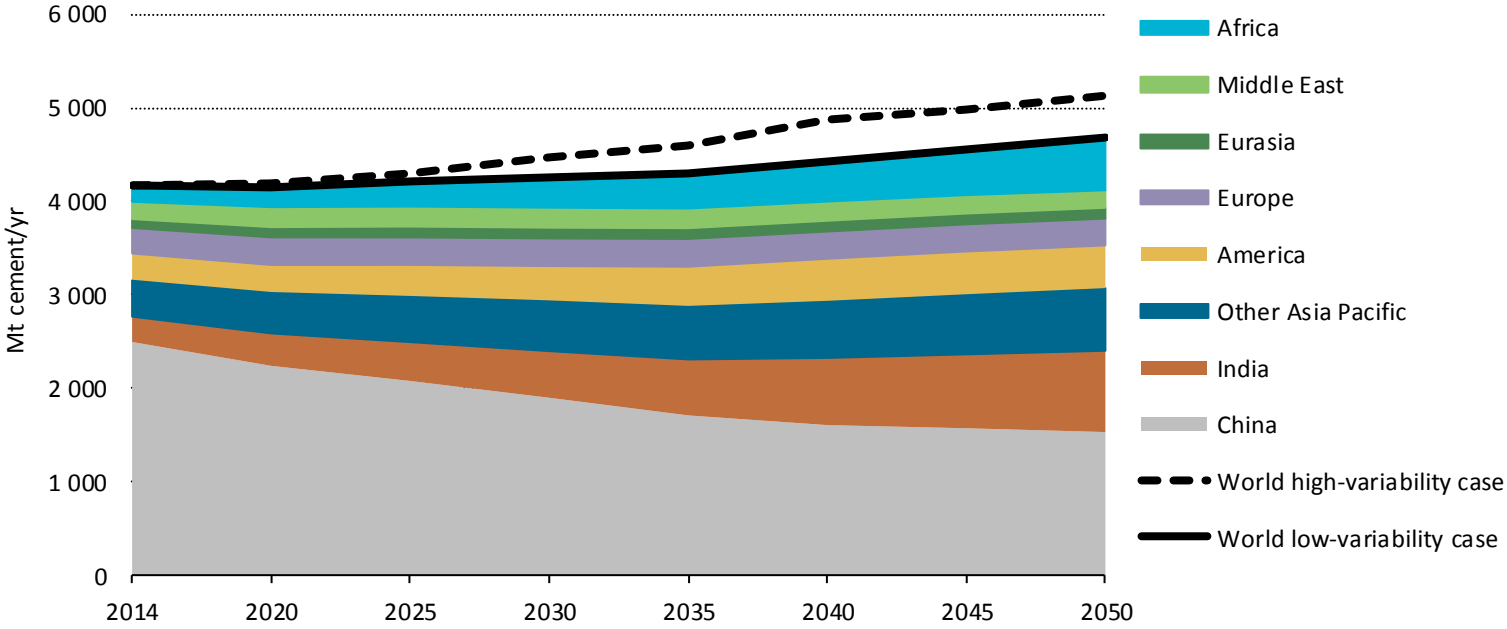
Direct CO_2 emissions
(2nd industrial CO_2 emitter)
(1st industrial process CO_2 emitter)



Estimated average cement composition
(Reliance on industrial by-products)

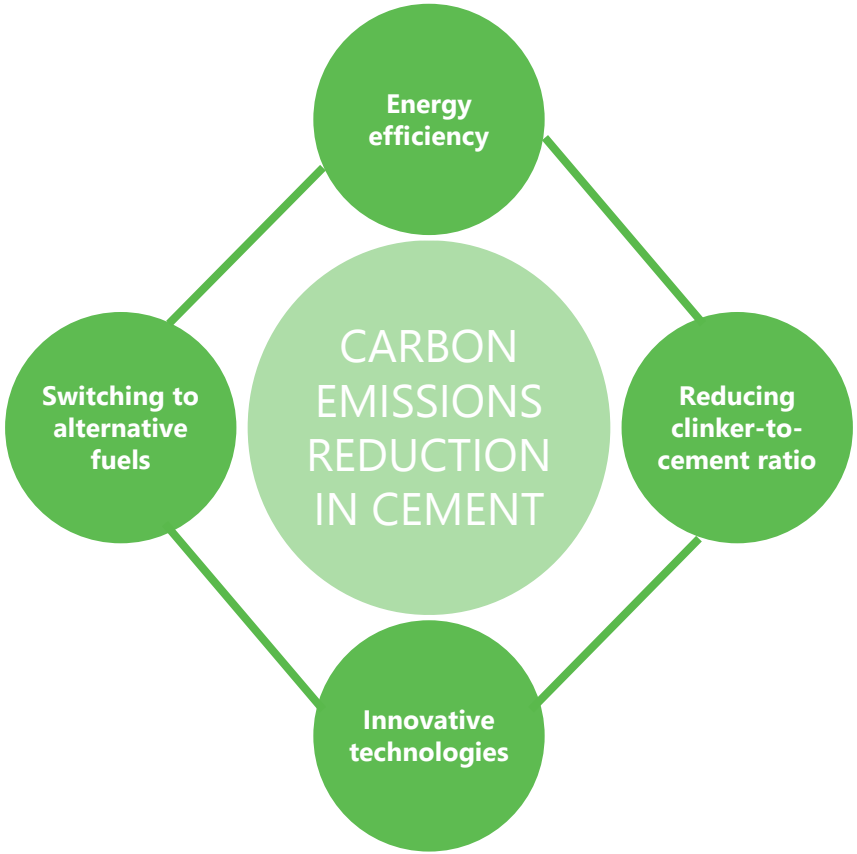


Cement production by region



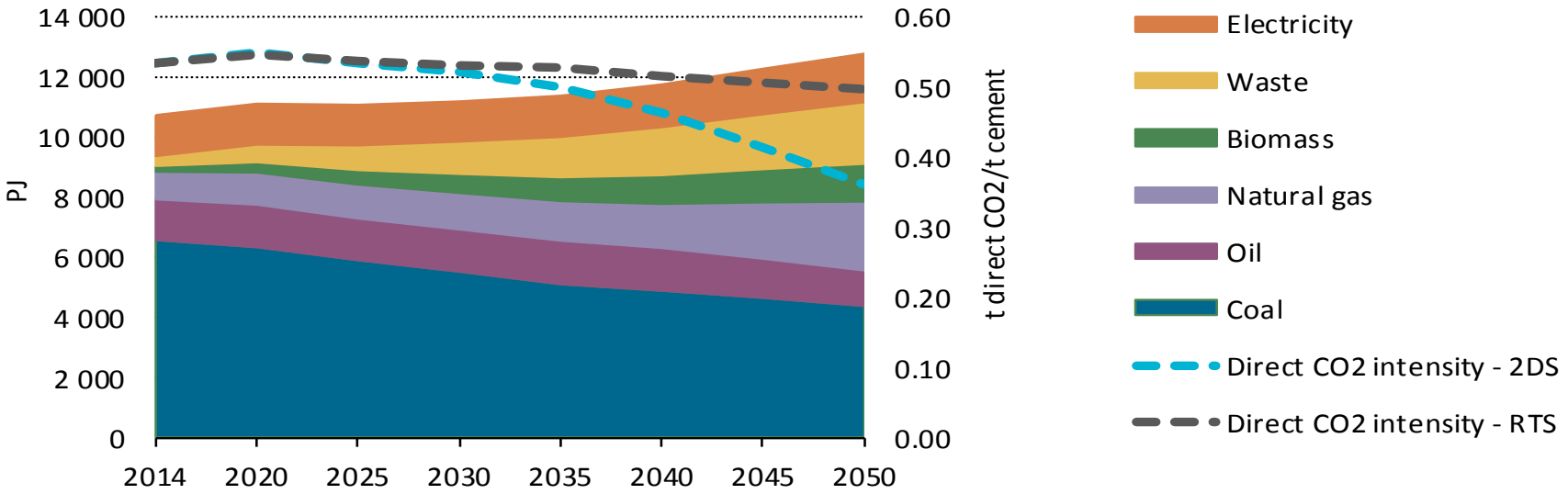
Strong growth in cement production growth in developing Asian countries compensates for the decline in Chinese cement sector activity.

Strategies to reduce CO_2 emissions from cement production



- Carbon emissions reduction levers can influence the potential for emissions reductions of other options
- For instance,
  - Alternative fuels use typically requires greater thermal energy compared to conventional fossil fuels due to lower calorific content and required kiln operating conditions.
  - Carbon capture equipment requires additional energy to operate.
  - Reducing the clinker-to-cement ratio may involve the use of cement constituents requiring energy in their preparation process (e.g. calcined clay).

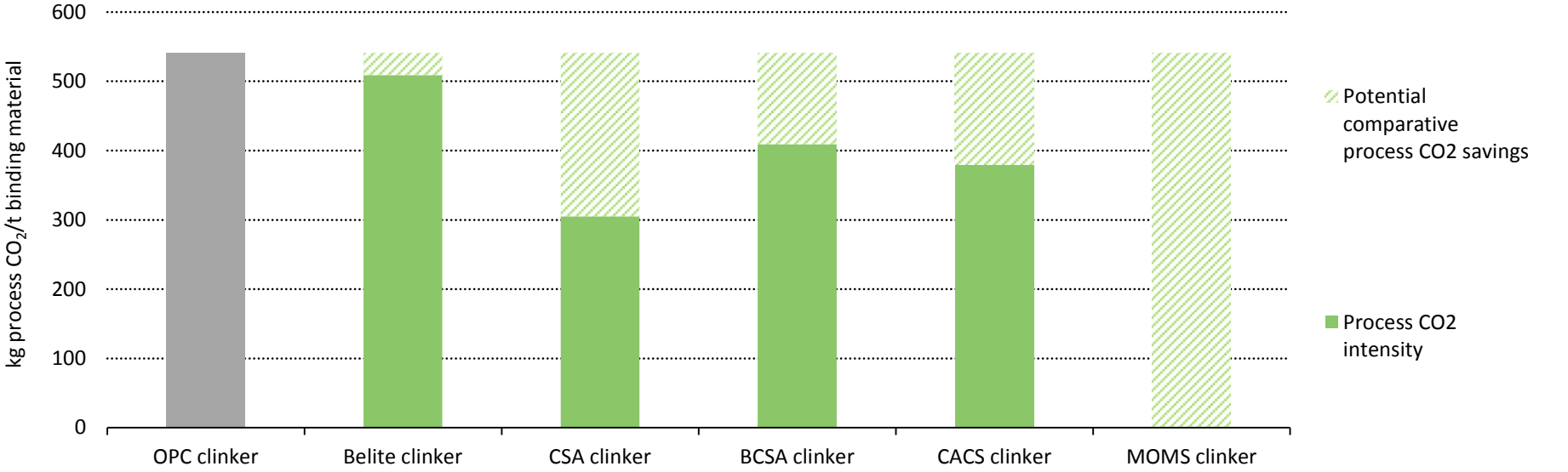
Global final energy demand and direct CO_2 intensity of cement – 2DS



A 32% reduction in the global direct CO_2 intensity of cement by 2050 in the 2DS is supported by

- Energy efficiency levels reaching best performing levels
- A reduction of fossil fuels share in cement kilns of 26%
- Significant reductions of the clinker-to-cement ration across regions, reaching a global level of 0.6 by 2050
- Integrating carbon capture technologies in cement production with CO_2 captured reaching around 30% of the generated direct CO_2 by 2050

Process CO_2 emissions intensity for selected binding materials



Alternative binding materials open possibilities for reductions of process CO_2 emissions in cement manufacturing but raw materials and operational costs, limited market applicability and standards, as well as further R&D needs in some cases, limit further deployment.

Note: PC = Portland cement, CSA = calcium sulphoaluminate, BCSA = belite calcium sulphoaluminate, CACS = carbonation of calcium silicates, MOMS = magnesium oxide derived from magnesium silicates. OPC clinker mainly contains 63% alite, 15% belite, 8% tricalcium aluminate and 9% tetracalcium alumino-ferrite. Belite clinker is considered to mainly contain 62% belite, 16% alite, 8% tricalcium aluminate and 9% tetracalcium alumino-ferrite. CSA clinker is considered to mainly contain 47.5% ye'elimite, 23.9% belite, 12.9% wollastonite and 8.6% tetracalcium alumino-ferrite. BCSA clinker is considered to mainly contain 46% belite, 35% ye'elimite and 17% tetracalcium alumino-ferrite. Commercial compositions of CACS clinker are not currently available. CACS clinker in this assessment is considered to primarily consist of wollastonite but commercial composition is likely to be different at some extent, and possibly higher in process CO_2 emissions. Process CO_2 emissions generated in CACS clinker making are in principle re-absorbed during the curing process.
Source: Quillin, K., 2010, Scrivener, K. L. et al., 2016 and Sui, T. and Gartner, E., 2017.

Global Cement Technology Roadmap: a living process

Encompassing projects

- Technology papers development covering 52 technologies by European Cement Research Academy in 2017.
  https://www.wbcsdcement.org/pdf/technology/CSI_ECRA_Technology_Papers_2017.pdf
- IEA analytical support to
  - Forthcoming Brazil Cement Technology Roadmap.
  - Forthcoming report to track progress of the India Cement Industry since 2013 when the national IEA/CSI cement roadmap was launched.

THANKS!

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