european cement research academy

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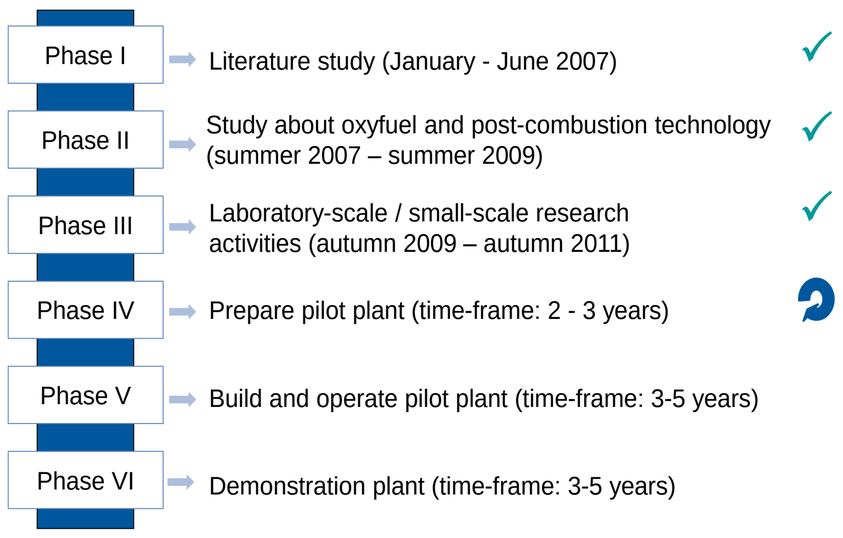
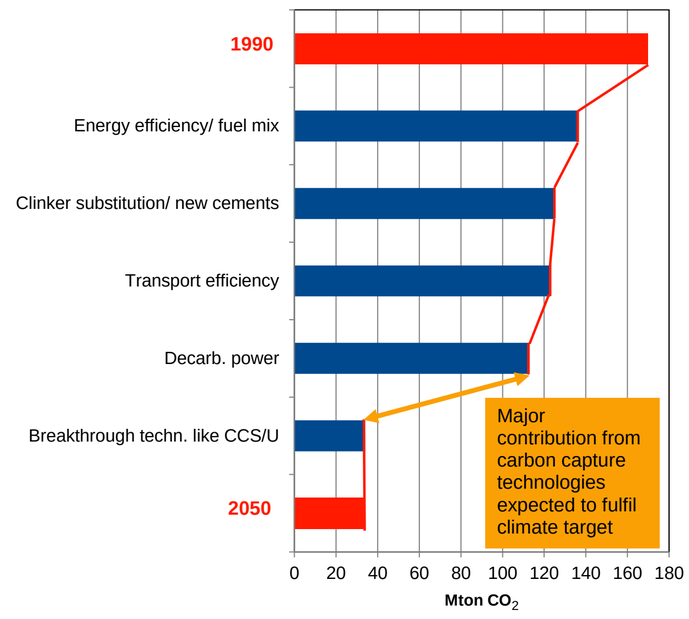
The cement industry's approach to carbon capture

ECRA's approach from basic research towards an industrial implementation of carbon capture

- All low-carbon roadmaps require a significant reduction of CO_2, also in the cement sector.
- Correspondingly and according to CEMBUREAU approx. 60% of cement plants in the EU should be equipped with CCS technology by 2050.
- Based on the need to develop this breakthrough technology, ECRA is investigating its technical and economic feasibility in its CCS research project.
- A focus is also being placed on CO_2 reuse in cooperation with the University of Mons.
- In the current phase IV of the project an oxyfuel pilot plant is being prepared, taking economic and technical issues into account.



Time schedule of ECRA's CCS project, so far fully industry-funded.



Multiple paths to emission reduction

Source: CEMBUREAU: the role of cement in the 2050 low carbon economy

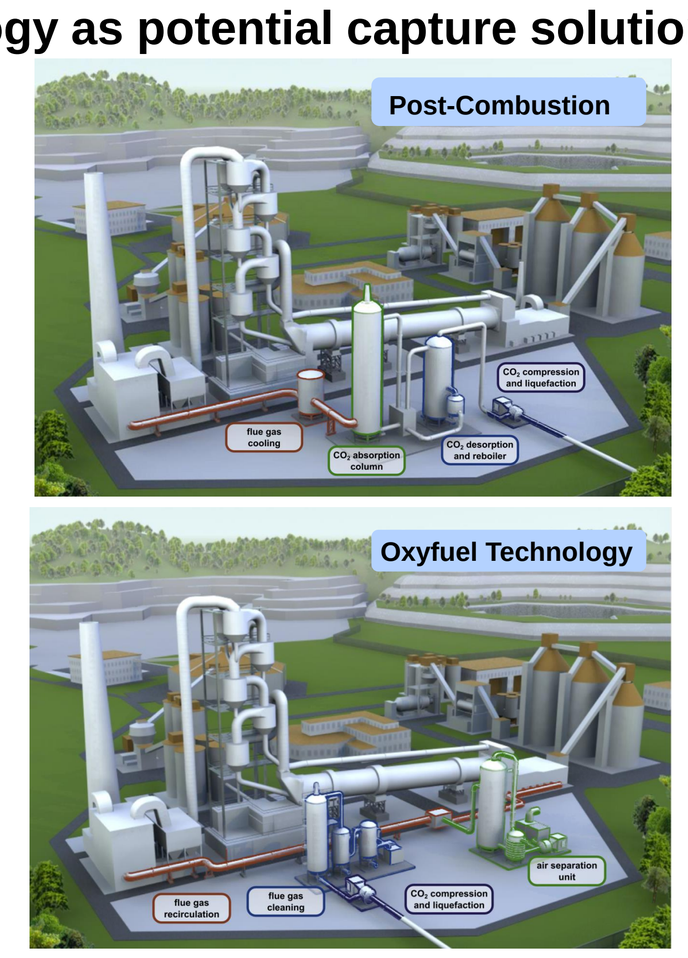
Post-Combustion and Oxyfuel Technology as potential capture solutions for the cement industry

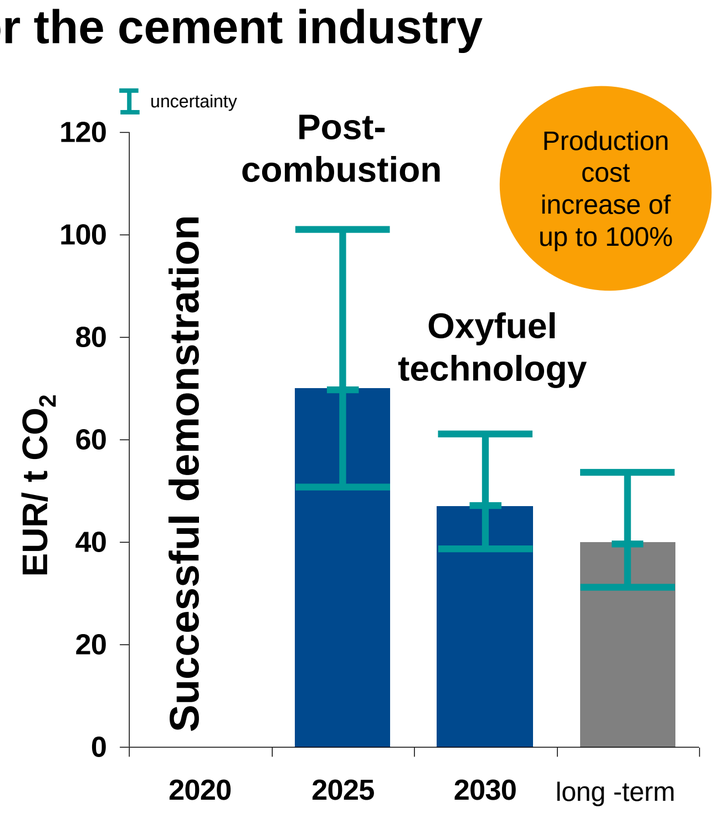
Post-Combustion: Tail-end separation of CO_2 from flue gas by e.g. chemical absorption, adsorption, membranes or Calcium Looping.

- A very energy-intensive technology.
- Important projects: Norcem's Brevik project (pilot testing), CEMCAP (prototype testing).

Oxyfuel Technology: Combustion with pure oxygen instead of air in combination with flue gas recirculation to increase the CO_2 concentration.

- Requires process and design adaptations.
- Important projects: ECRA (complete oxyfuel), LafargeHolcim / AirLiquide / FLSmidth (pilot testing of partial oxyfuel), CEMCAP (prototype testing).



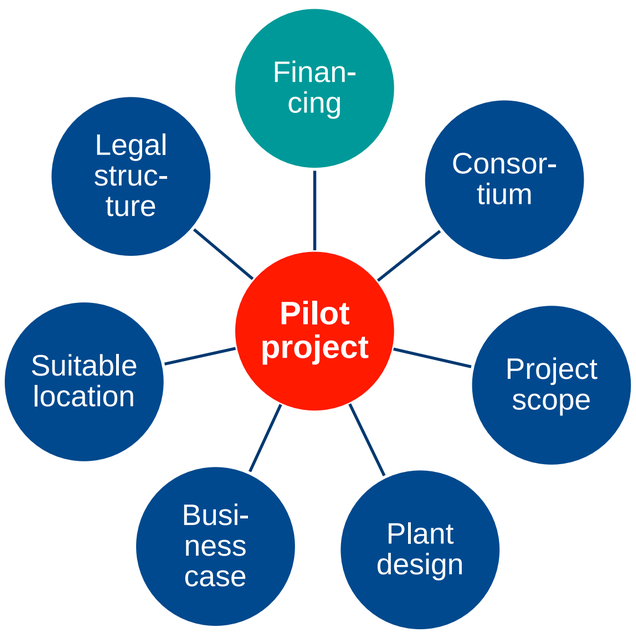


Estimated costs for carbon capture and its corresponding implementation horizon.

Source: ECRA CCS Project: Report on Phase III, 2012

Envisaged next steps towards an industrial-scale oxyfuel cement kiln

- Demonstration of technical and economic feasibility in an industrial surrounding.
- Designs: Brownfield (new installation using the infrastructure of existing line) or blackfield (retrofitting existing line).
- Size: Industrial-scale > 500 t/d
- Two potential locations (blackfield) have been selected.
- Projects costs estimated at up to 80 M €.
- Project includes engineering/construction, training and operation/scientific evaluation.
- Project requires significant funding which might only be available in 2019/20.



Finalisation of the most important research packages

Source: ECRA CCS Project : Reports on phase III, 2012 and phase IV.A, 2015

Potential sites for the oxyfuel demo project

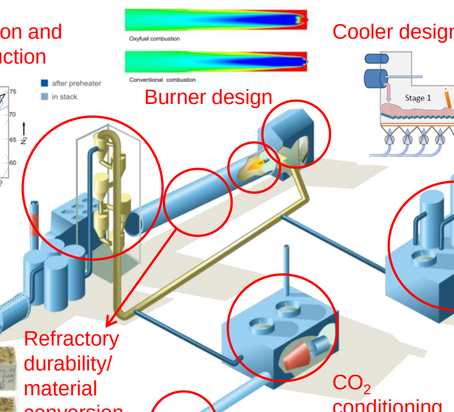
Colleferro Plant:

- HeidelbergCement Group (Italcementi Plant)
- Plant located in Italy, close to Rome
- Kiln not used for daily production
- Petcoke as fuel; no alternative fuels
- Kiln currently on stand-by
- Lowest CAPEX / medium OPEX

Retznei Plant:

- LafargeHolcim Group
- Plant located in the south-east of Austria
- 100 % alternative fuels goal
- Currently operated at maximum production
- Low CAPEX / high OPEX

New calciner for the Colleferro Kiln →



Layout of the modified Retznei Kiln →