

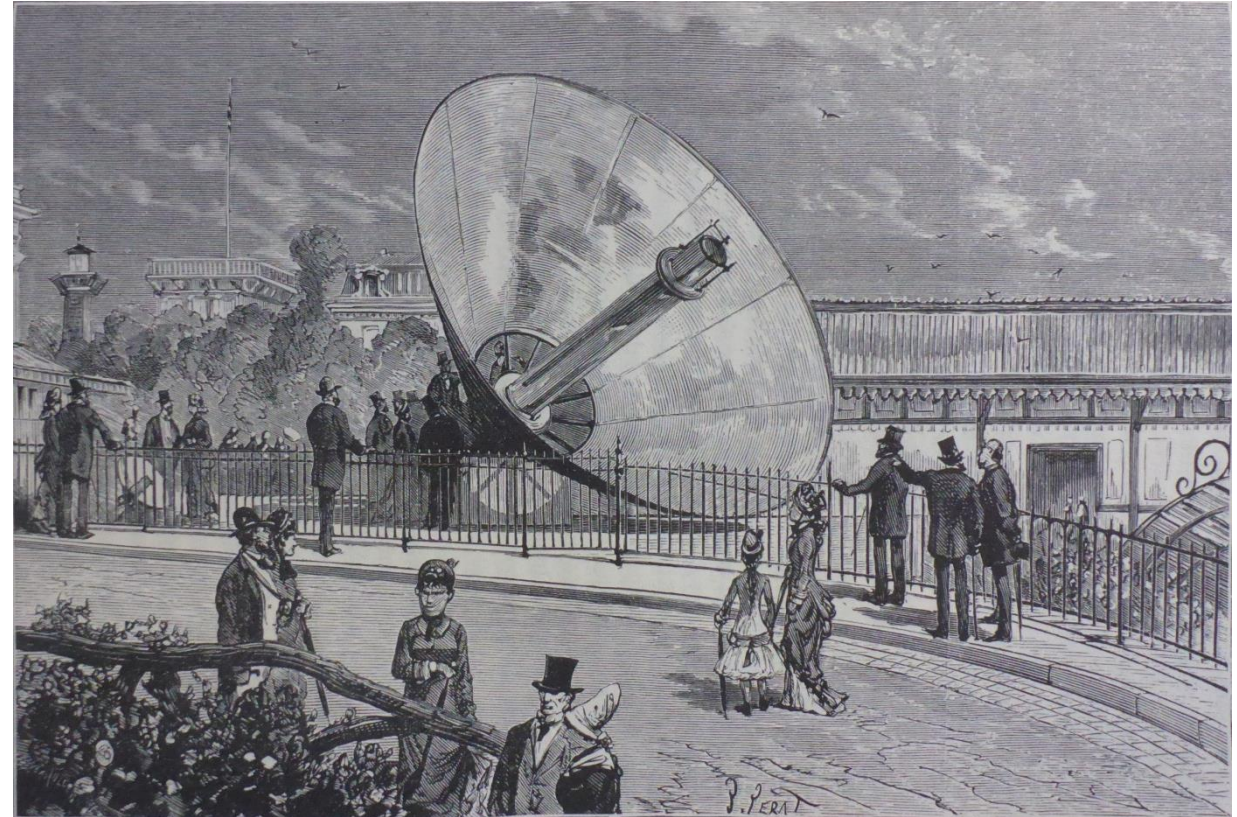
Applications of solar heat for the calcination of minerals

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Laying the foundation

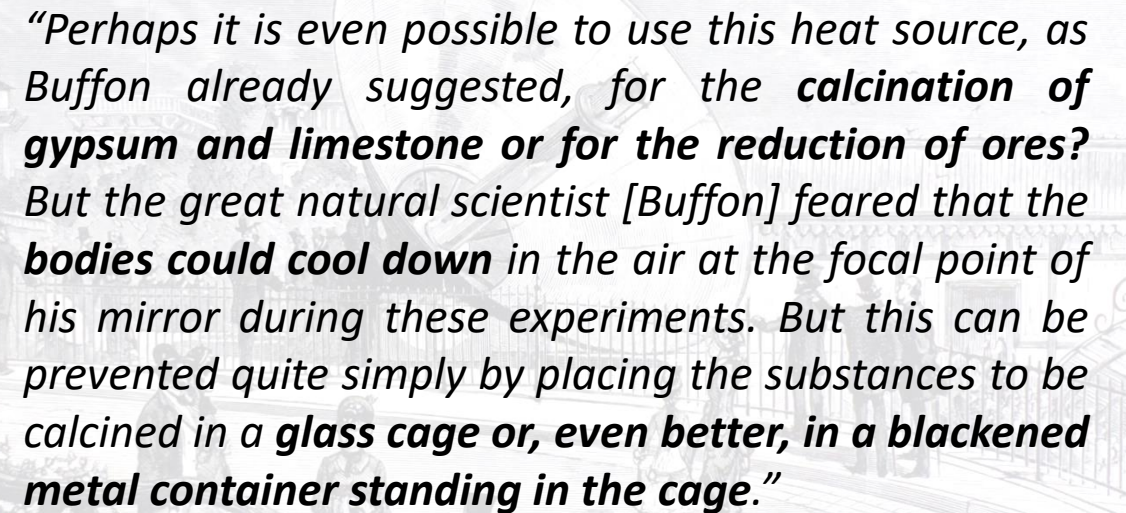
- 1878, Augustin Mouchot at the world exhibition in Paris
- 20 m² mirror surface, 100 litre volume of tank
- Production of steam at 6 atm



A. Mouchot, „Die Sonnenwärme und ihre industriellen Anwendungen“, translated from French original 1879, 1987

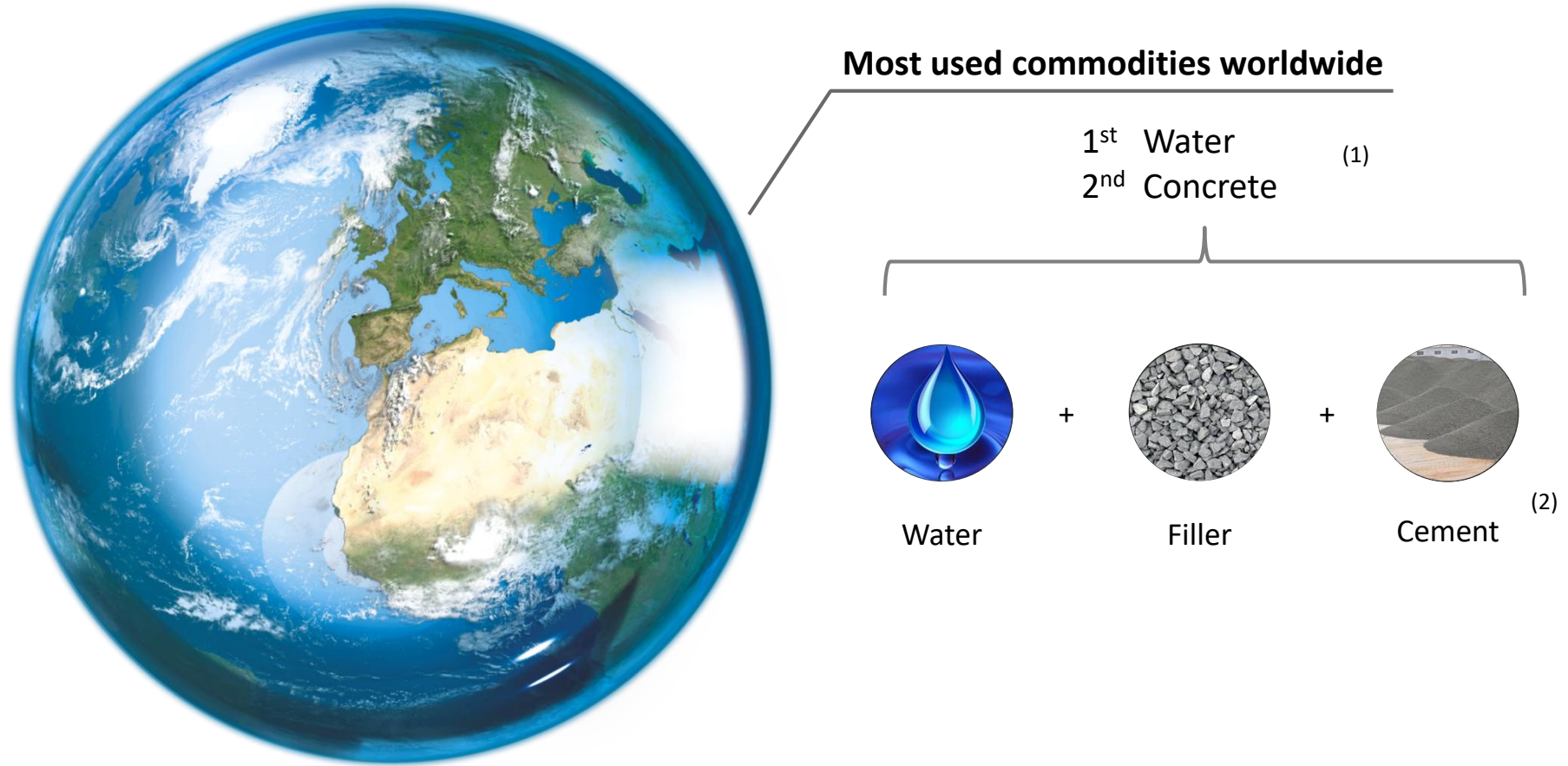
And going beyond?

- 1878, Augustin Mouchot at the world exhibition in Paris
- 20 m² mirror surface, 100 litre volume of tank
- Production of steam at 6 atm



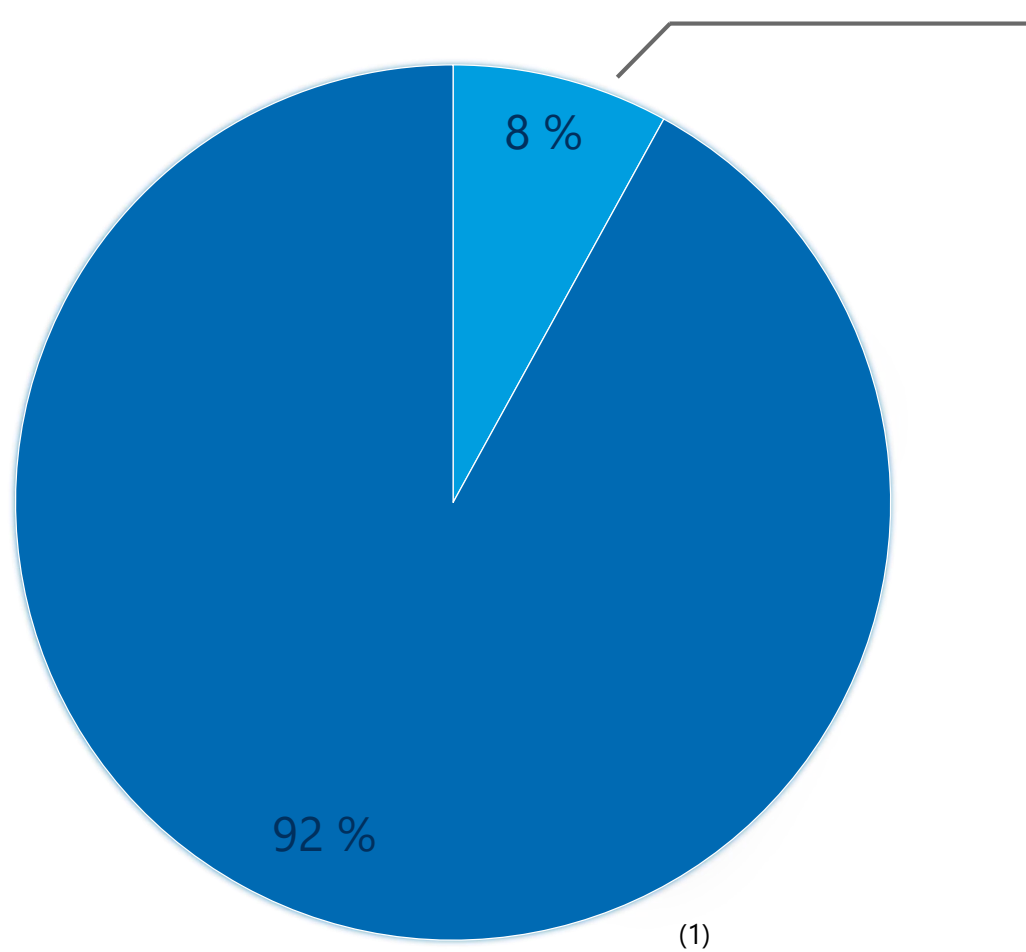
*“Perhaps it is even possible to use this heat source, as Buffon already suggested, for the **calcination of gypsum and limestone or for the reduction of ores?** But the great natural scientist [Buffon] feared that the **bodies could cool down** in the air at the focal point of his mirror during these experiments. But this can be prevented quite simply by placing the substances to be calcined in a **glass cage or, even better, in a blackened metal container standing in the cage.**”*

Relevance of cement

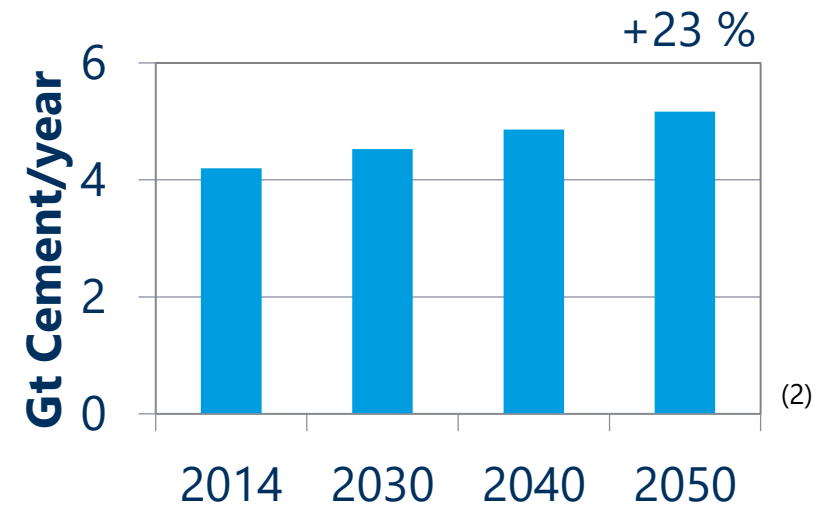


(1) Cement Technology Roadmap, WBSCD, 2009
(2) Concrete constituents, mastour.com

Emissions of cement production



Cement production

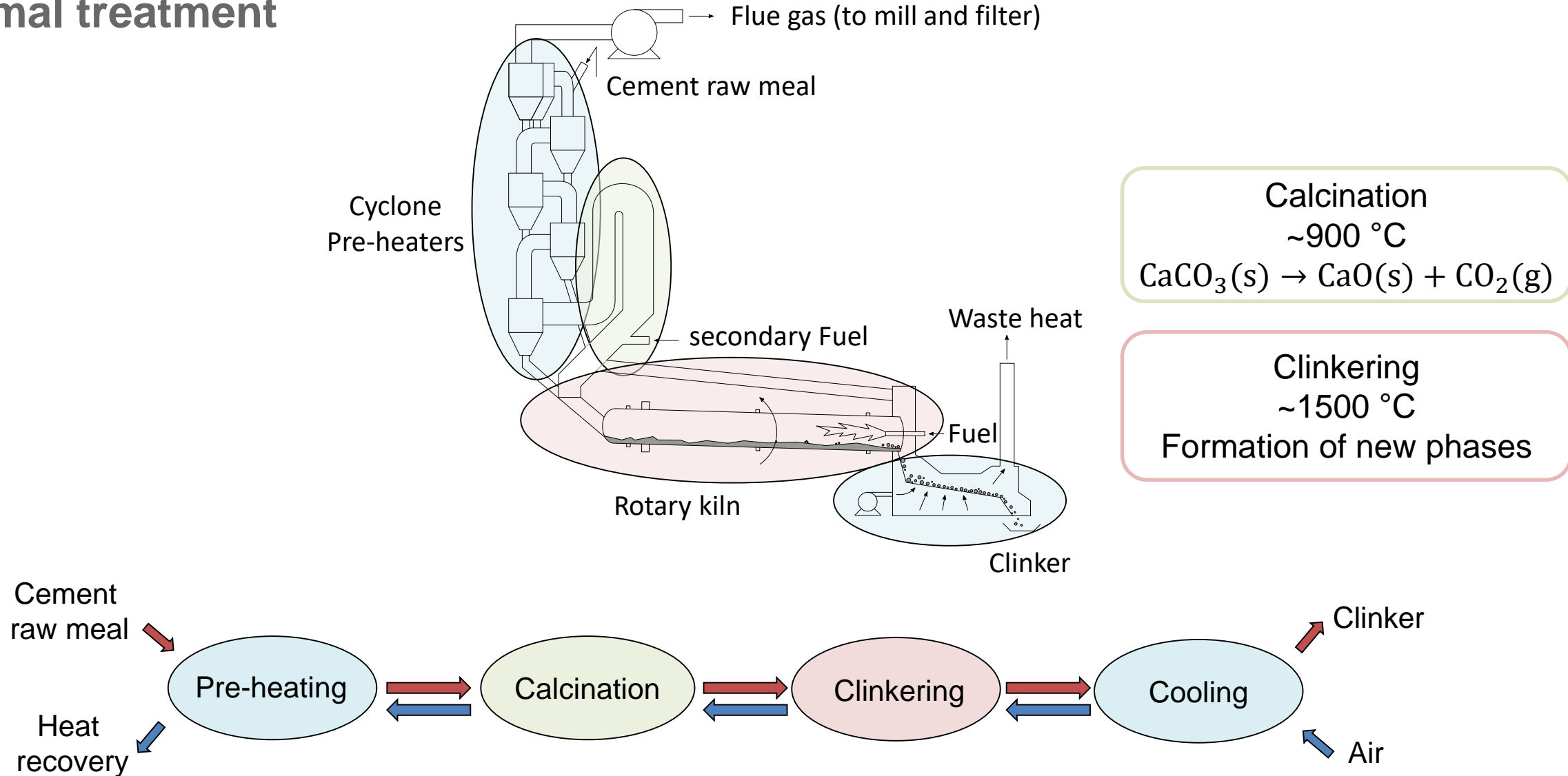


(1)

(1) A blueprint for a climate friendly cement industry, WWF, 2008

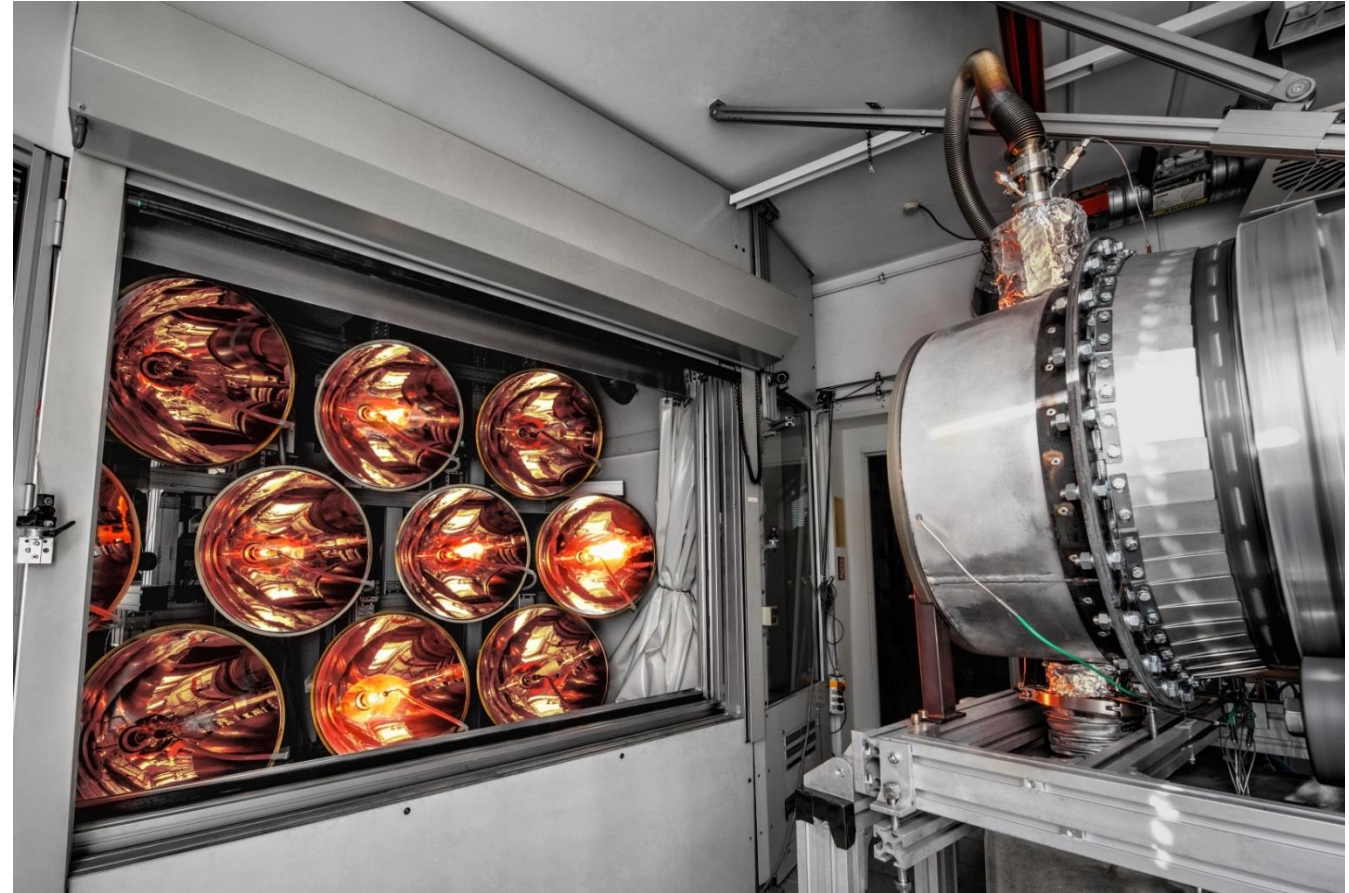
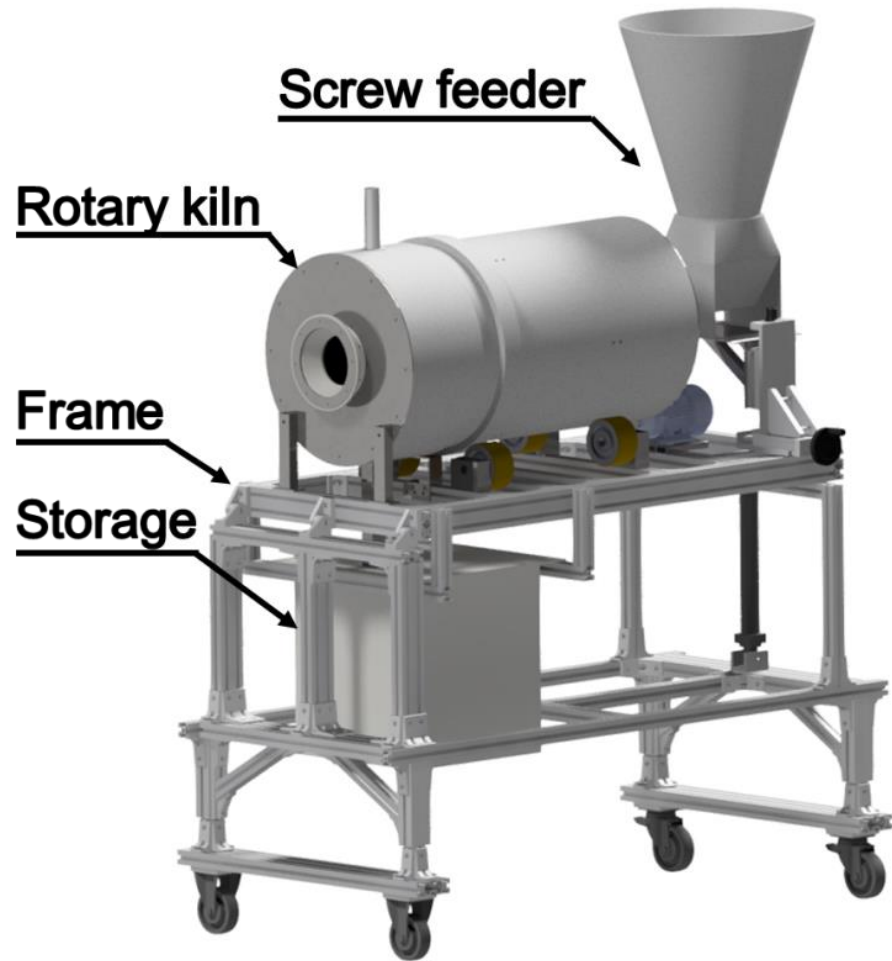
(2) Technology Roadmap: Low-Carbon Transition in the Cement Industry, IEA, 2018

Thermal treatment

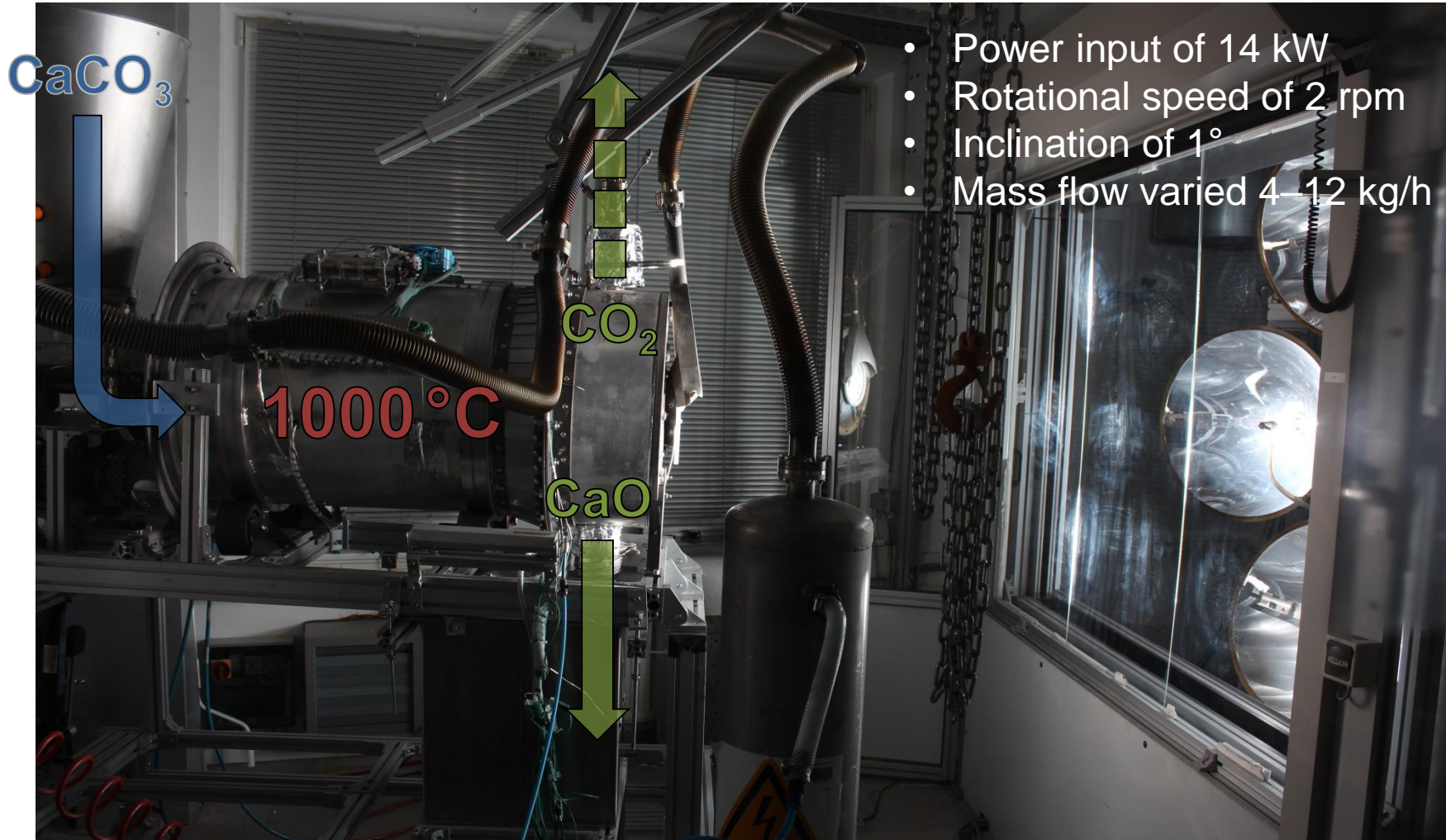


Sprung, S., Cement, in Ullmann's Encyclopedia of Industrial Chemistry, 2008

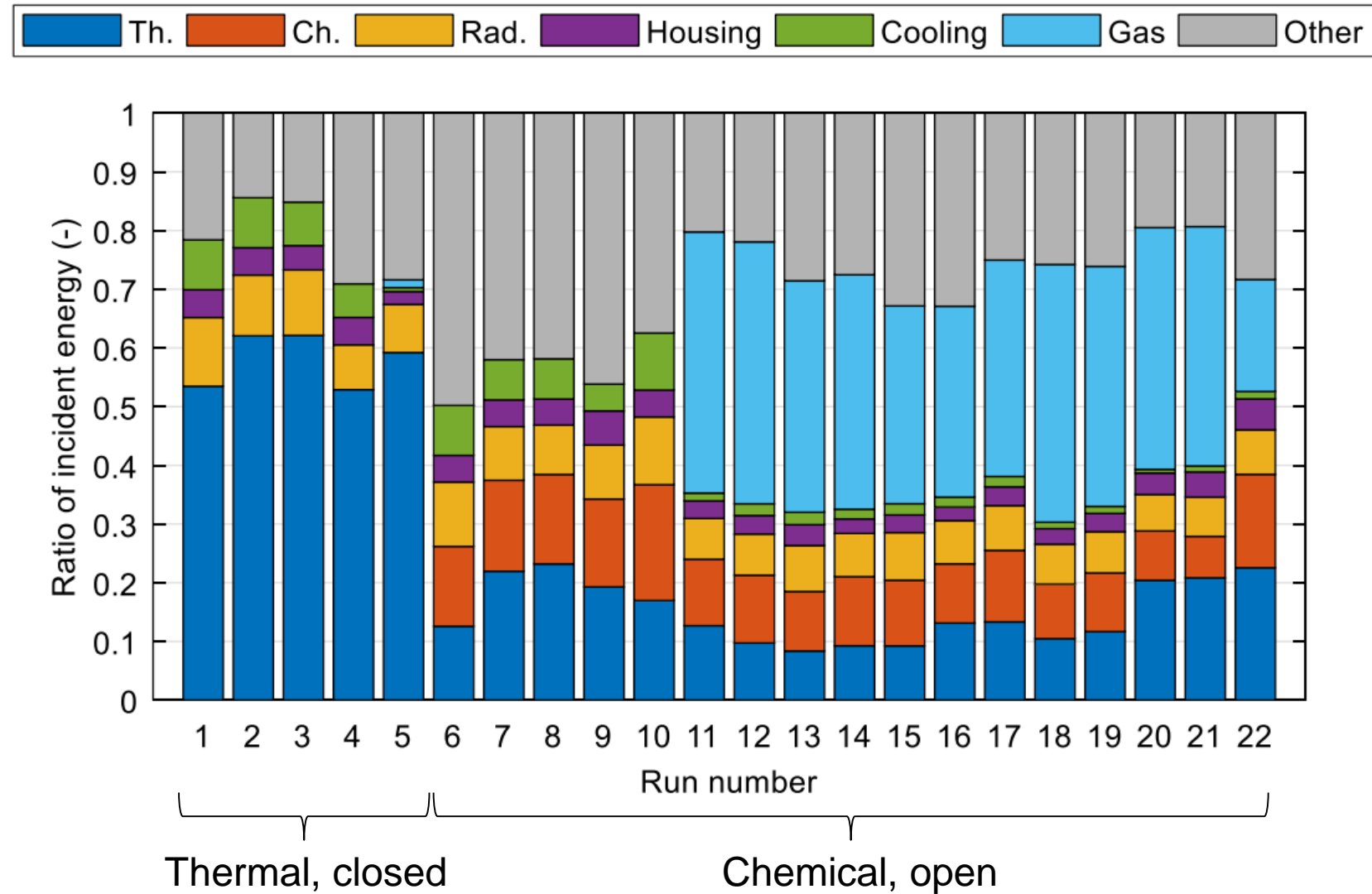
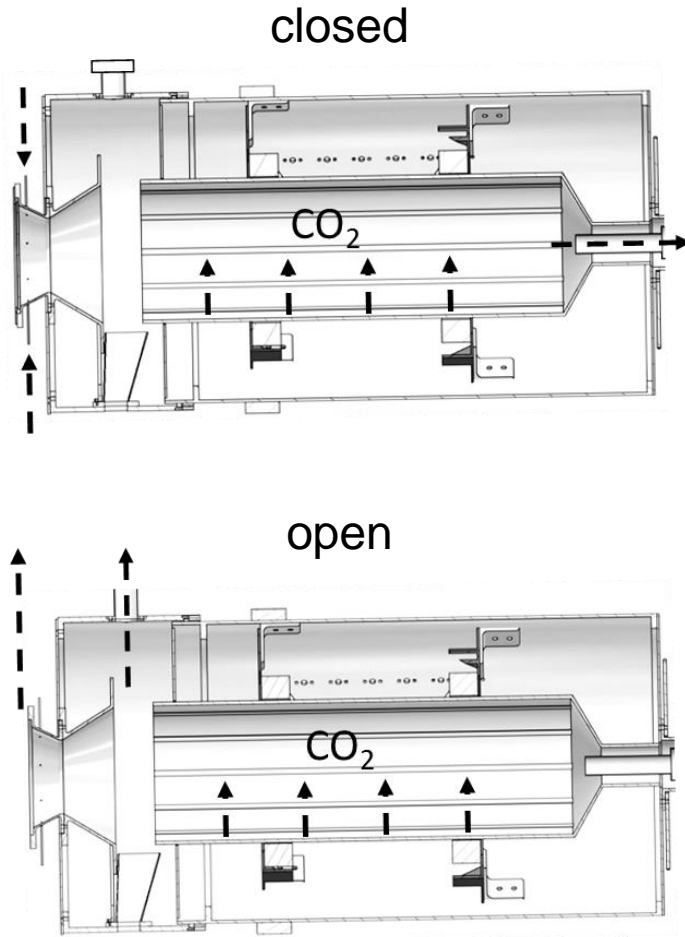
Solar rotary kiln for calcination



Experiments in the solar simulator



Results of the solar campaigns



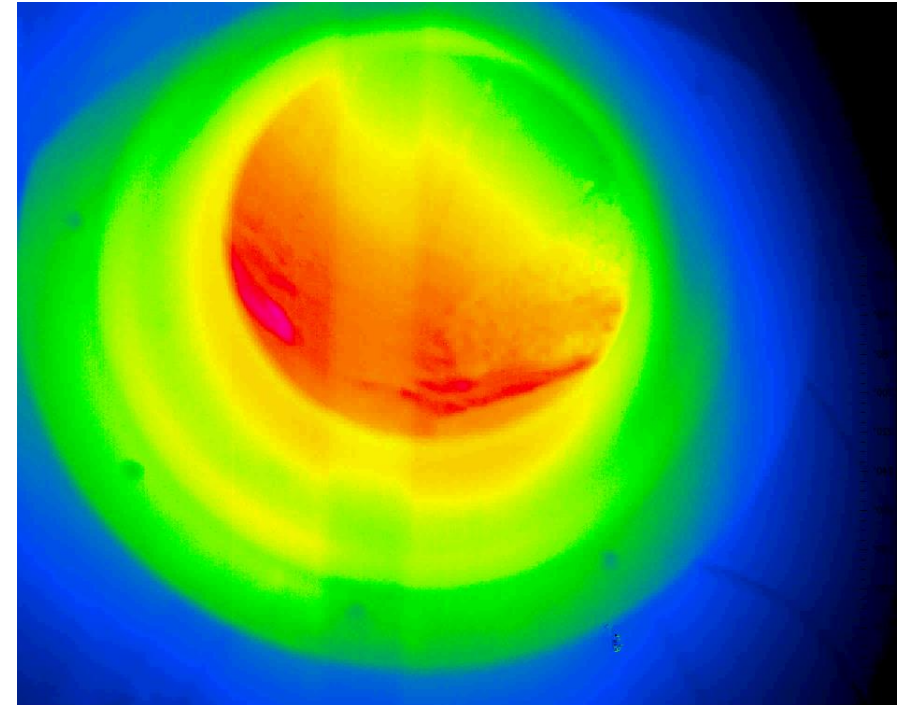
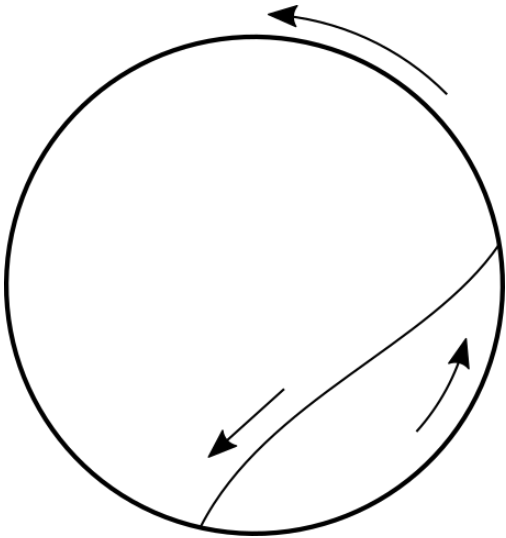
Degree of calcination

Particles with bed height

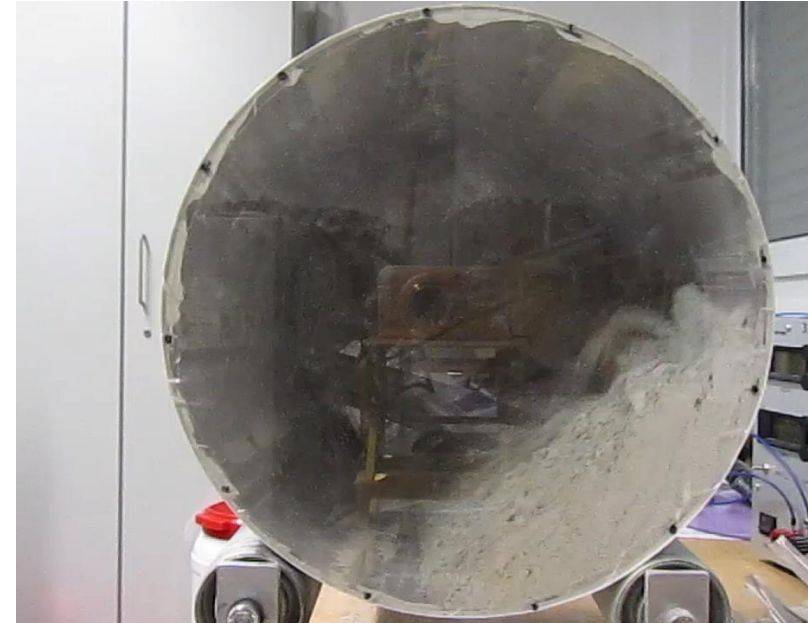
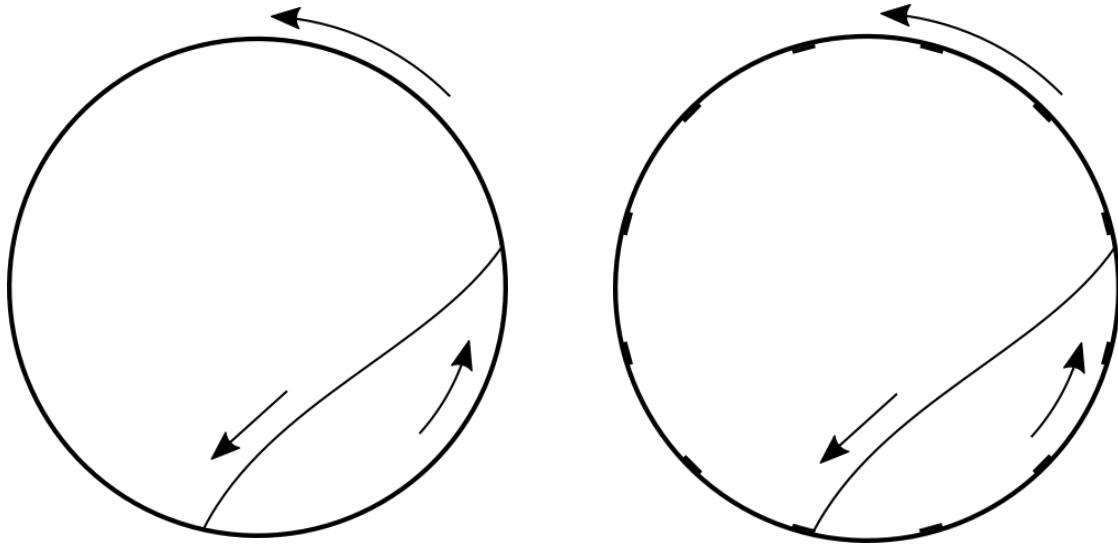
Single particles



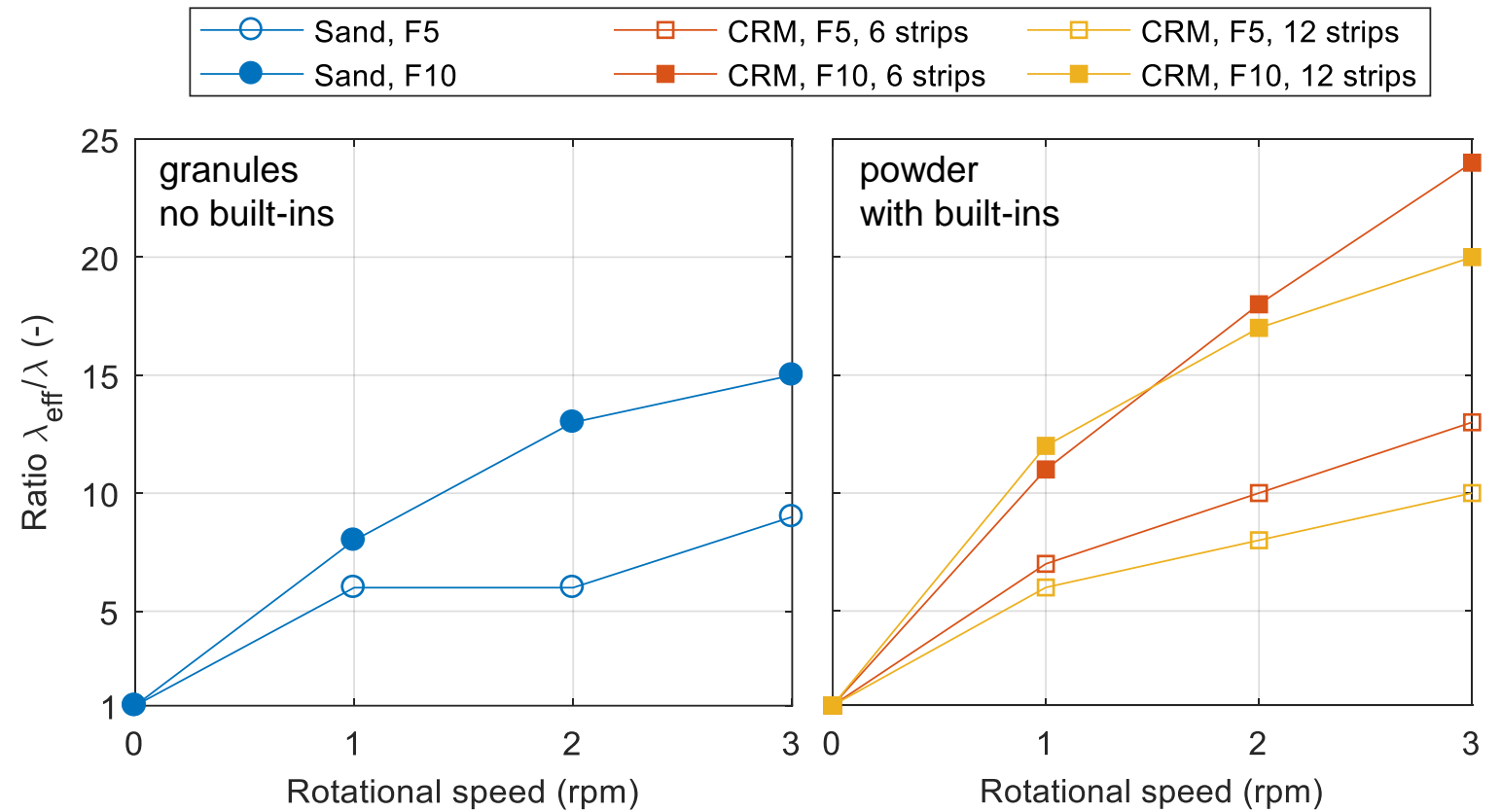
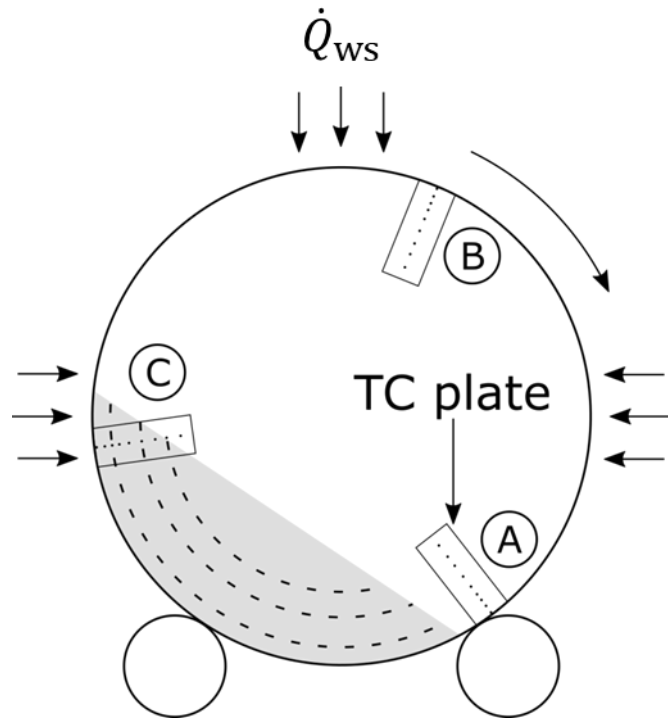
Bed motion inside the kiln



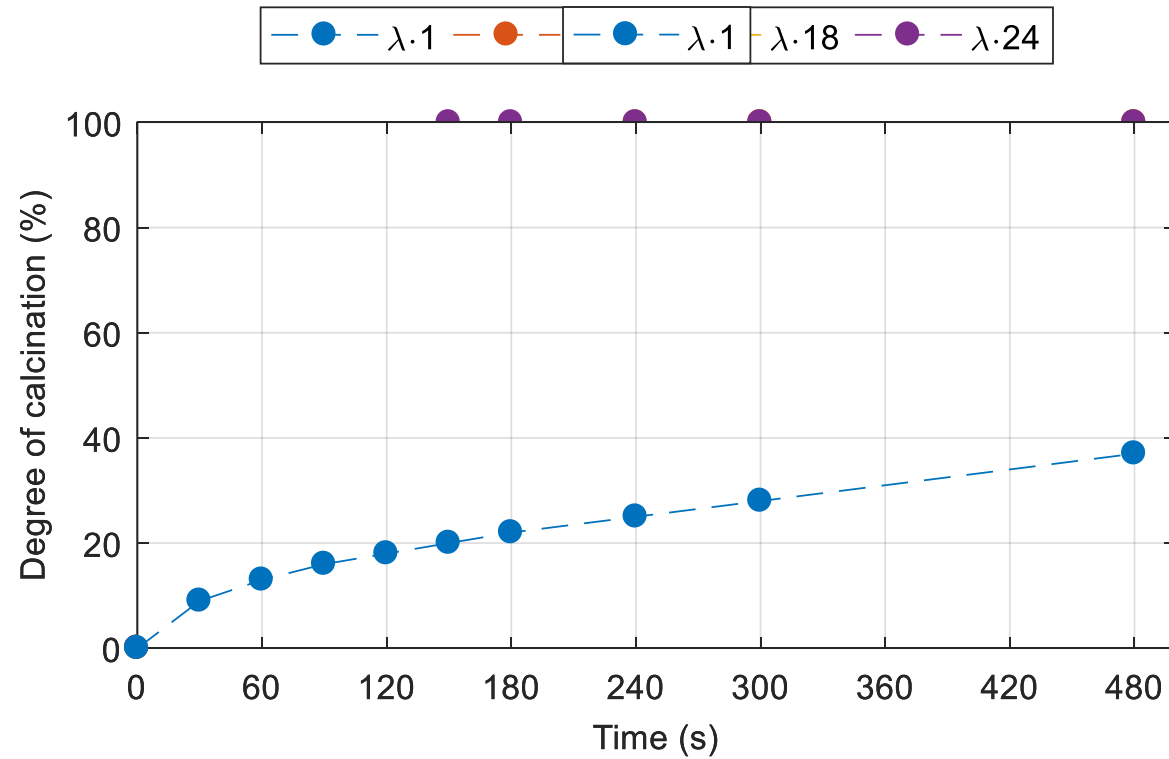
Bed motion inside the kiln



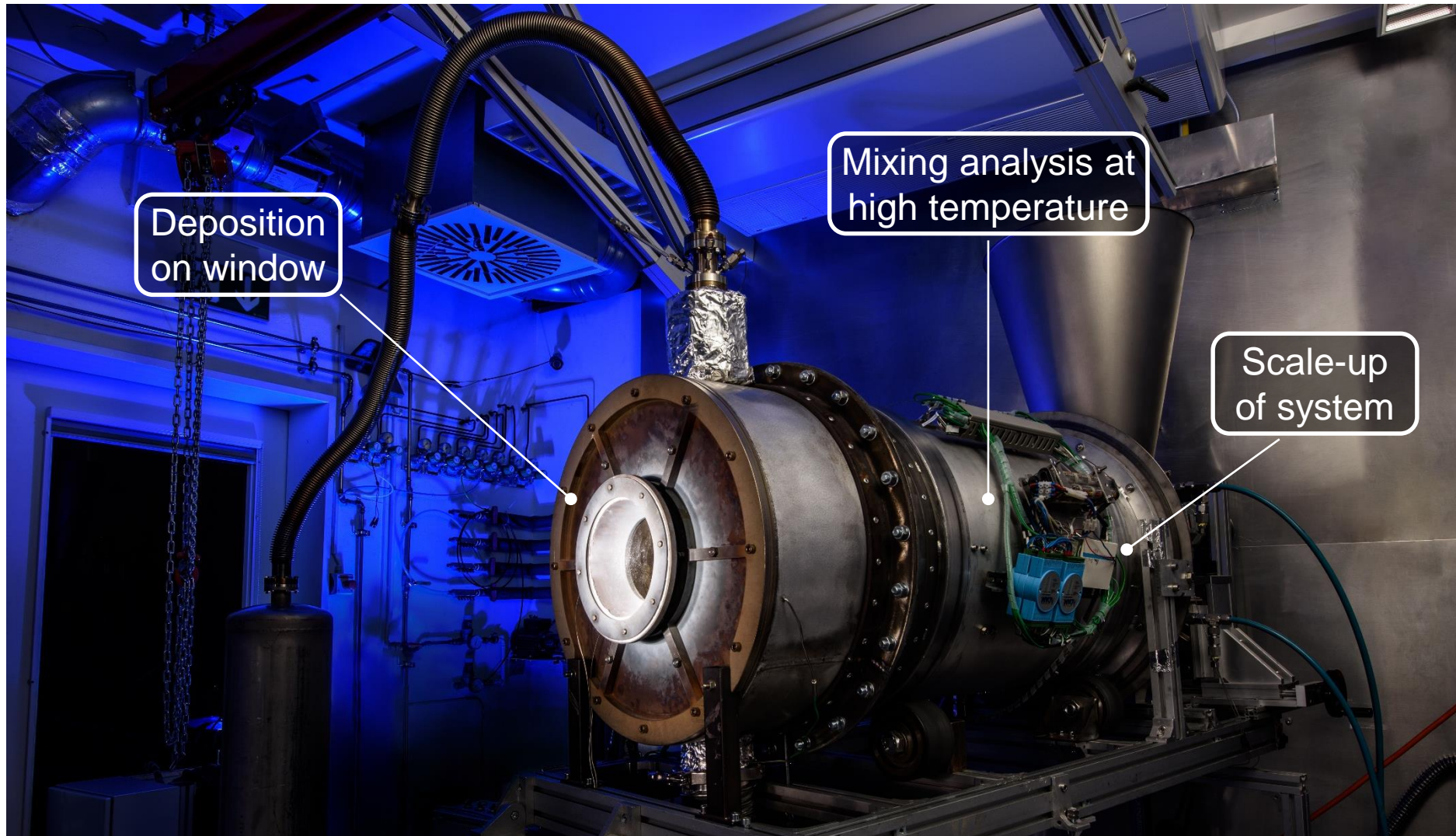
Impact on the bed thermal conductivity



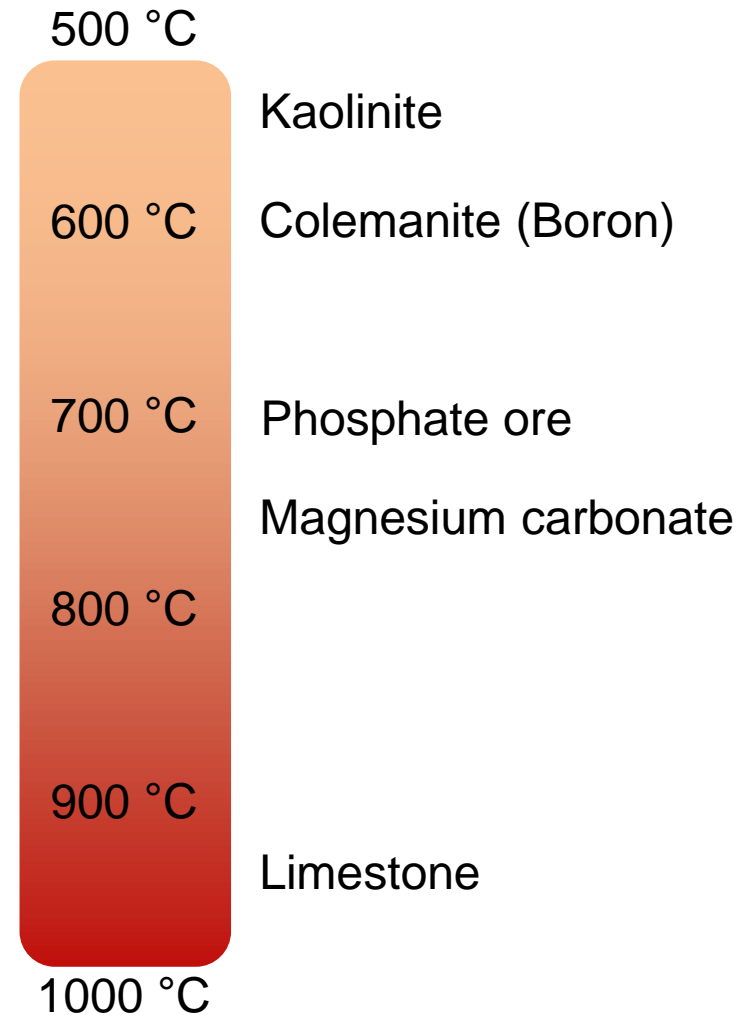
Reduction of calcination time



Present and planned studies



And going beyond?



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Thank you for your attention!