ANICA

Adva**n**ced **I**ndirectly Heated
Carbonate Looping Process

Accelerating CCS Technologies

Advanced CO_2 capture technologies for cement and lime industries

Workshop of the ANICA project

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GSRT
GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY

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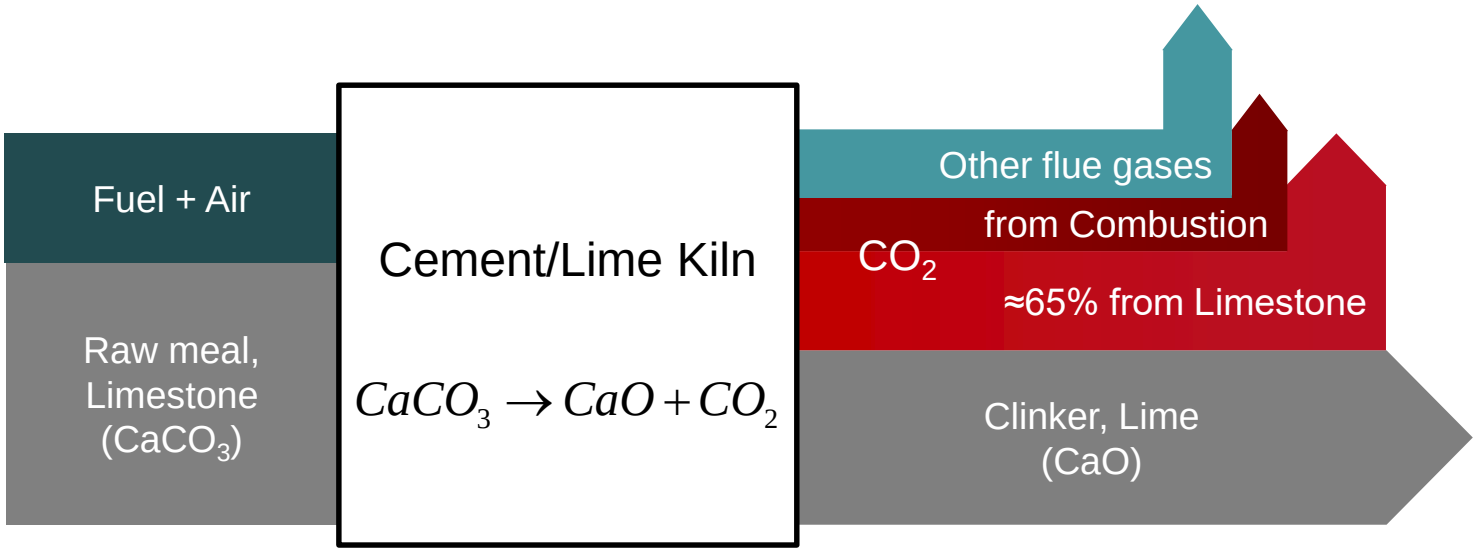
Agenda

9.00 – 9.15	Welcome & Introduction
9.15 – 10.45	**Session 1:** Development of the IHCaL Process for Cement and Lime Plants ▪ Integration of the IHCaL Process into Lime Plants, M. Greco-Coppi (TUDA) ▪ IHCaL Pilot Testing: Presentation and Virtual Tour, C. Hofmann (TUDA) ▪ Integration of the IHCaL Process into Cement Plants, V. Erfurt (VDZ) ▪ Experimental Characterization of Cement Raw Meal, K. Böge (FAU) ▪ Integration of the Direct Separation into the IHCaL Process, T. Hills (CALIX) ▪ Q & A
10.45 – 11.00	Break
11.00 – 12.15	**Session 2:** Ongoing Projects on CO_2 Capture from Cement Production ▪ The Brevik CCS Project, P. Brevik (Norcem) ▪ Status of CLEANKER Pilot Plant, F. Magli (Buzzi-Unicem) ▪ LEILAC: Scaling Up Low-Carbon Solutions, S. Thomsen (CALIX) ▪ Progress of the AC2OCem Project, C. Kroumian (Uni Stuttgart) ▪ Q & A
12.15 – 12.30	Concluding Remarks

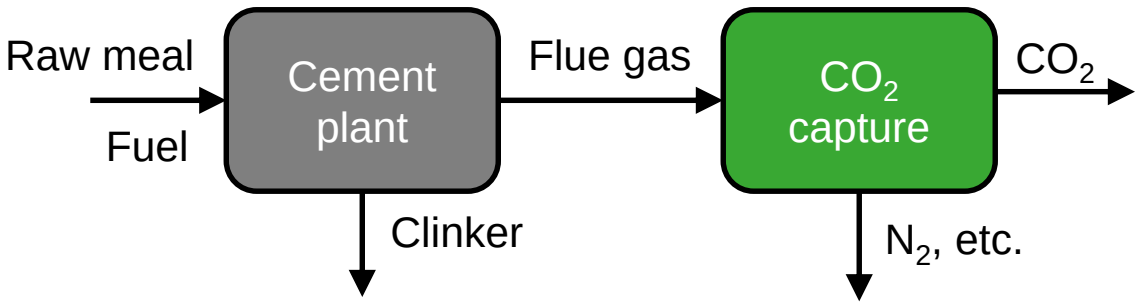
Write questions in Chat

Motivation

- Lime/cement industries contribute to ~8 % of worldwide CO_2 emissions
- 2/3 process CO_2 emissions (unavoidable):
  → **CO_2 capture required**
- Efficient, economic CO_2 capture technologies
  → **Various ongoing projects**



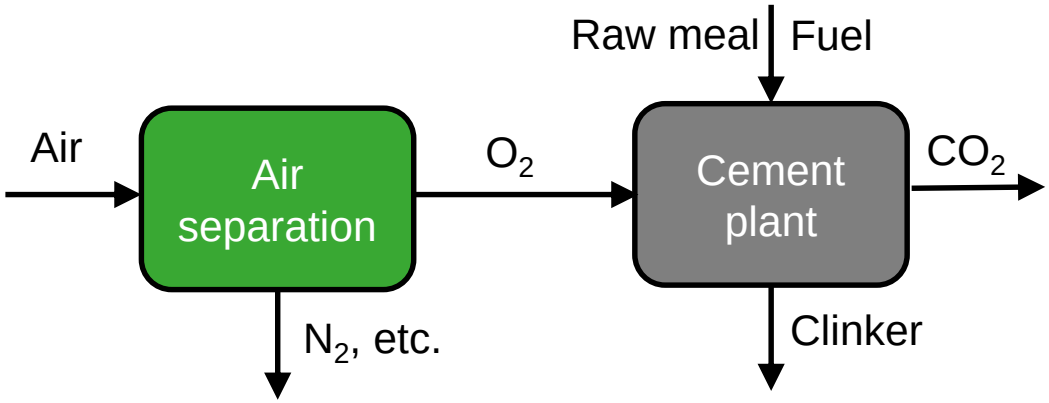
CO_2 Capture Technologies



Brevik project

Post-combustion capture

- Amine scrubbing
- Carbonate looping
- Membranes



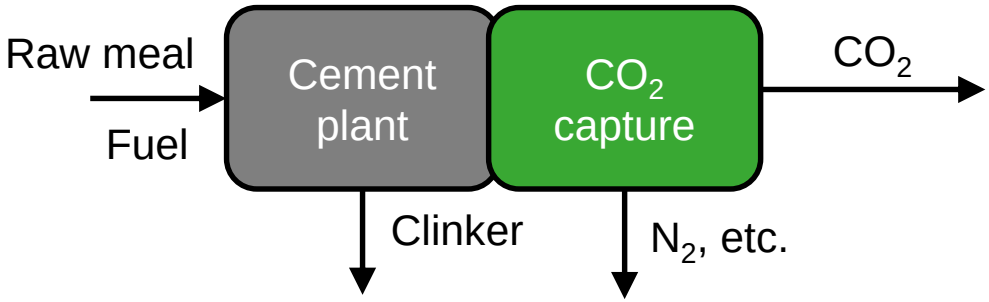
AC2OCem

Oxyfuel combution

LEILAC

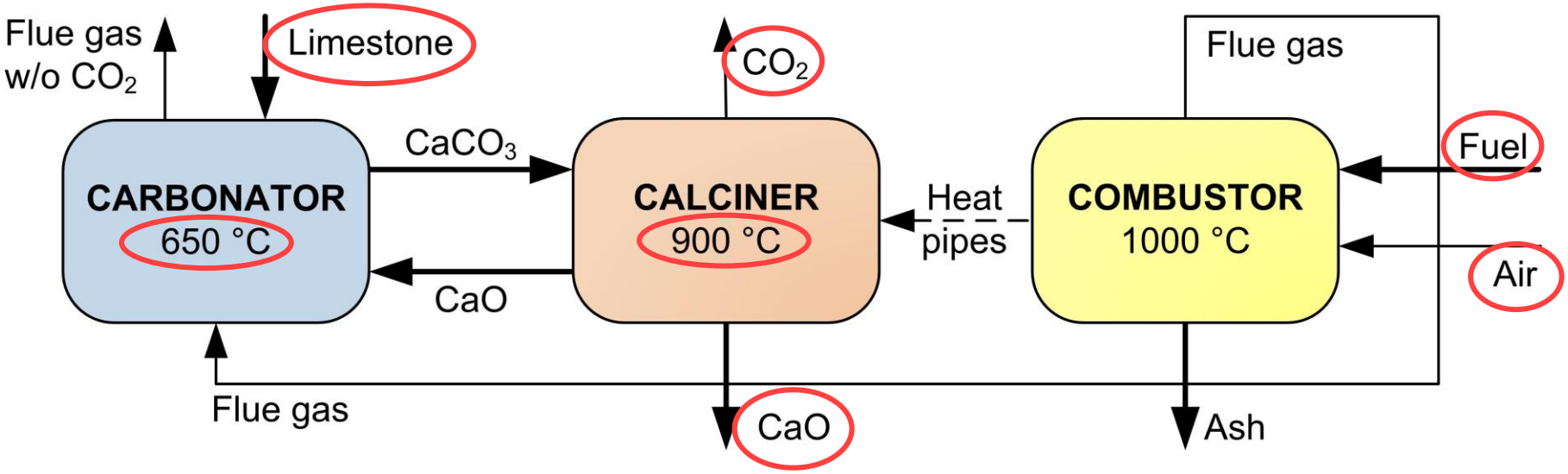
CLEANKER

ANICA



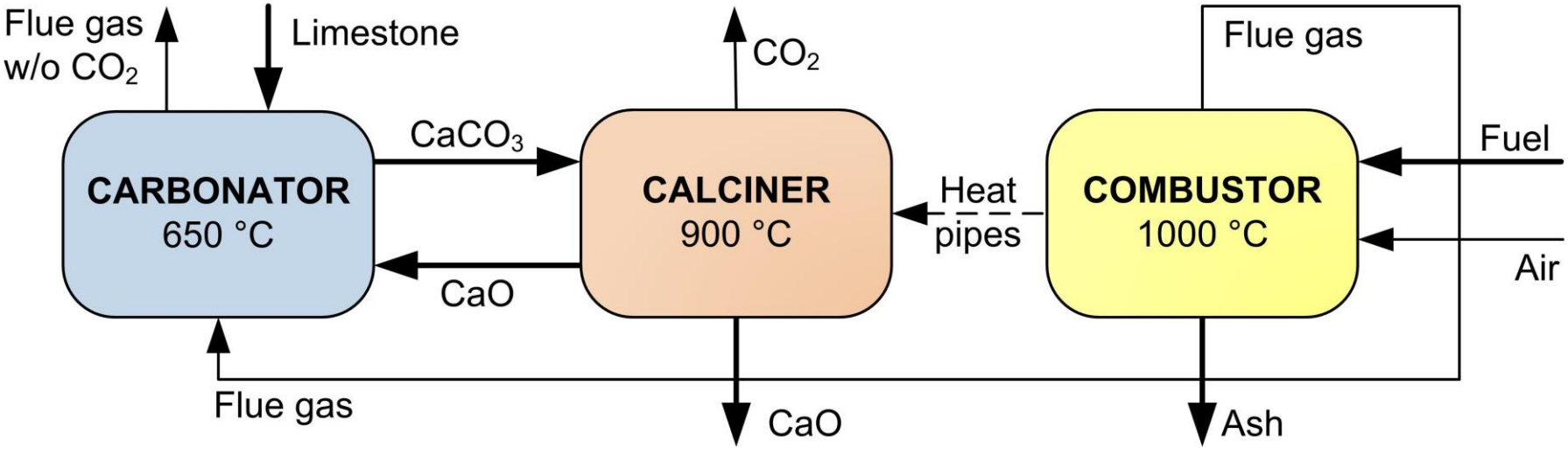
Integrated CO_2 capture

Indirectly Heated Carbonate Looping (IHCaL)



- Sorbent (limestone): **cheap**, abundant, non-toxic, environmentally friendly
- Utilization of sorbent (CaO) in lime/cement production (→ **material** integration)
- Utilization of heat at high temperature (→ **highly efficient** steam cycle)
- No oxygen for calciner → No ASU, **low energy loss**
- No fuel in calciner → few impurities (sulfur, ash), **low deactivation / dilution**
- Almost **pure CO_2** stream at calciner exit

KPIs for Lime/Cement Plants

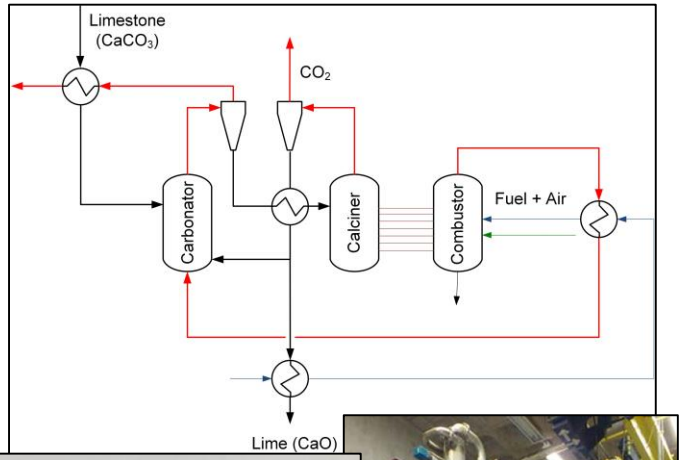


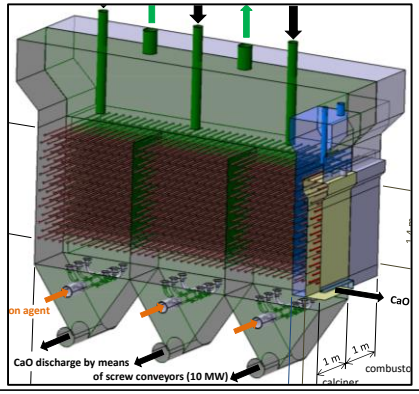
Key Performance Indicator (KPI)	Target
CO_2 capture efficiency	> 90 %
CO_2 purity	> 95 %
Net efficiency for power co-generation	> 45 %
Sorbent utilization	> 90 %
CO_2 avoidance costs	< 25 €/t
Net CO_2 emissions	< 0

ANICA Objectives

Develop and evaluate concepts of indirectly heated carbonate looping (IHCaL) process for **CO_2 capture** from **lime** and **cement** plants:

- Develop **process** and **reactor concepts**
- Test concepts at 300 kW_{th} **pilot plant**
- Prove feasibility of **utilizing of spent sorbent**
- Assess **risks**, **economics**, **environmental** impact
- Design a 20 MW_{th} **demonstration** plant





Consortium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Thank you for your attention!