

Clean clinker production via calcium looping process

Summary

CLEANKER is a Horizon 2020 project that will demonstrate the integrated calcium looping process at TRL 7, in a new demo system connected to the 1300 kton/year cement plant, operated by Buzzi Unicem, in Vernasca (Piacenza, Italy).

Main Features:

Starting date: October 1st 2017

Duration: 48 months

Number of partners: 13 from five EU member states plus Switzerland and China

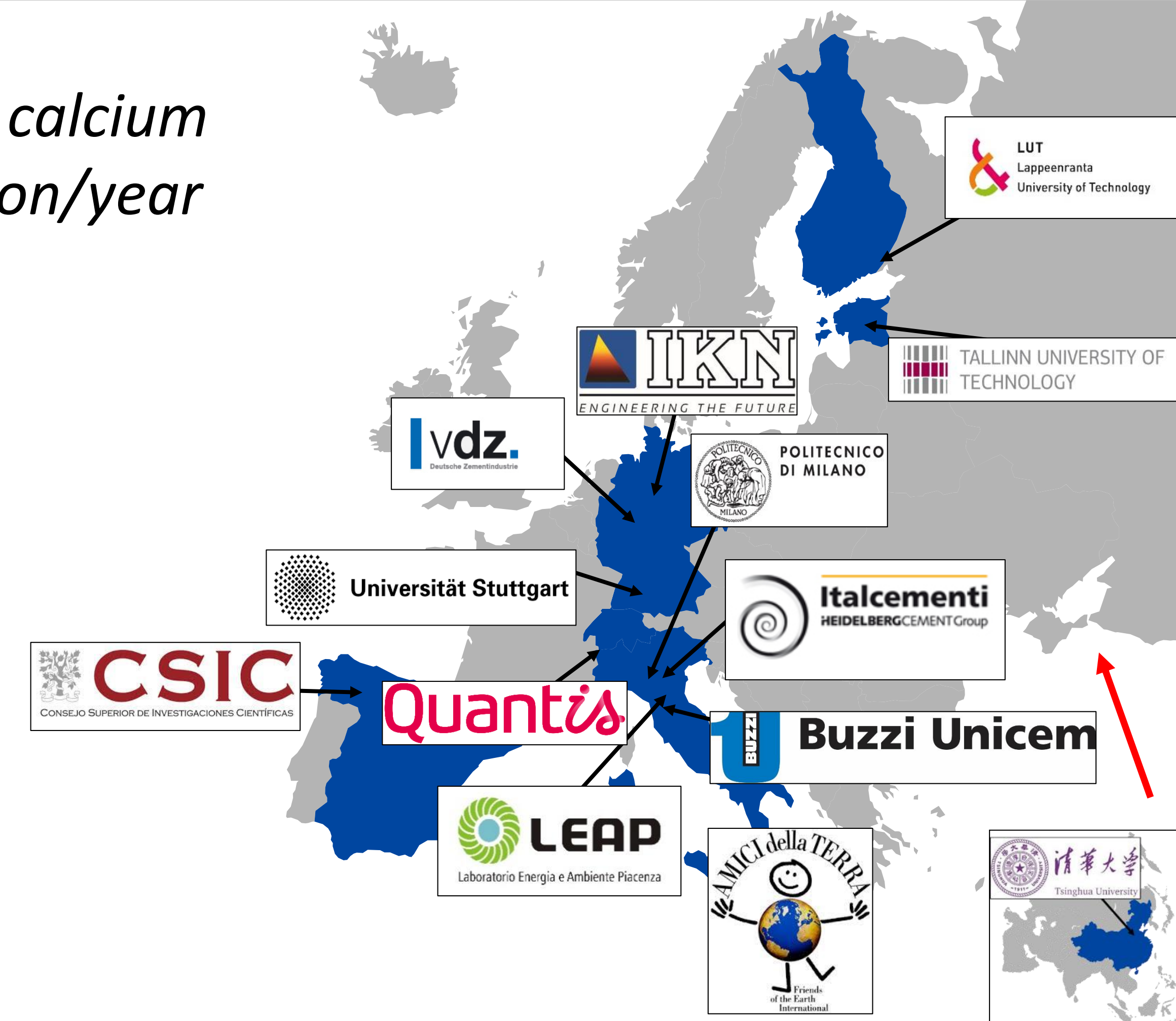
Budget: 9.237.851 €

EC contribution: 8.972.201 €

Chinese government funding: 265.650 €

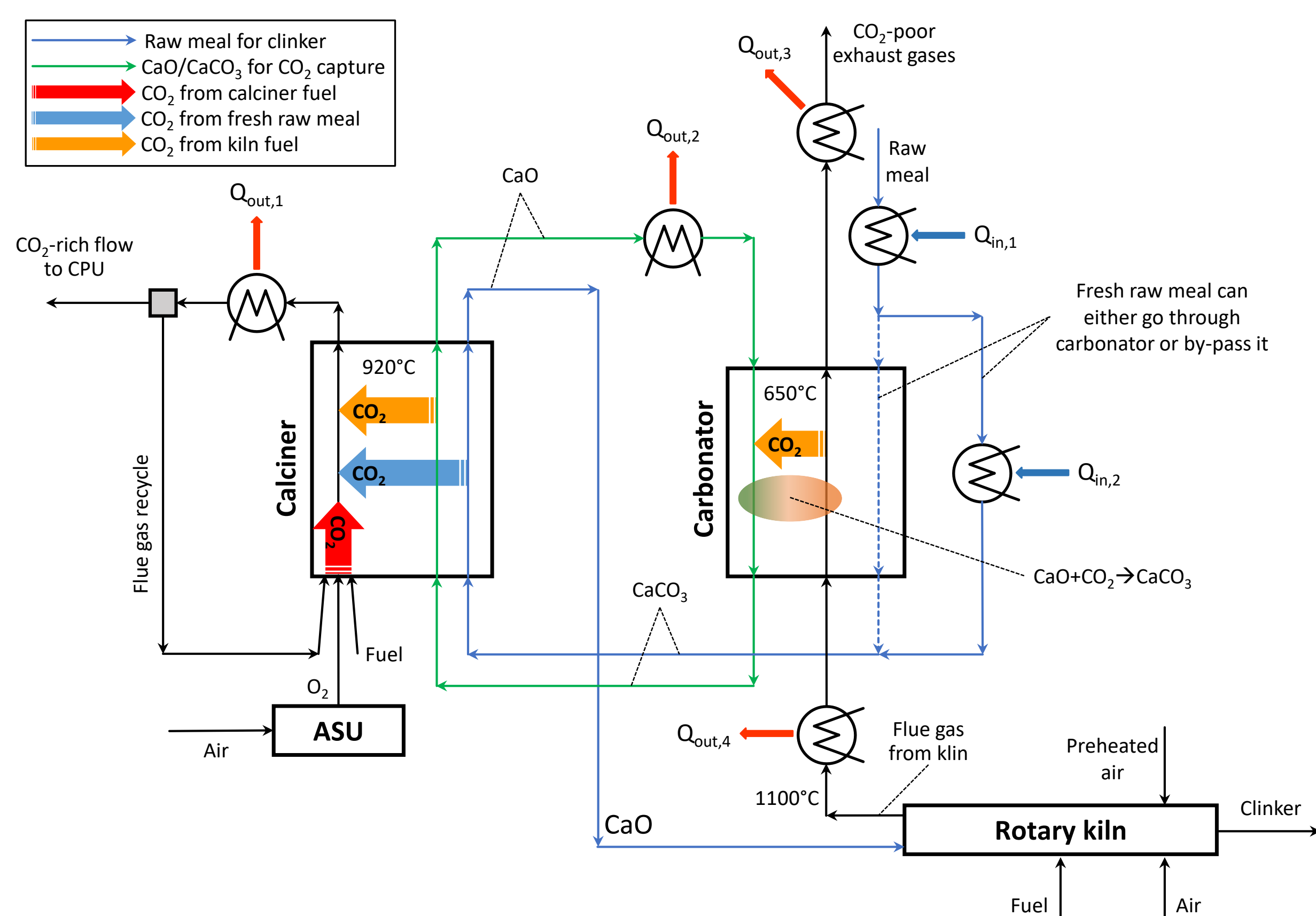
Coordinator: LEAP scarl - Laboratory of Energy and Environment Piacenza

- Two cement producers
- One technology provider
- One SME
- One environmental association
- Eight universities/research organizations



Technology

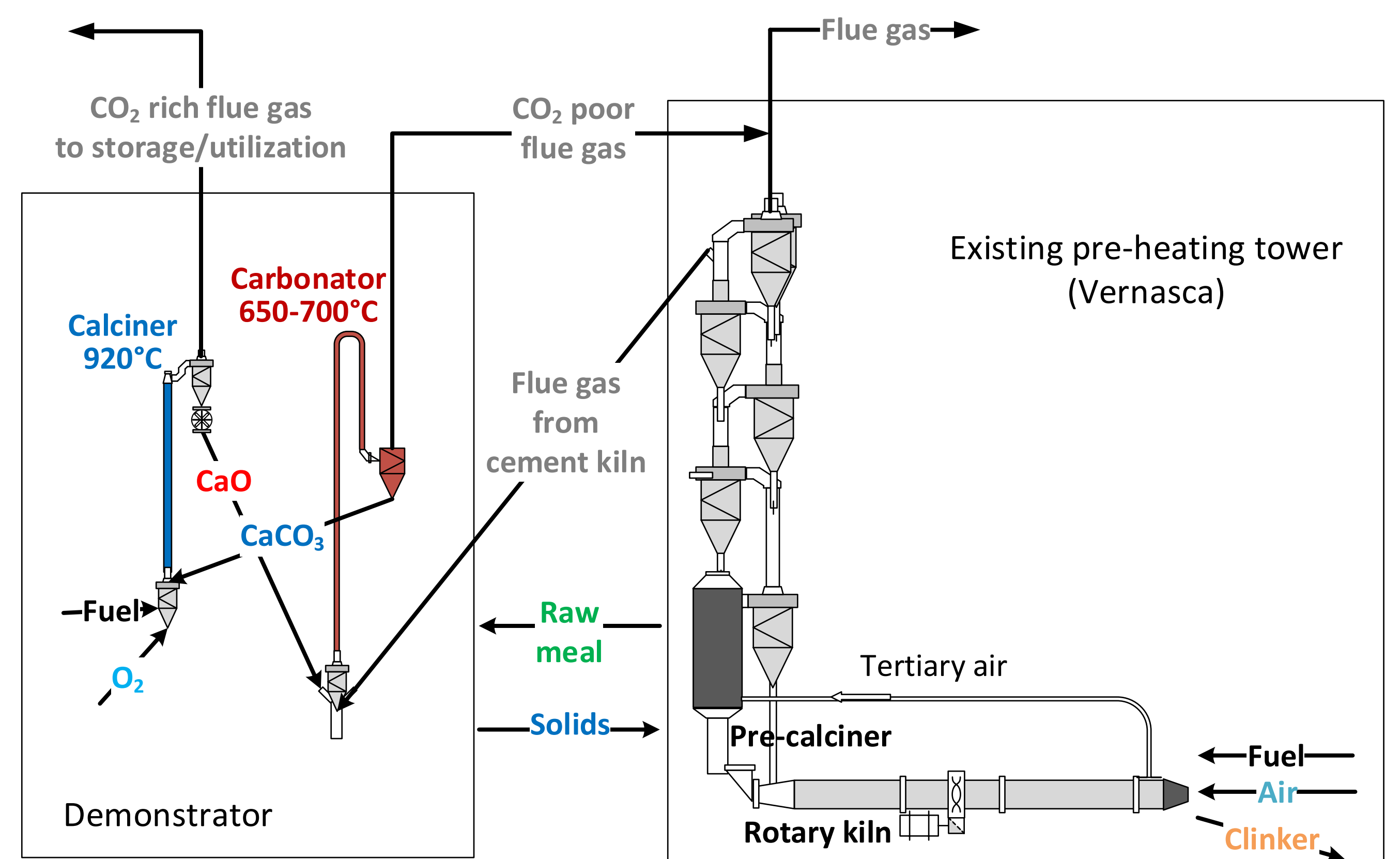
Concept



Q_{out} is the heat made available by cooling (1) the calciner flue gases; (2) the calcined raw meal to be used in the carbonator; (3) the CO₂-poor gases exiting the carbonator and (4) the kiln flue gases. Q_{in} is the heat required for (1) fresh raw meal pre-heating up to the carbonation temperature; (2) if applicable, further fresh raw meal pre-heating beyond the carbonation temperature.

Integrated configuration (to be tested in Vernasca cement plant)

- CO₂ from kiln flue gases captured in the carbonator;
- The calciner of the CaL process is oxy-fired (in the full-scale plant the oxy-fired CaL calciner will act also as pre-calciner).



Integration of the Demonstrator within the existing cement plant (Vernasca)

Methodology

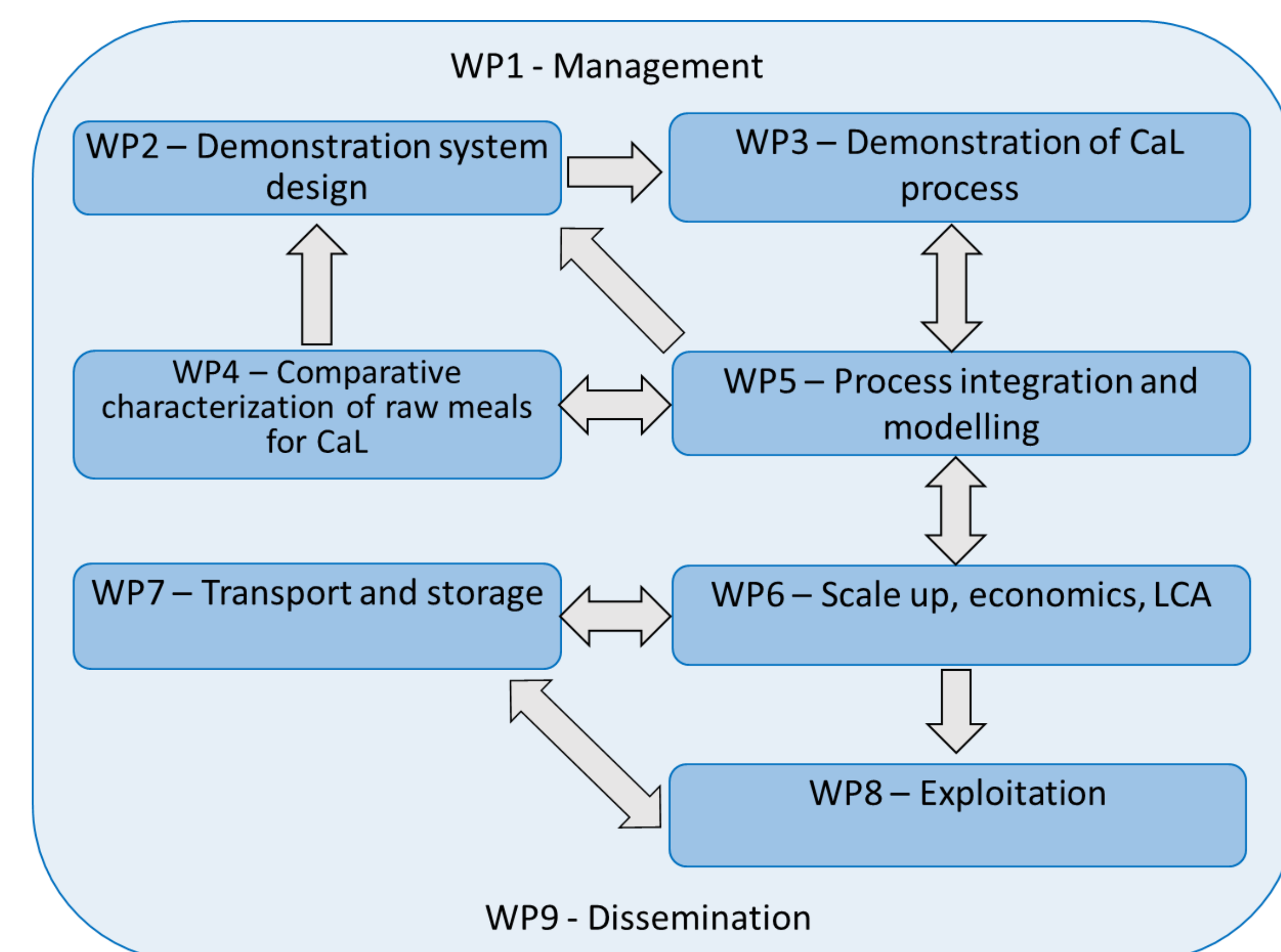
Objective	Key indexes	Target
CO ₂ emissions	<ul style="list-style-type: none"> • CO₂ capture efficiency • CO₂ specific emissions 	<ul style="list-style-type: none"> • Cement plant CO₂ capture efficiency >90% • Negative direct CO₂ emissions by biomass co-firing (Bio-CCS) • Reduction of total CO₂ specific emissions (kg_{CO2} per ton of cement) >85%
Economics	<ul style="list-style-type: none"> • Cost of cement • Cost of CO₂ avoided 	<ul style="list-style-type: none"> • Increase of cement cost < 25 €/t_{cement} • Cost of CO₂ avoided <30 €/t_{CO2}

Main CLEANKER targets

Core activity: design, construction and operation of a calcium looping demonstration system.

Other activities:

- (i) screening of different raw meals to assess their properties as CO₂ sorbent;
- (ii) reactors and process modelling;
- (iii) scale-up study;
- (iv) economic analysis;
- (v) LCA;
- (vi) CO₂ transport, storage and utilization study;
- (vii) demonstration of the complete value chain, including mineral carbonation of waste ash;
- (viii) exploitation study for the demonstration of the technology at TRL>7.



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