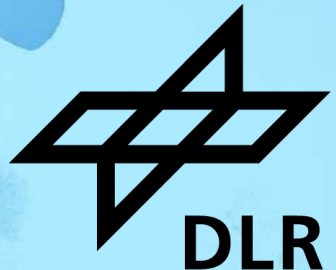


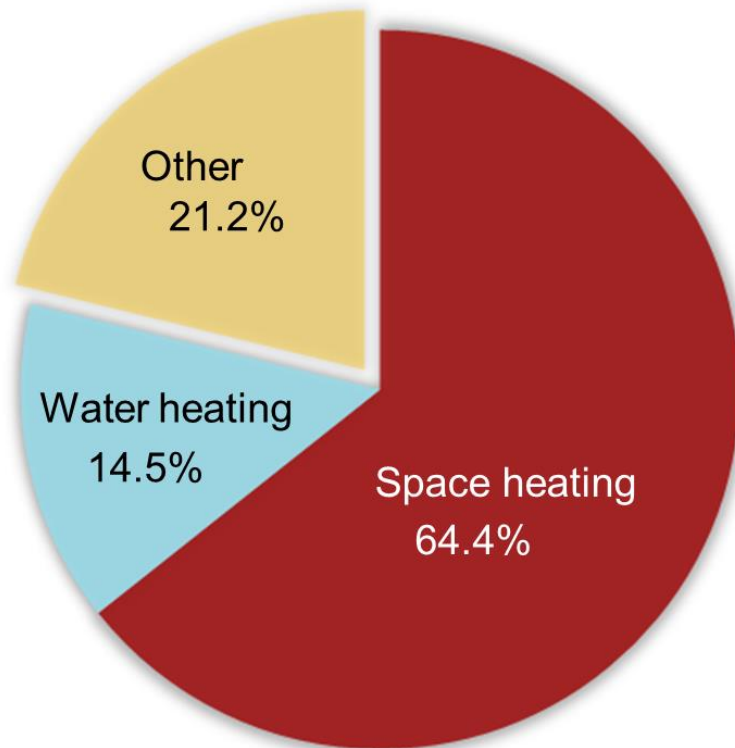
CARBON CAPTURE AND HEATING

– CAN WE COMBINE LONG-TERM ENERGY STORAGE WITH DIRECT AIR CAPTURE?

Eva Klockow, Matthias Schmidt, Venizelos Sourmelis, Viktor Kühl, Marie Gollsch, Marc Linder
German Aerospace Center (DLR)

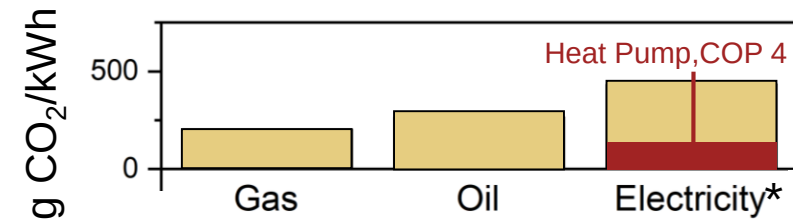


Final Energy Demand in Private Households
EU, 2021



Eurostat, 2023

CO₂ emissions for heating depending on the fuel
2023



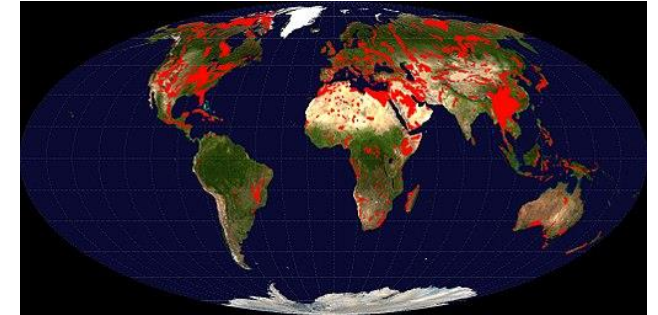
* German Electricity Mix 2022, 44% Renewable Energy

Major Challenge for any storage: no. of cycles

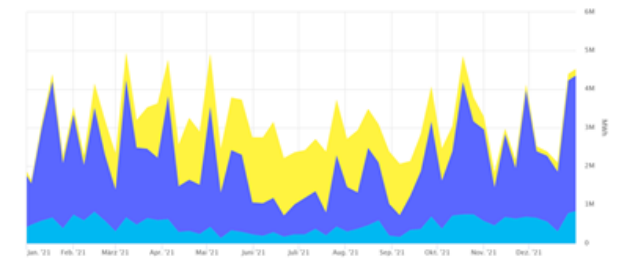
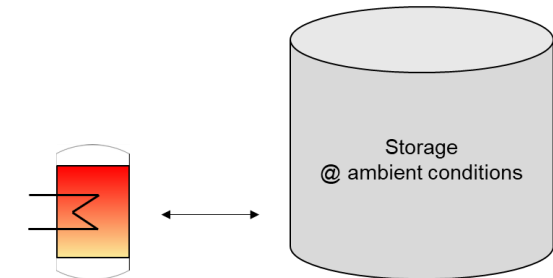
Our approach

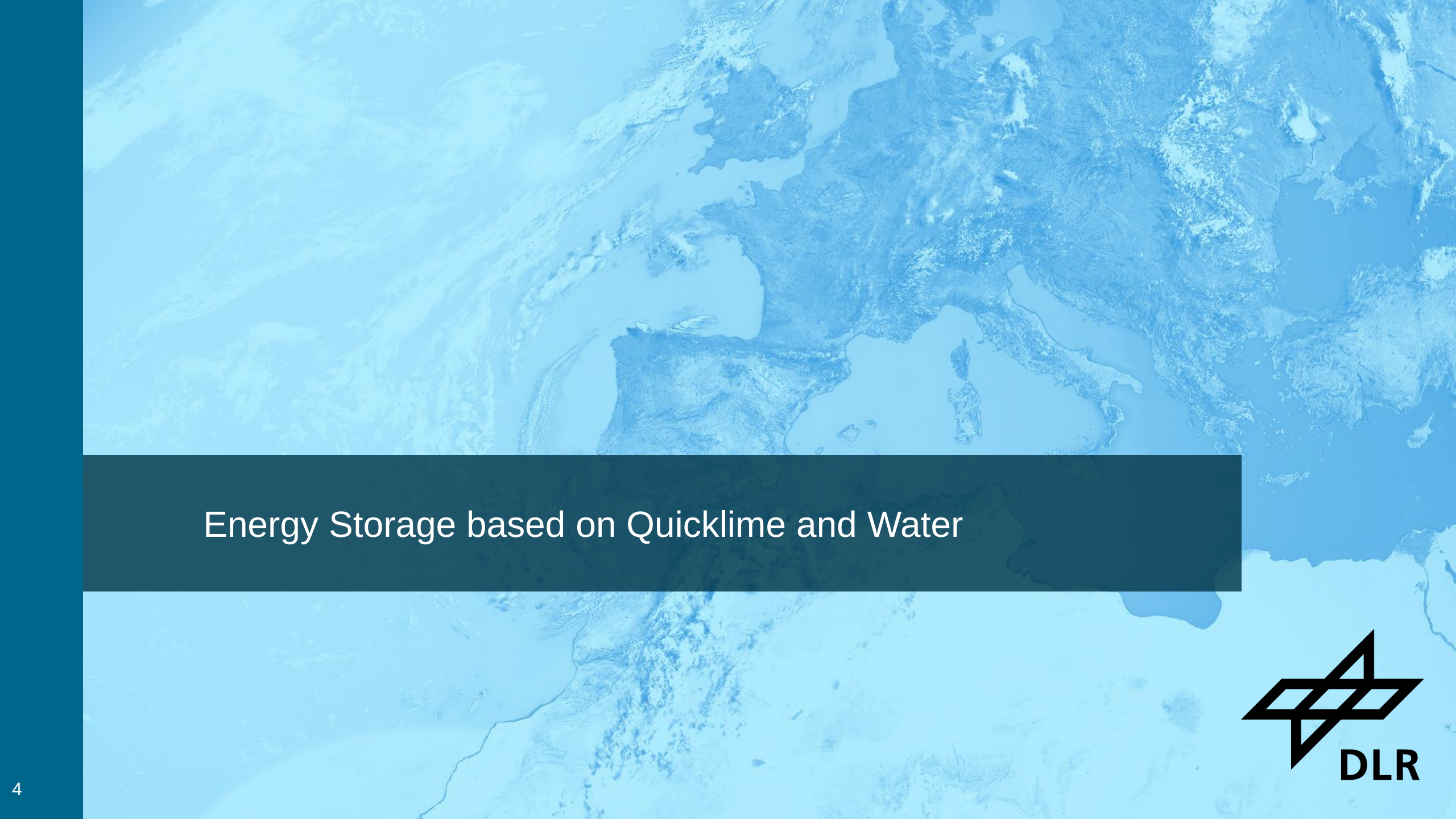


- Applied material has to be inexpensive
 - Certainly no critical materials...
("stones and/or salt water" would be ideal)
- Scalable capacity in cheap volumes
 - Separation of Reactor and Storage
(comparable to "Redox-Flow")
- Potentially re-charging
 - Connecting Heat demand with renewable Electricity
- "Activating" the so far passive storage period

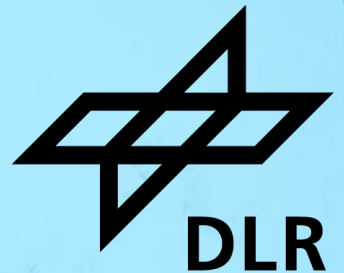


<https://commons.wikimedia.org/>

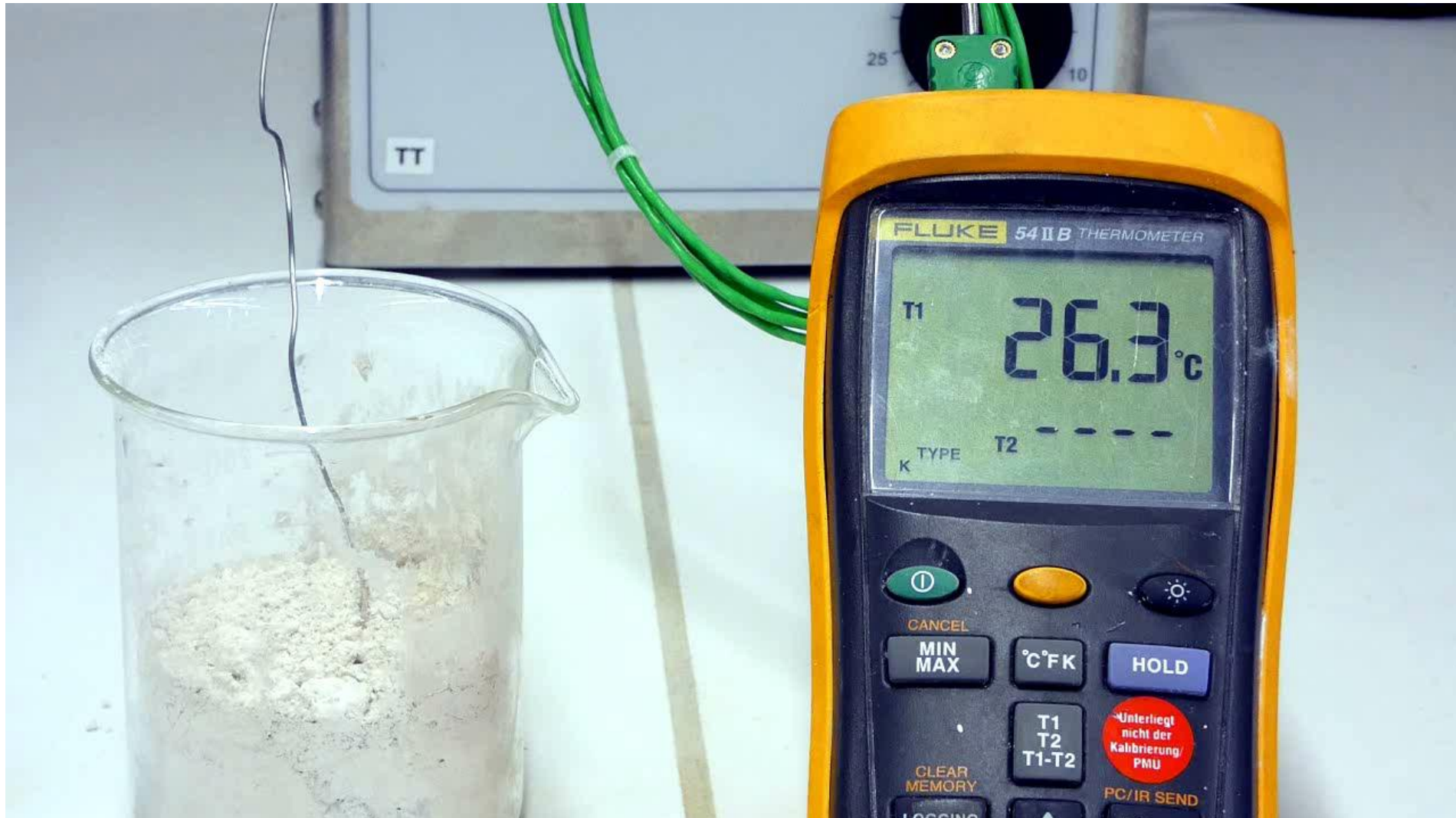


A satellite map of Europe and surrounding regions, rendered in a monochromatic blue color scheme. The map shows the outlines of continents and the texture of clouds or terrain. A dark blue horizontal bar is superimposed over the middle of the map.

Energy Storage based on Quicklime and Water

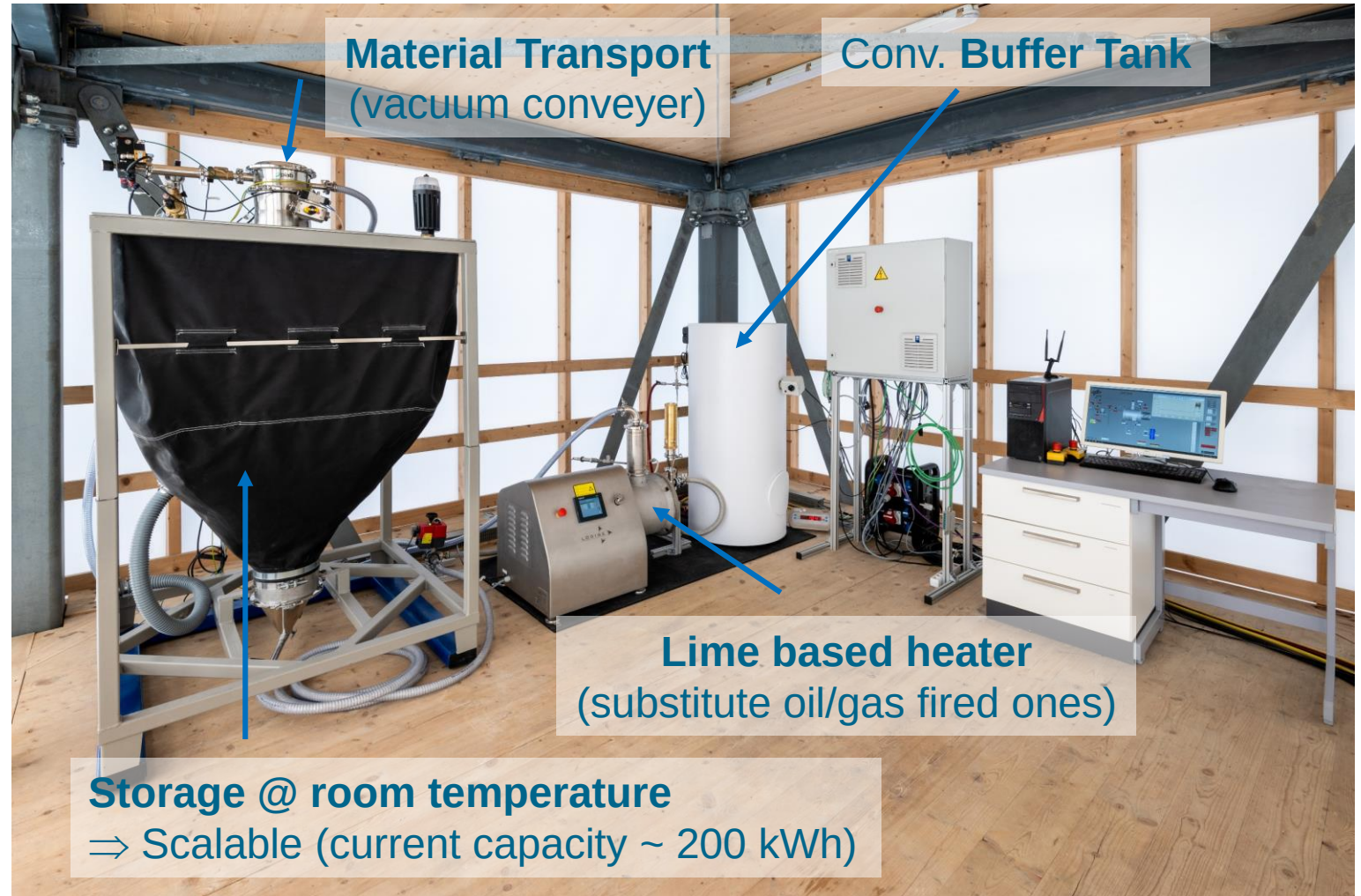


Energy Storage based on Quicklime and Water



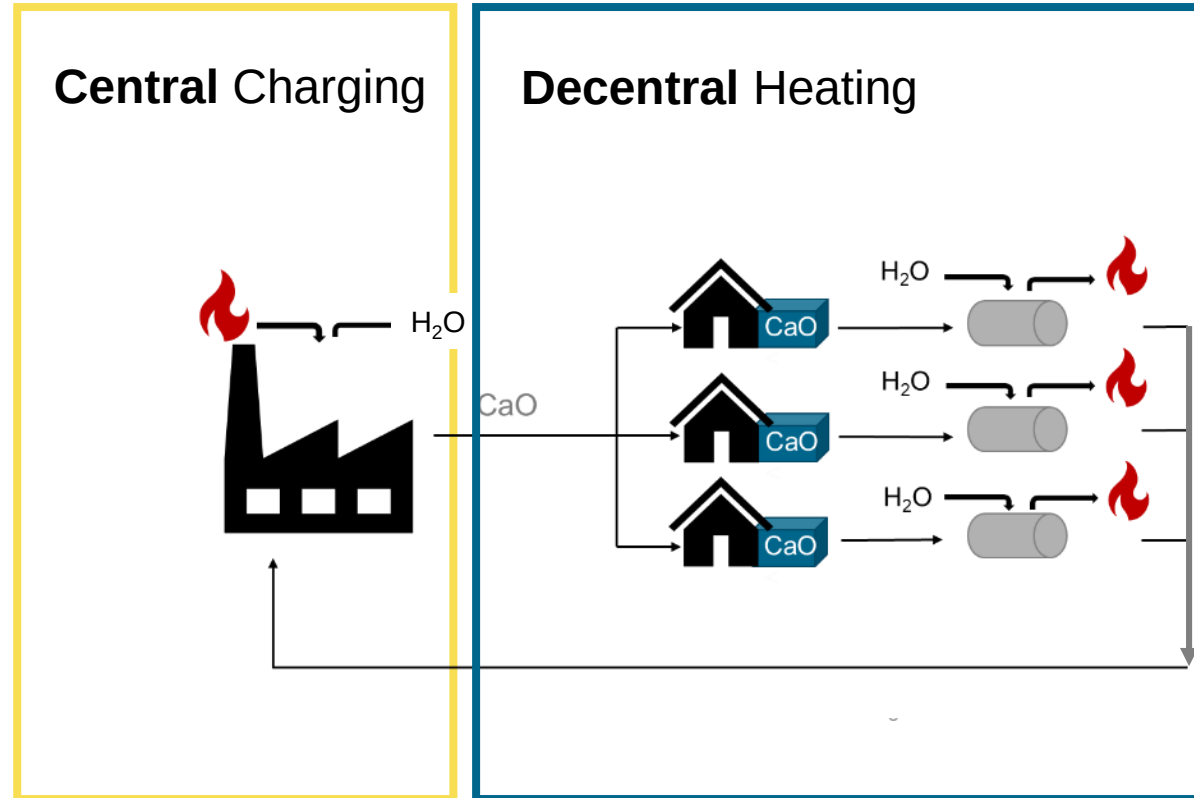
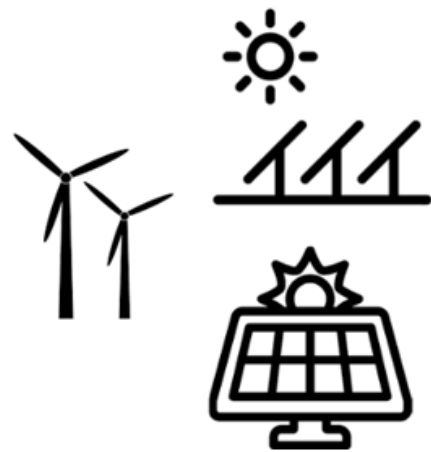
Energy Storage based on Quicklime and Water

Current Status



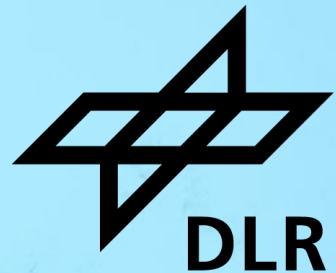
Energy Storage based on Quicklime and Water

One potential concept



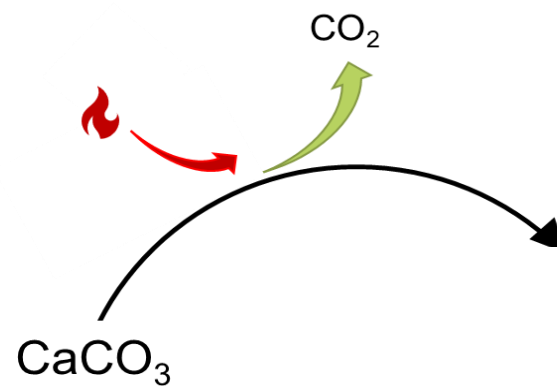
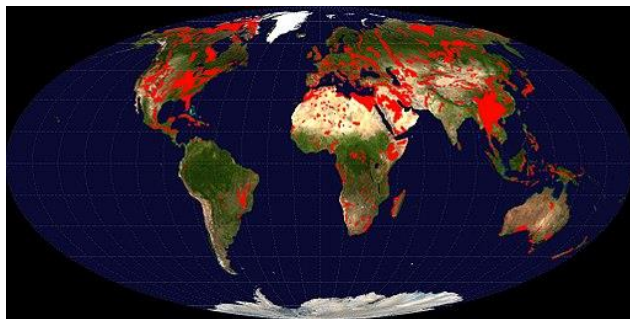
A satellite map of Europe and surrounding regions, rendered in a monochromatic blue color scheme. The map shows the outlines of continents and the texture of clouds and land. A dark blue horizontal bar is positioned across the middle of the image, containing the text "Carbon Capture?".

Carbon Capture?



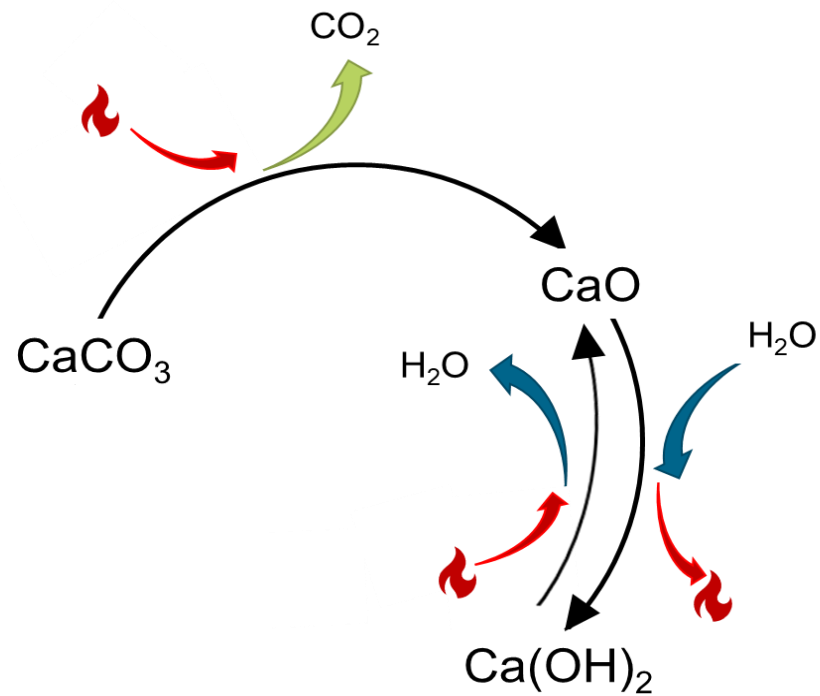
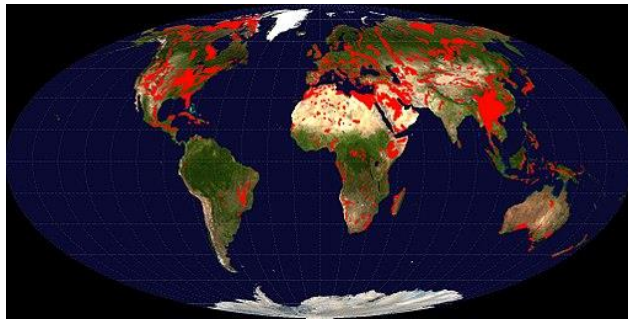
How could that work?

Technical Lime Cycle



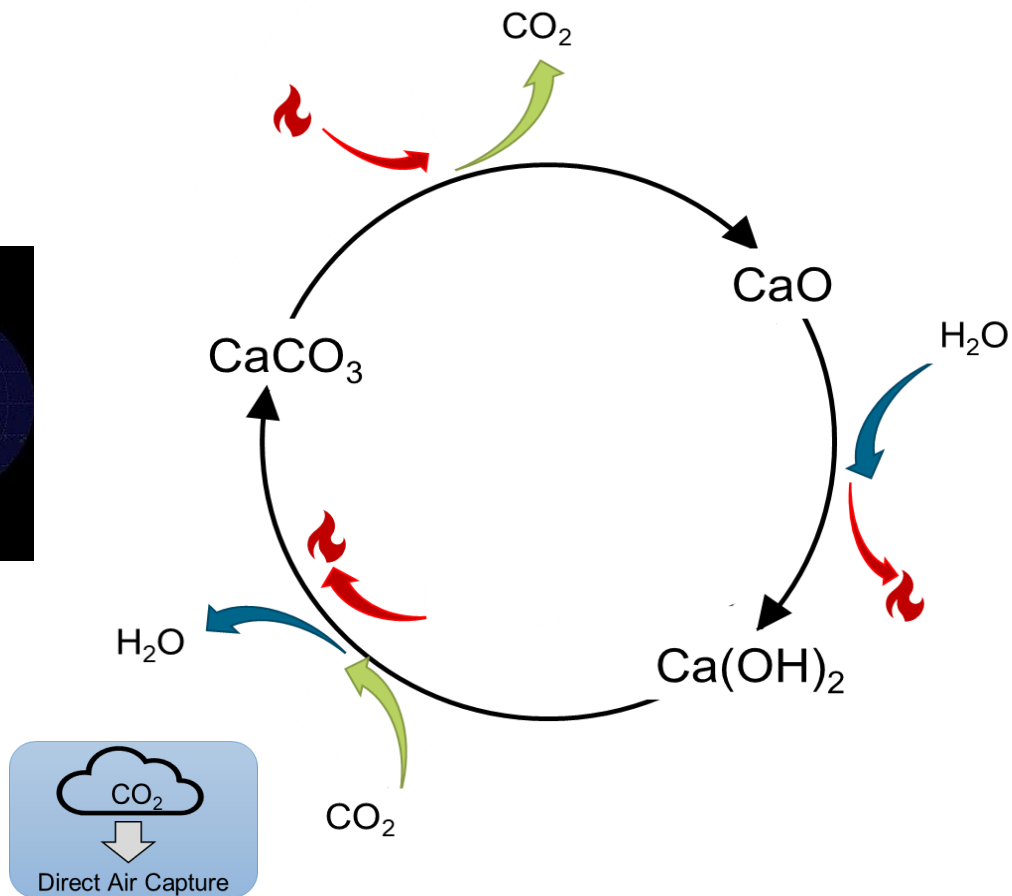
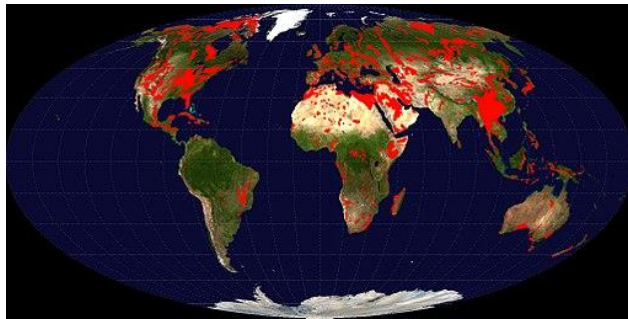
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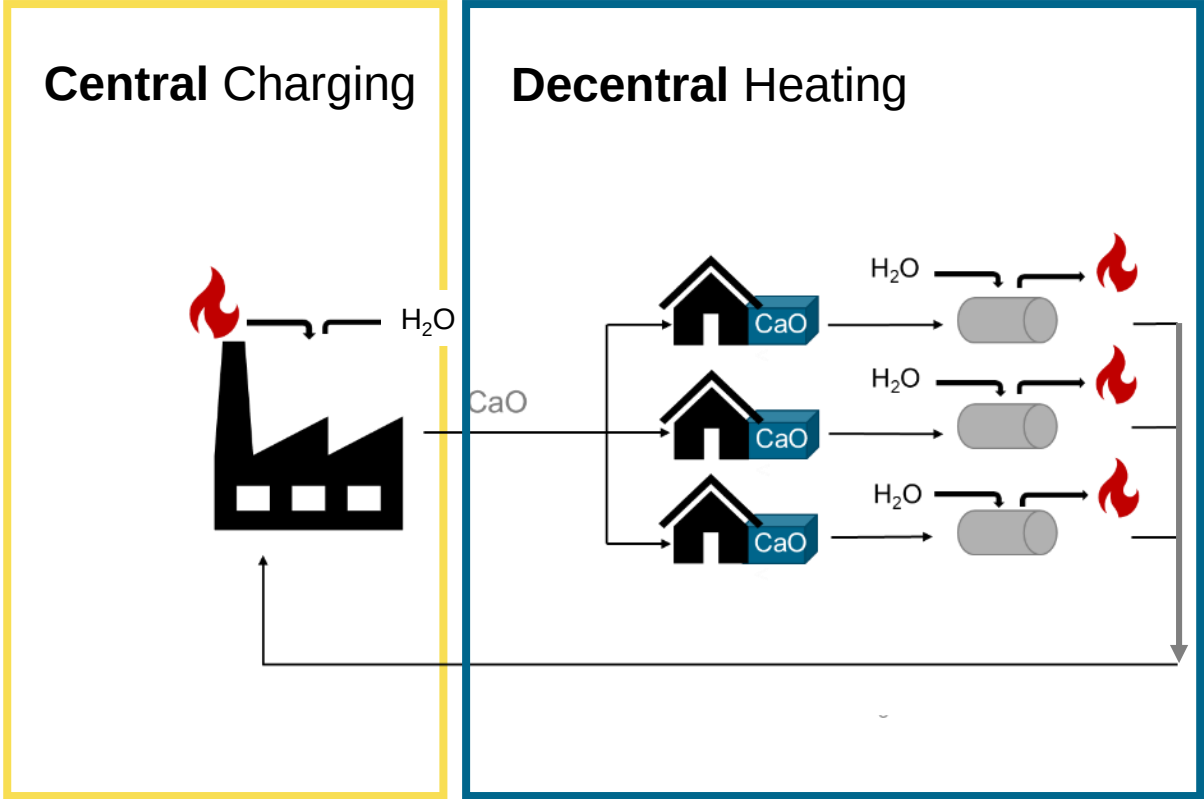
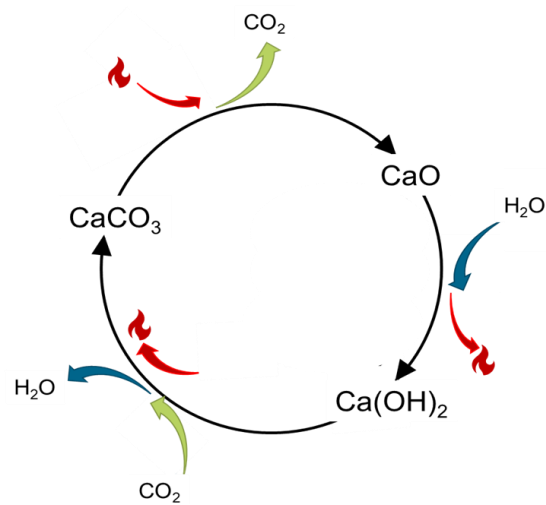


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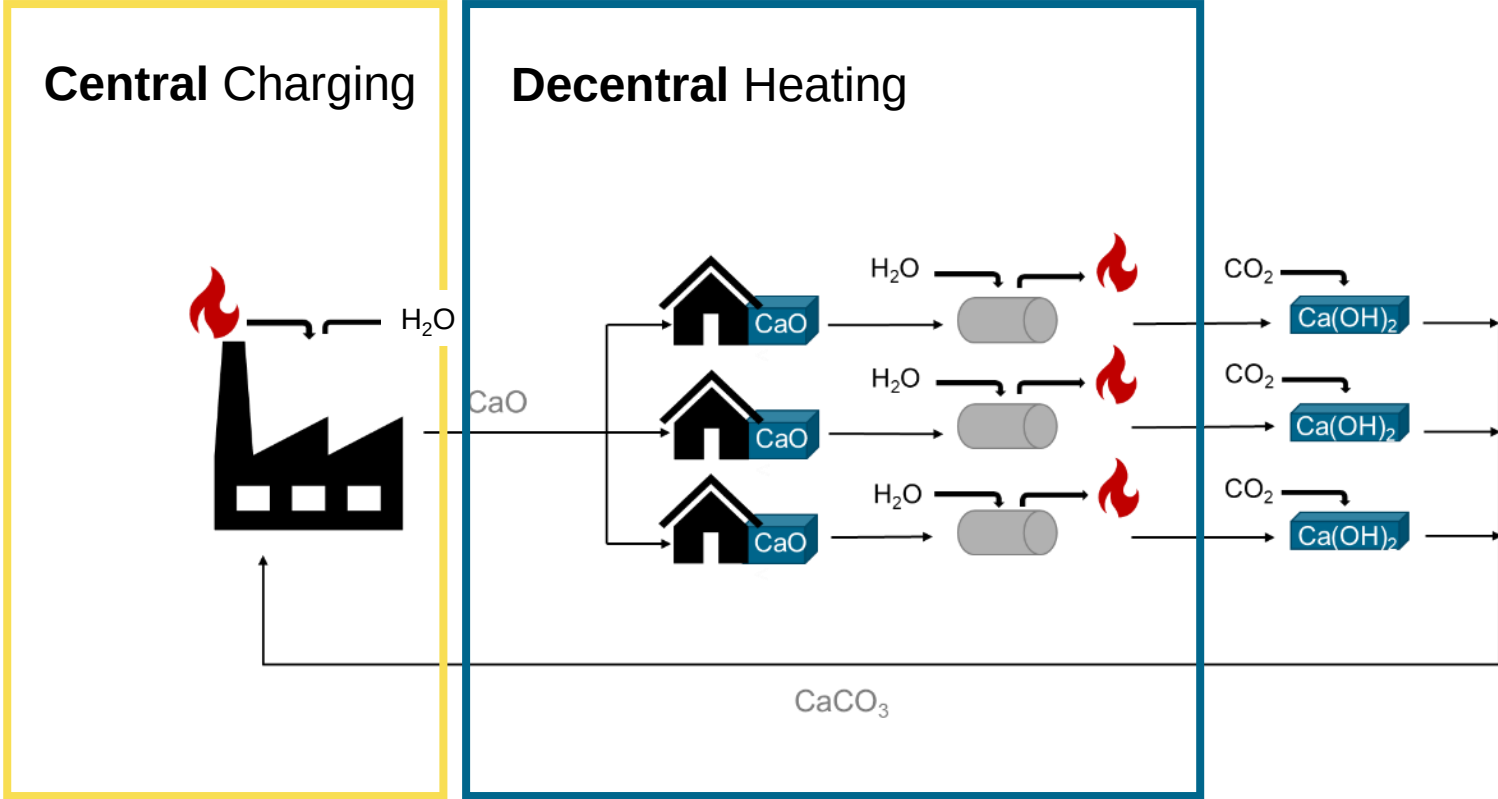
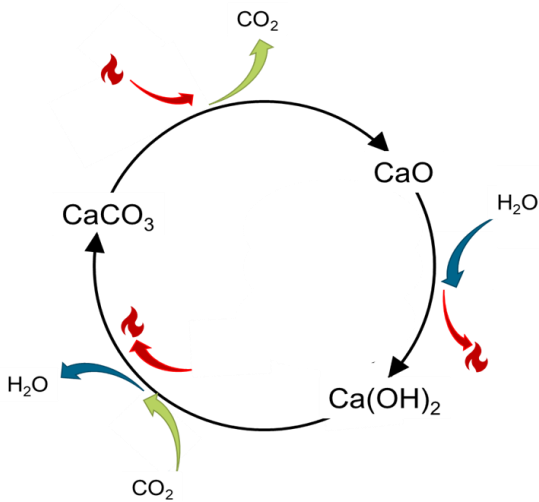
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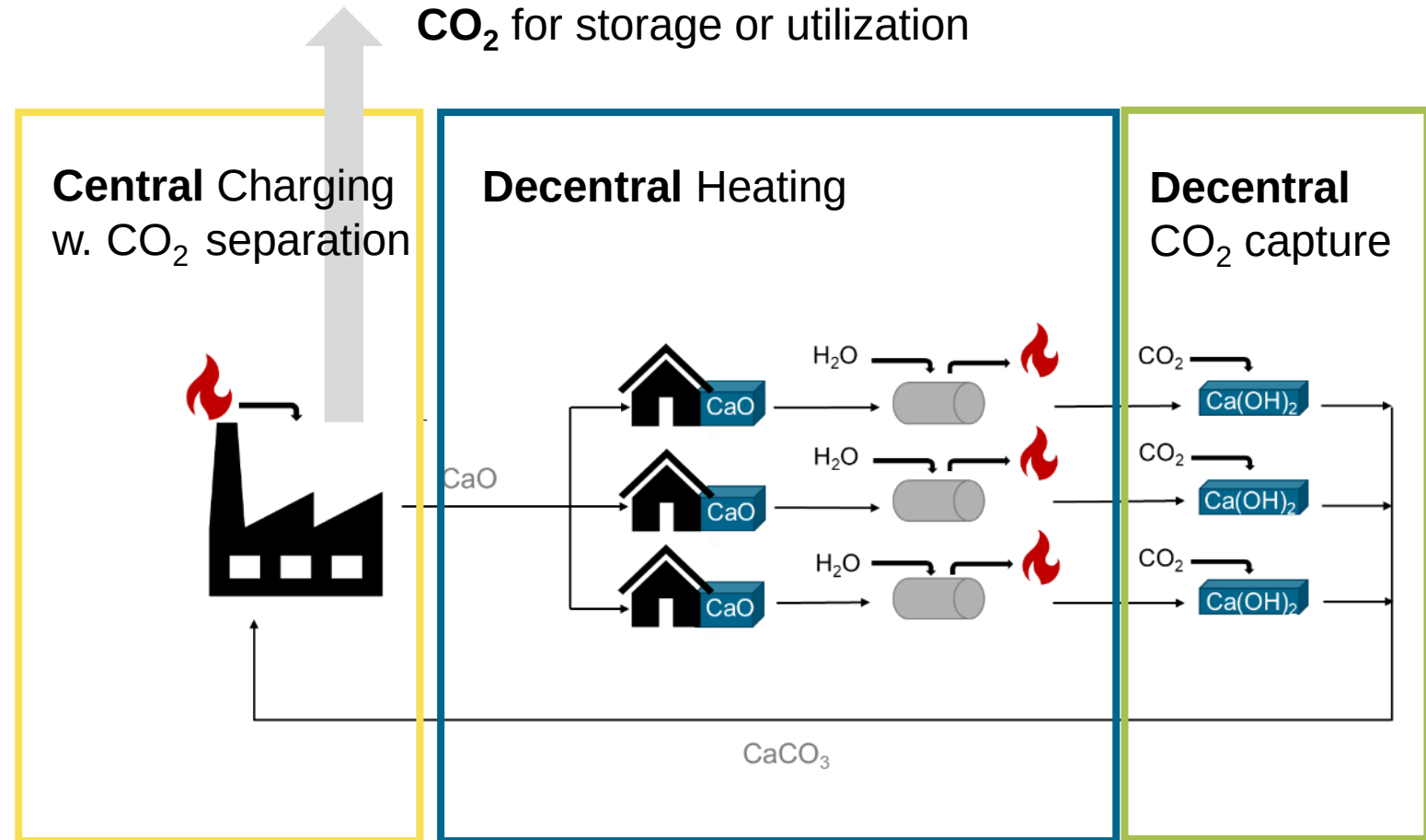
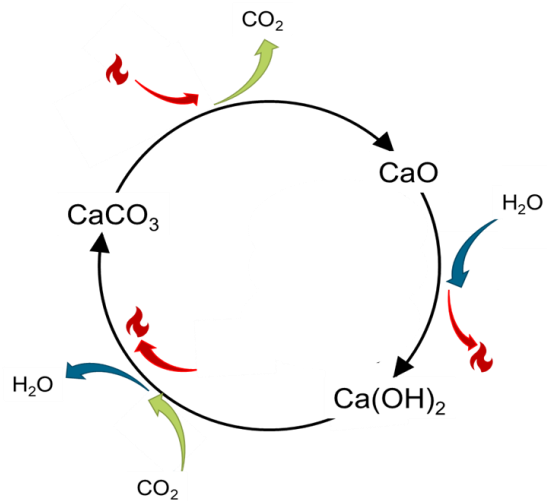
Carbon Capture and Heating



Carbon Capture and Heating



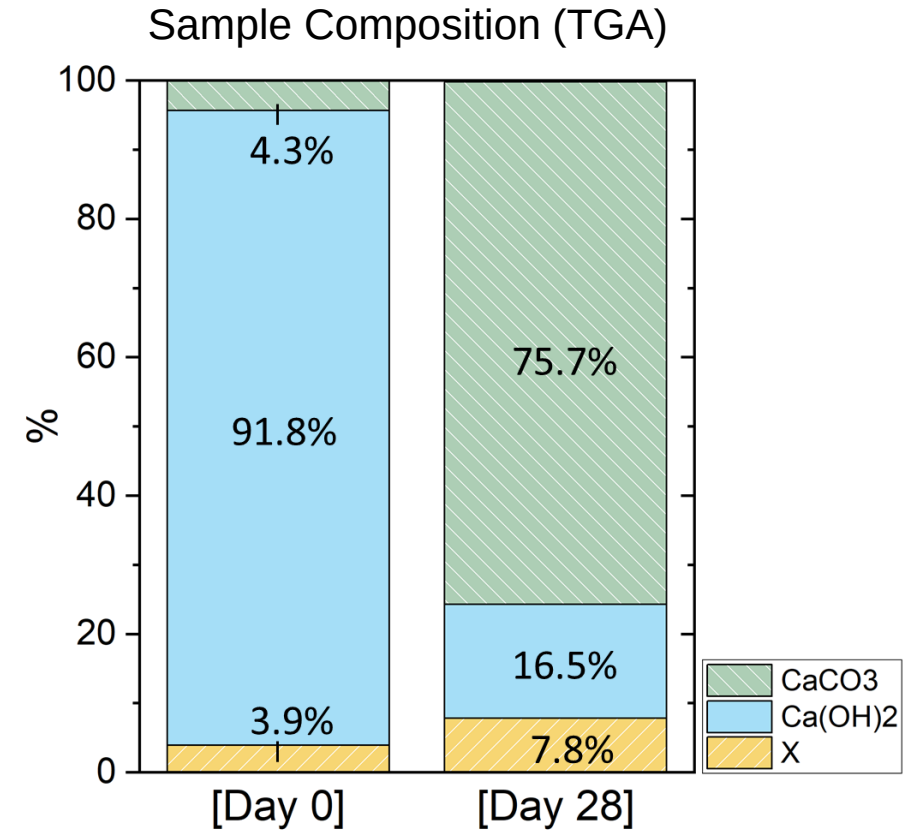
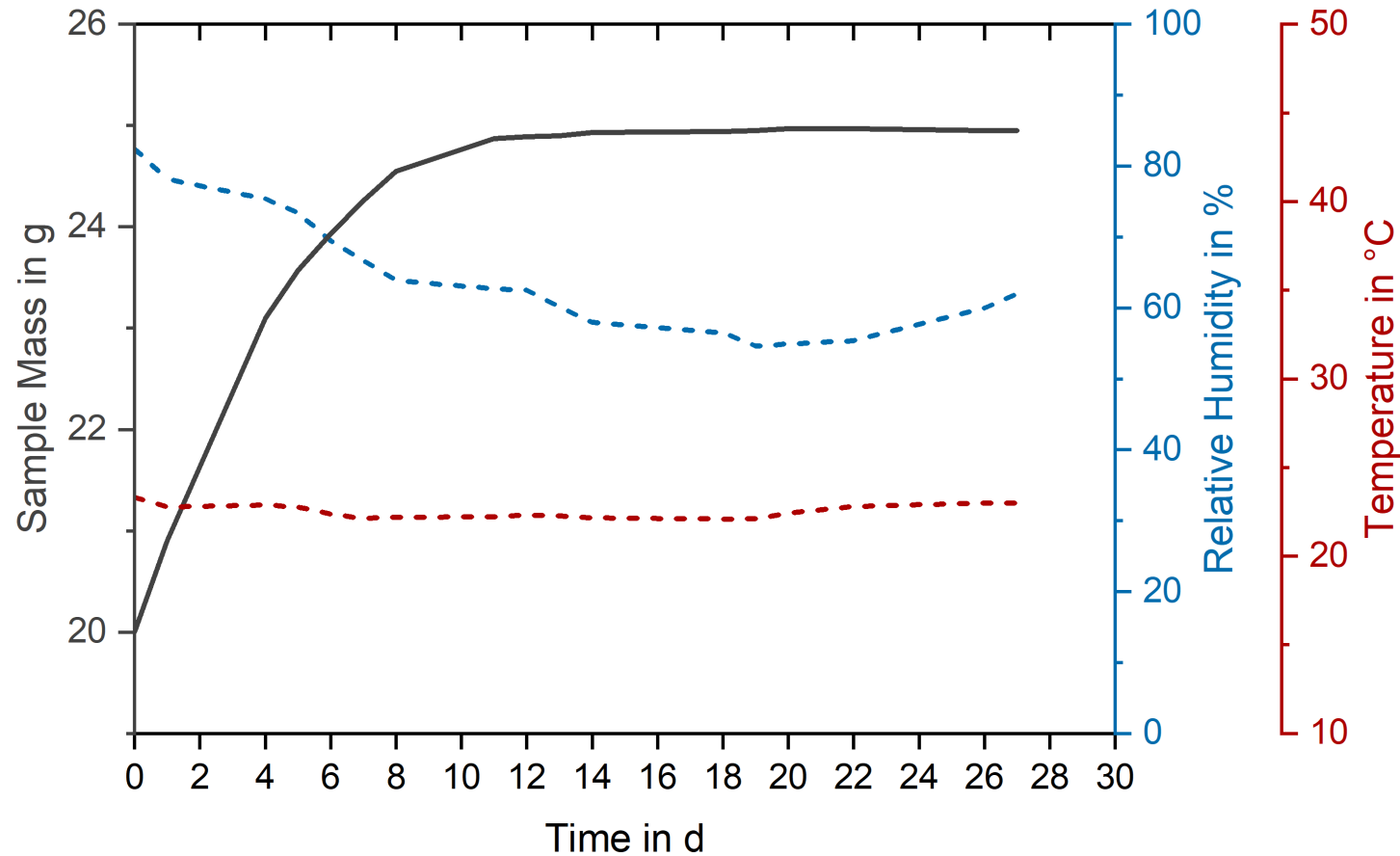
Carbon Capture and Heating



Preliminary Results

Carbonation Reaction in high humidity

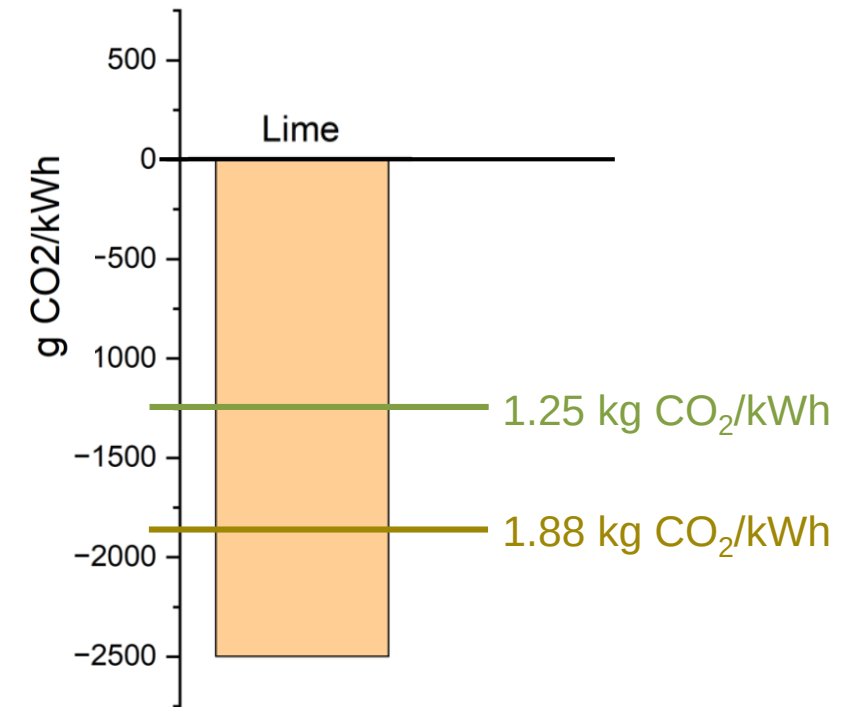
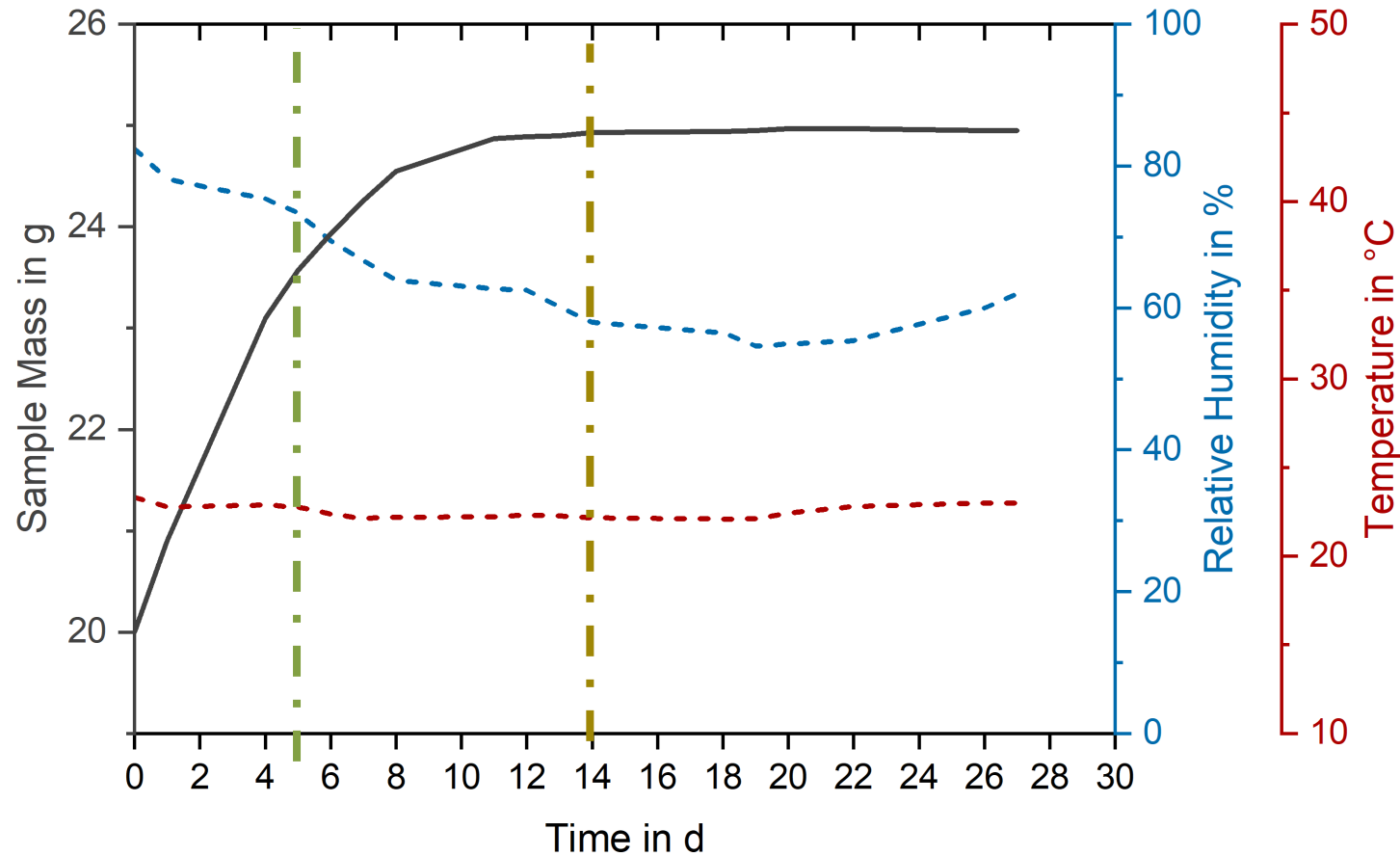
Relative Humidity: 55-85%



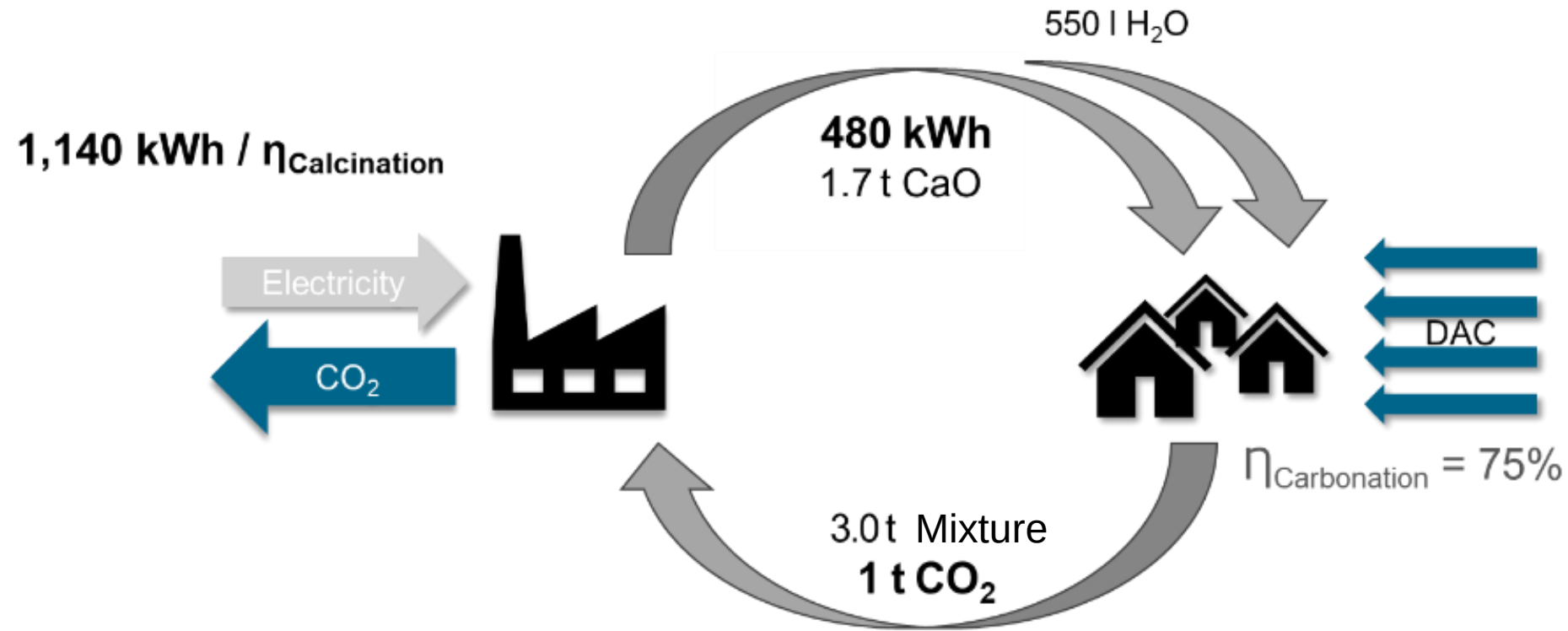
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Conclusion (graphical)



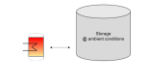
Summary

- Our approach for long-term storage
 - „stones and water“
 - separation of reactor and storage
 - „re-charging“
- Recent experimental set-up
- Double Storage Functionality (Energy and CO₂)

Major Challenge for any storage: no. of cycles
Our approach

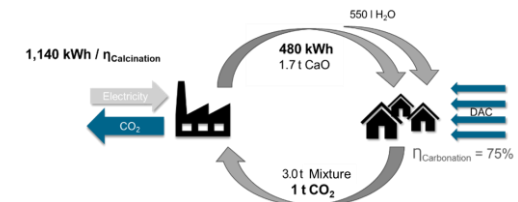


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Energy Storage based on Quicklime and Water
Current Status



THANK YOU!

PD Dr.-Ing. Marc Linder

Marc.linder@dlr.de

