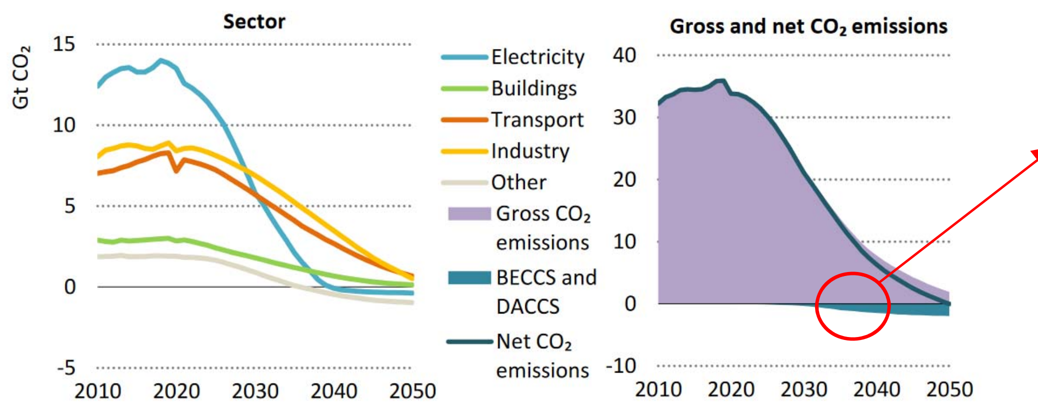
Zentrum für Sonnenenergie- und Wasserstoff-
Forschung Baden-Württemberg

CORA: CO2-Abtrennung aus Luft für Power-to-X Prozesse zur Sektorkopplung

CORA CO2 separation from air for Power-to-X processes for sector coupling

Motivation: DAC

- Carbon Capture and Utilisation (CCU)
  - Short term
  - Replacement of fossil fuels
- Carbon Capture and Storage (CCS)
  - Long term
  - Reduction of CO2 concentration in atmosphere



Quelle: IEA 2021, Net Zero by 2050 – A Roadmap for the Global Energy Sector

- Synthetic fuels (eMethan, eFuel)
- Chemical raw materials (solvents, urea, plastics, etc.)
- Industrial gas (beverages, preservation, cleaning agents, refrigerants, etc.)

Reduction of

min. 2 $GtCO_2$

Quelle: IASS 2021, Infografik: Mario Mensch

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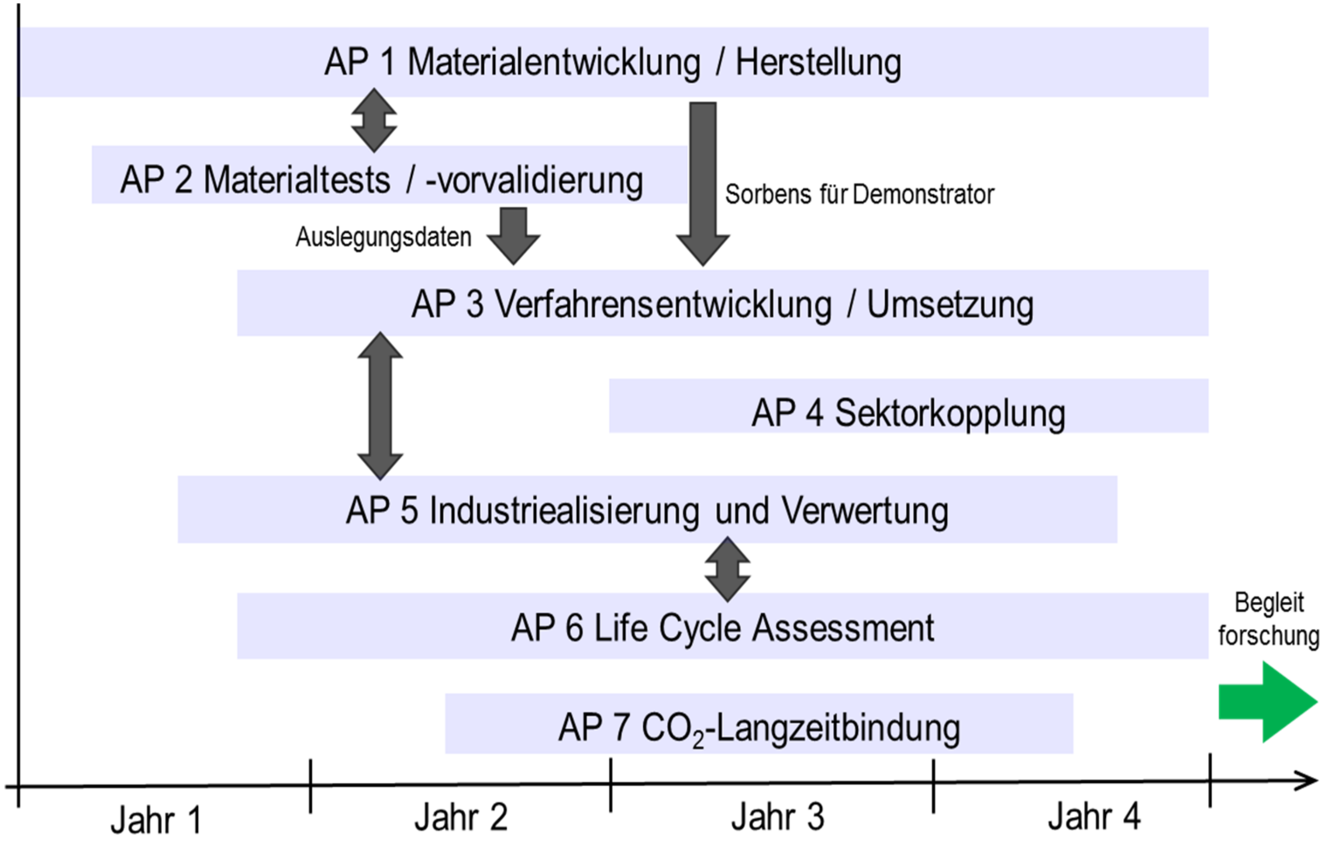
CORA Work packages and Partners



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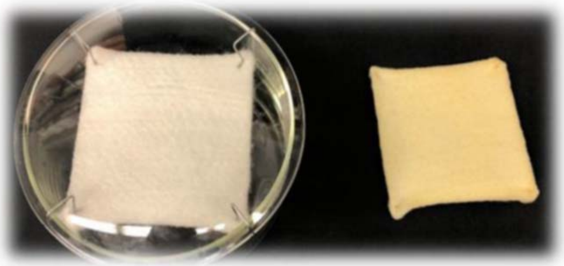
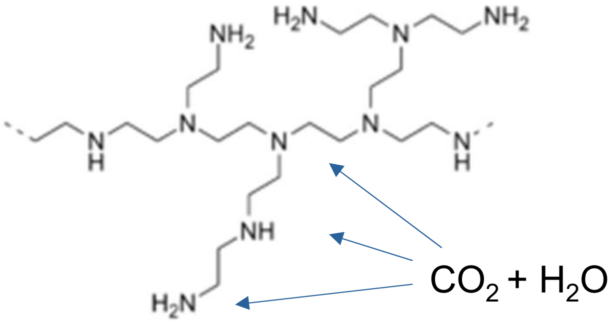
CORA – Tasks - Risks

Material development



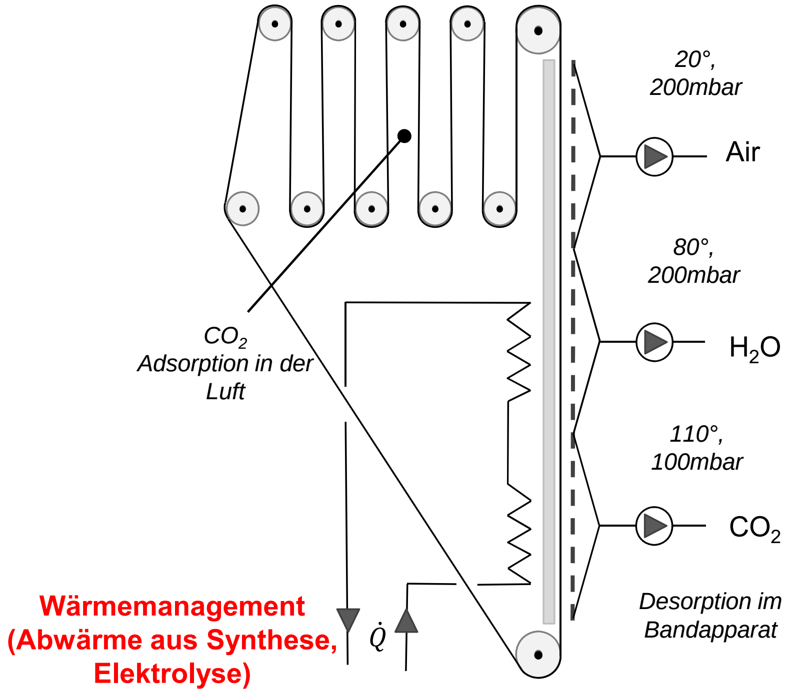
PEI Polyethylenimin, branched
Adsorption capacity 15 mmol CO_2/g PEI
(theor. max. 0.66 g CO2/g PEI)



Scale-up: Production of fleece or fabric tapes

Material testing

Process Development

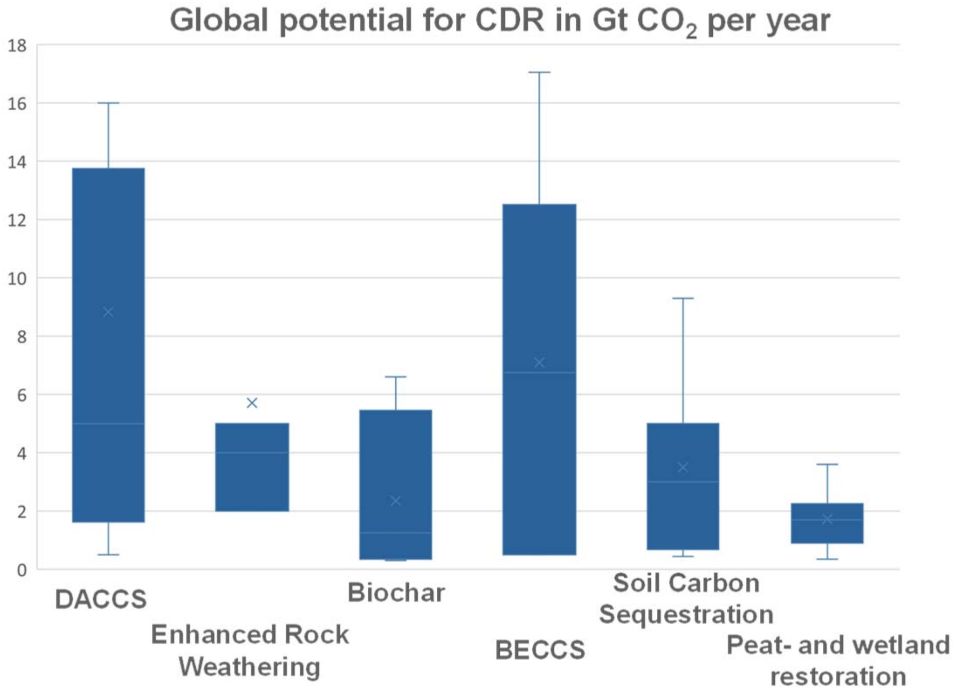


Mechanical challenges:
- Sealing of desorption zone
- Sorbent degradation
- Scale-up

Advantages of DAC Technology

Advantages

Free choice of DAC location because of uniform CO2 distribution in the atmosphere
High CO2 quality (Low levels of impurities)
Parallel H2O for electrolysis



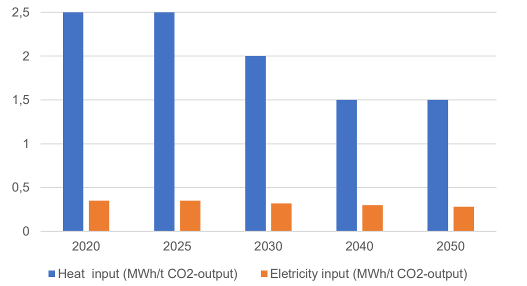
- DAC combined with CCS is expected to have the biggest global CO_2 sequestration potential.
- Further development of the DAC processes enables considerable cost reduction potentials.
- In addition to negative emissions, DAC can also provide the CO_2 needed by industry for climate-neutral processes.
- DAC is particularly important because it is uncertain to what extent existing potentials of natural CDR processes can actually be realized in the face of climate change.

Technical Risks - Hurdles

Technical Risks
Sorbent Material manufacturing
Sealing of the desorption zone with continuously tape transport
Scale-up, investment costs and CO2 production costs
Energy consumption (electricity and heat)

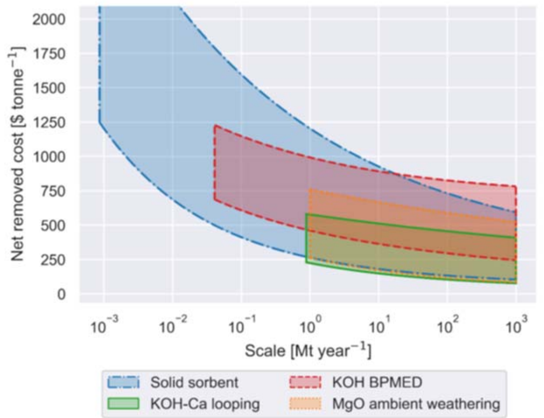
Regulatory hurdles
Creditability and remuneration of CO2 capture and usage / storage
Incentives for non-fossil CO2 demand
Additional installations of renewable energies for sustainable CO2 production
Governmental targets for negative emissions (< 2°C Paris Climate goal)

Examples for energy consumption
- Climeworks ~ 2,000 kWh / t CO_2
- Carbon Engineering ~ 2,400 kWh / t CO_2



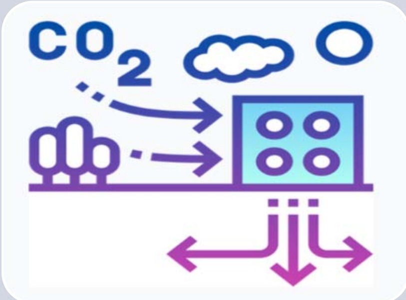
[Danish Energy Agency (2021)]

Development of net removed costs



[Young et al. (2022)]

What is needed for a successful business case



Carbon Market

Growing demand for sustainable carbon leads to growing carbon supply for multiple future carbon applications

Initiation of industrial manufacturing capacity (addressing qualified companies)

Building an industrial network with other activities, e.g. e-fuels

Technology

Process simulations to identify optimization measures, e.g. reduction of energy consumption

Scale-up and efficient system design to achieve low LCO

Development of industrialization and scaling concepts

Available and affordable products for operators

Policy

Define framework conditions for investments, e.g. incentives

Targets for negative emission technologies (use and long-term storage)

Creditability and remuneration of CO2 capture / usage

Renewable energy

Site requirement for installing DAC plant parks in the future

Nearby use or storage is considered advantageous

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THANK YOU FOR YOUR ATTENTION!

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