UKy-CAER CO_2 Capture System: Effectiveness for Reducing the Solvent Regeneration Energy and Capital Cost Reduction

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Corrosion
- Non-metal coating
- Inhibitor
- Localized effect

Pilot Plants
- Heat Integration
- Hybrid Processes
- Solvent & process testing

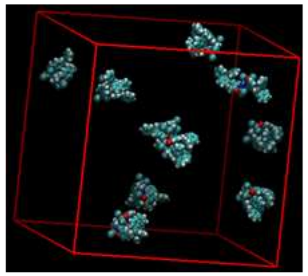
Conversion
- Gasification
- CO_2 Utilization
- NG Upgrading

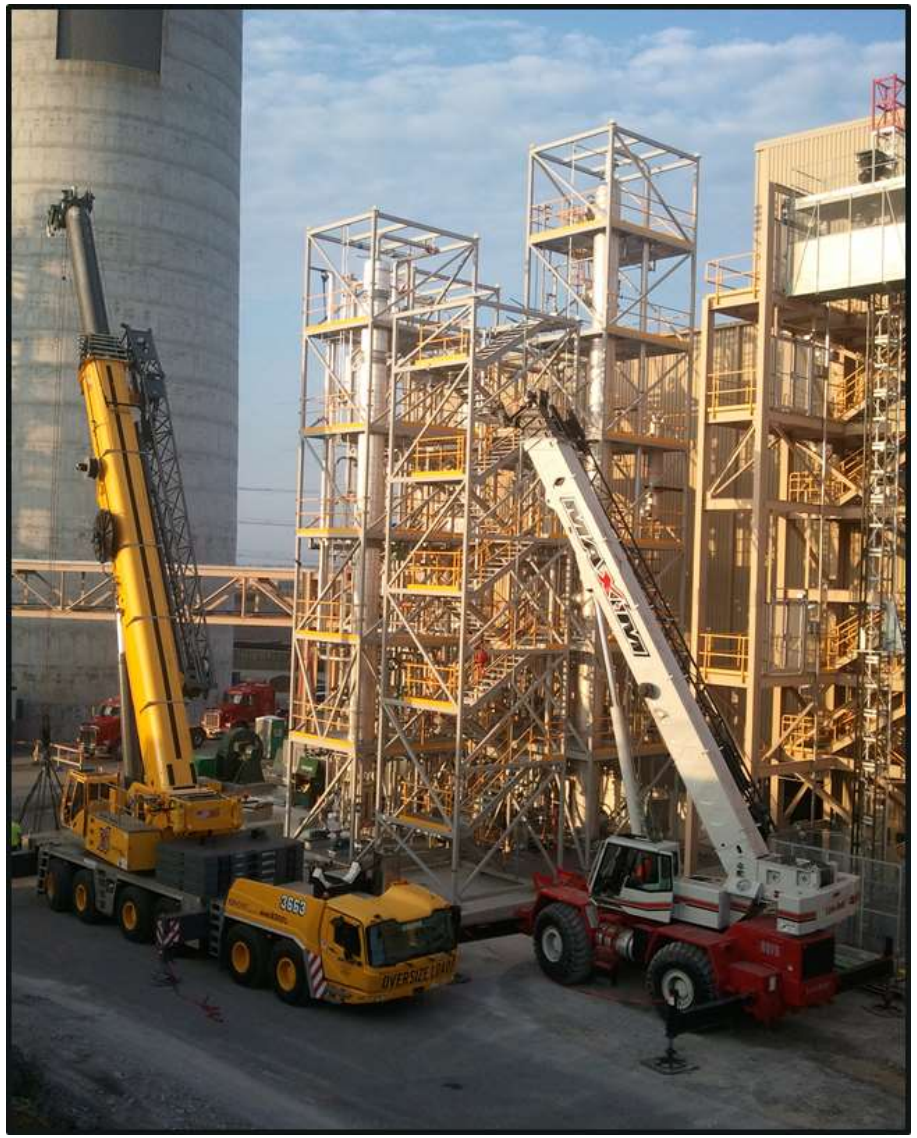
Solvents
- Chem/Physical Properties
- Emission
- Degradation

Membrane Separations
- Zeolite membranes
- Solvent enrichment

Chemical Looping
- Spouting Fluidized bed
- Combustion/gasification
- Solid particle handling

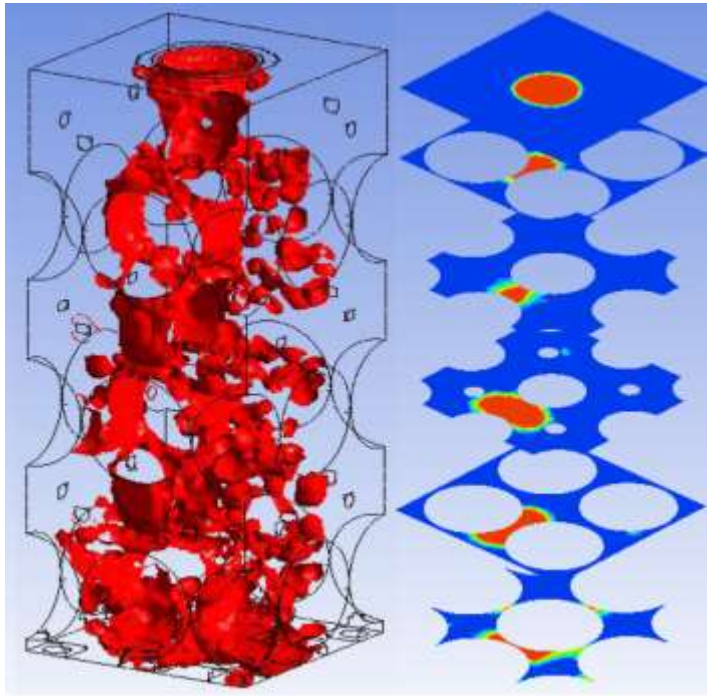
Electrochemistry
- Solvent enrichment
- Water treatment





Research around Surface Chemistry and Reaction Engineering

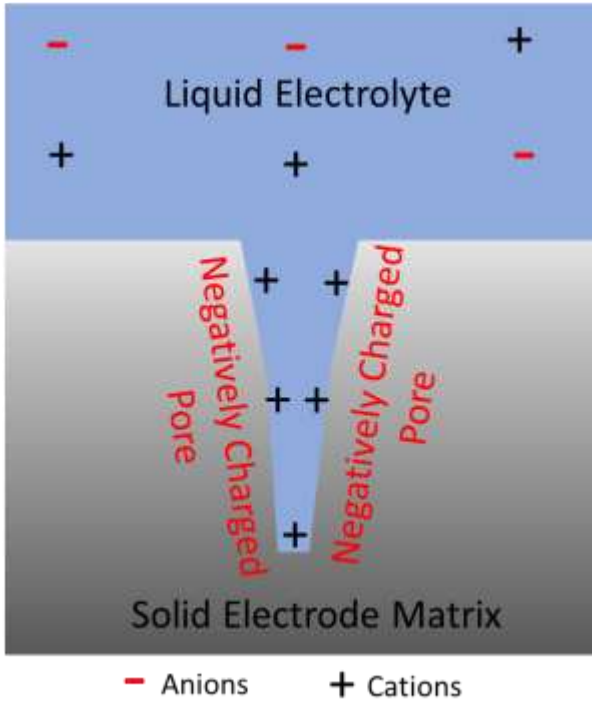
Solid-liquid-gas Interface



Focus Area:

CO_2 Separation

Solid-liquid Interface



Focus Area:

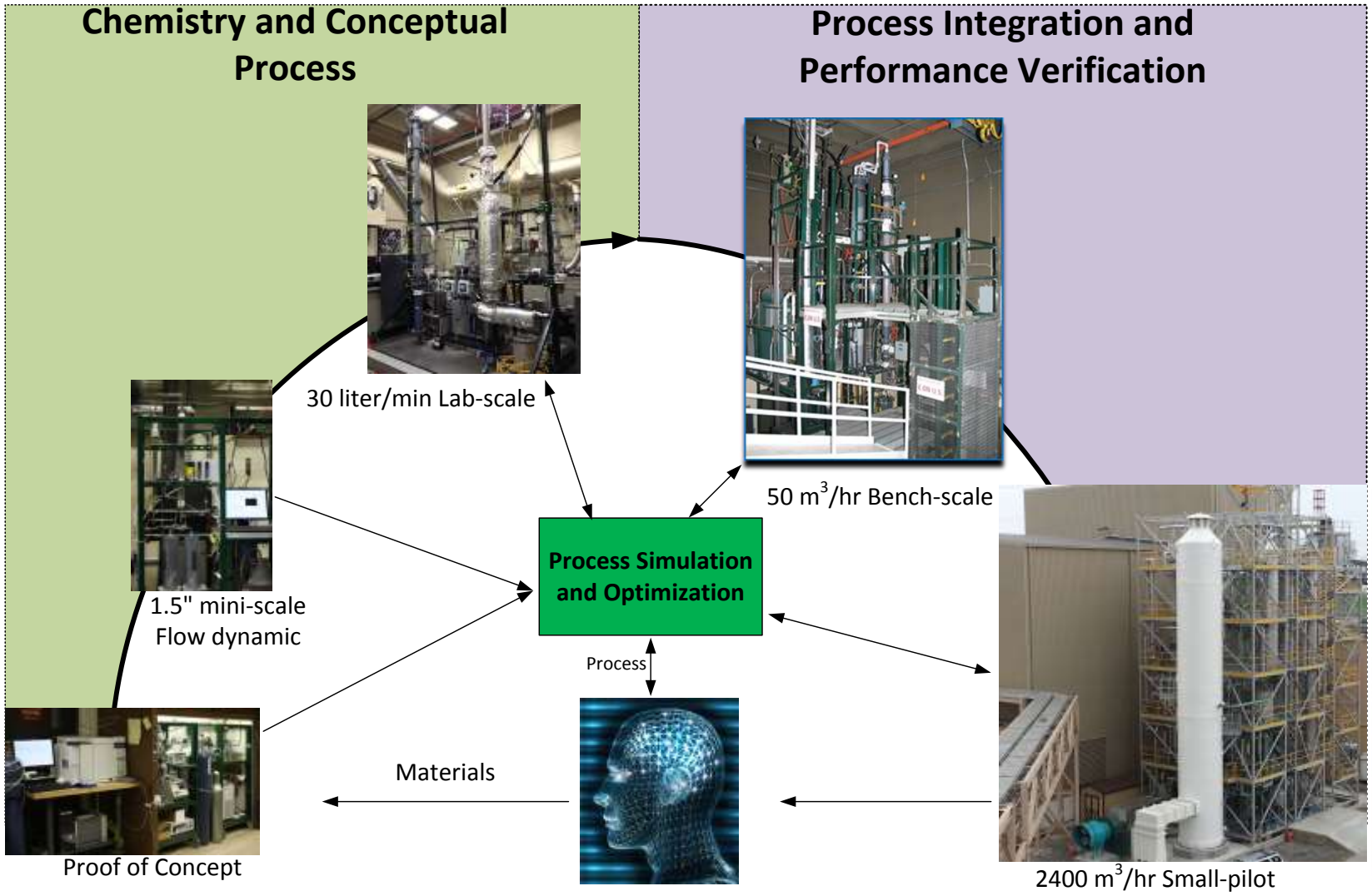
Water Treatment

Solid-solid-gas Interface

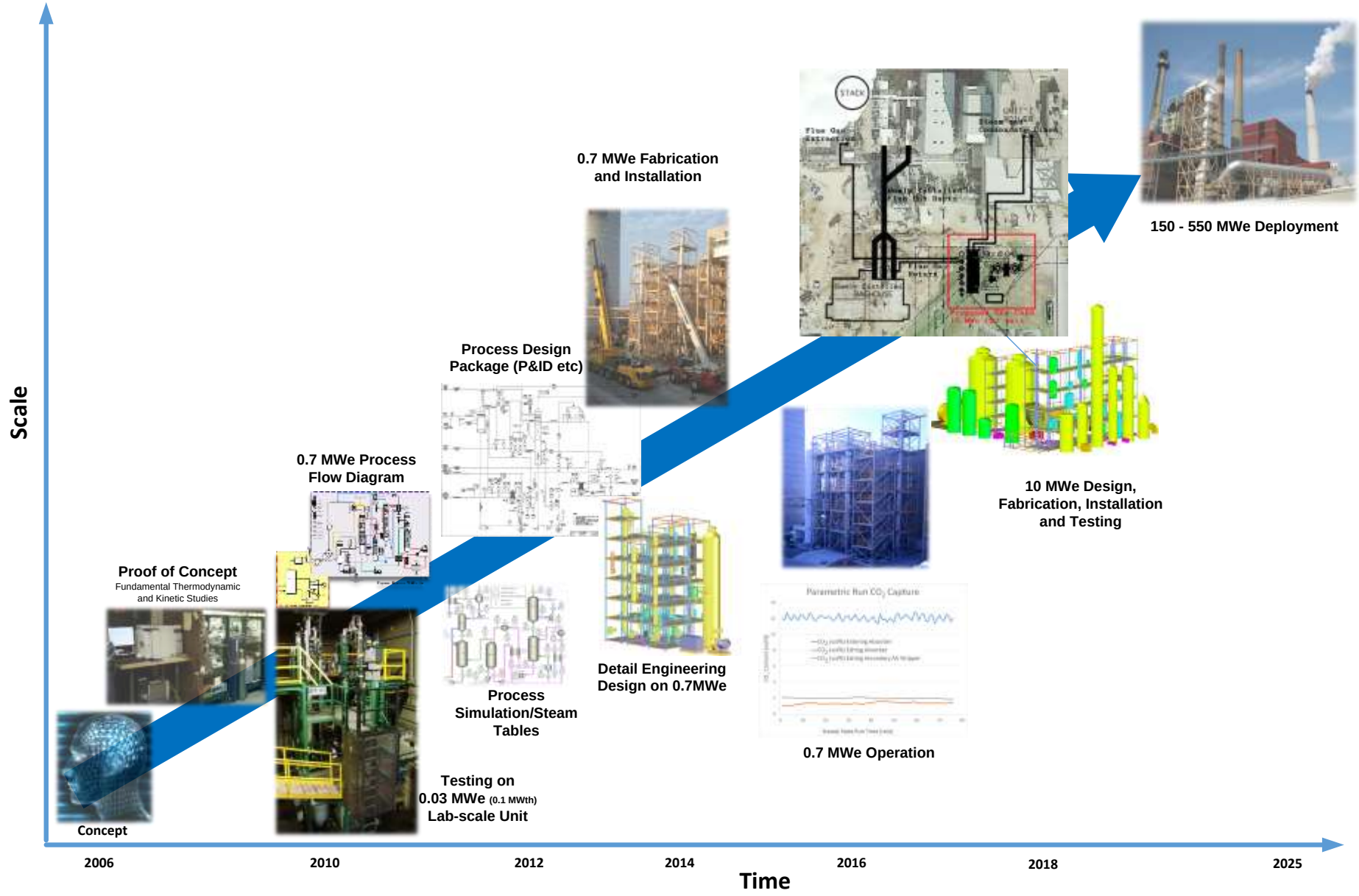
Focus Area:

Chemical Looping

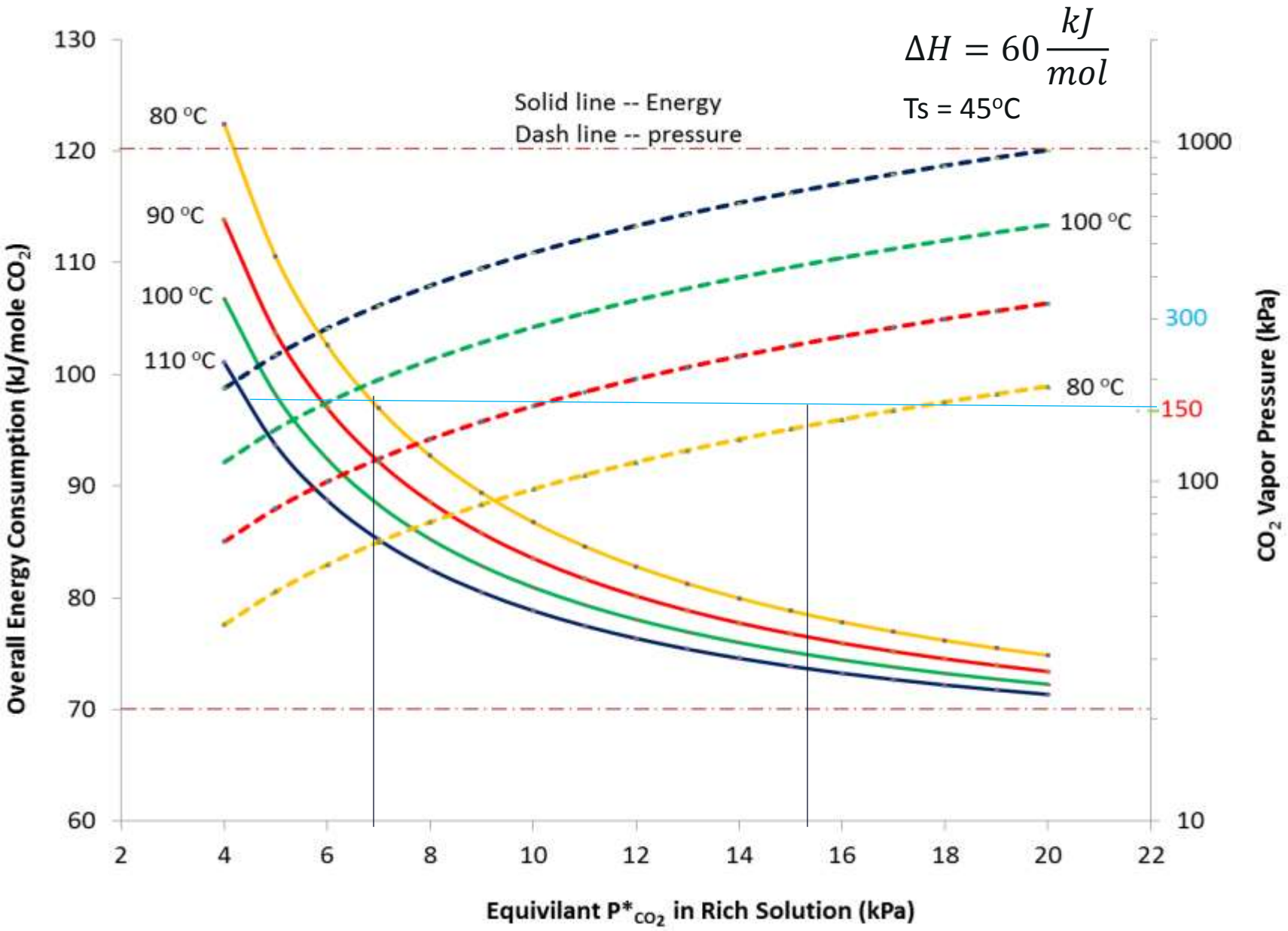
The Coordinated Effort



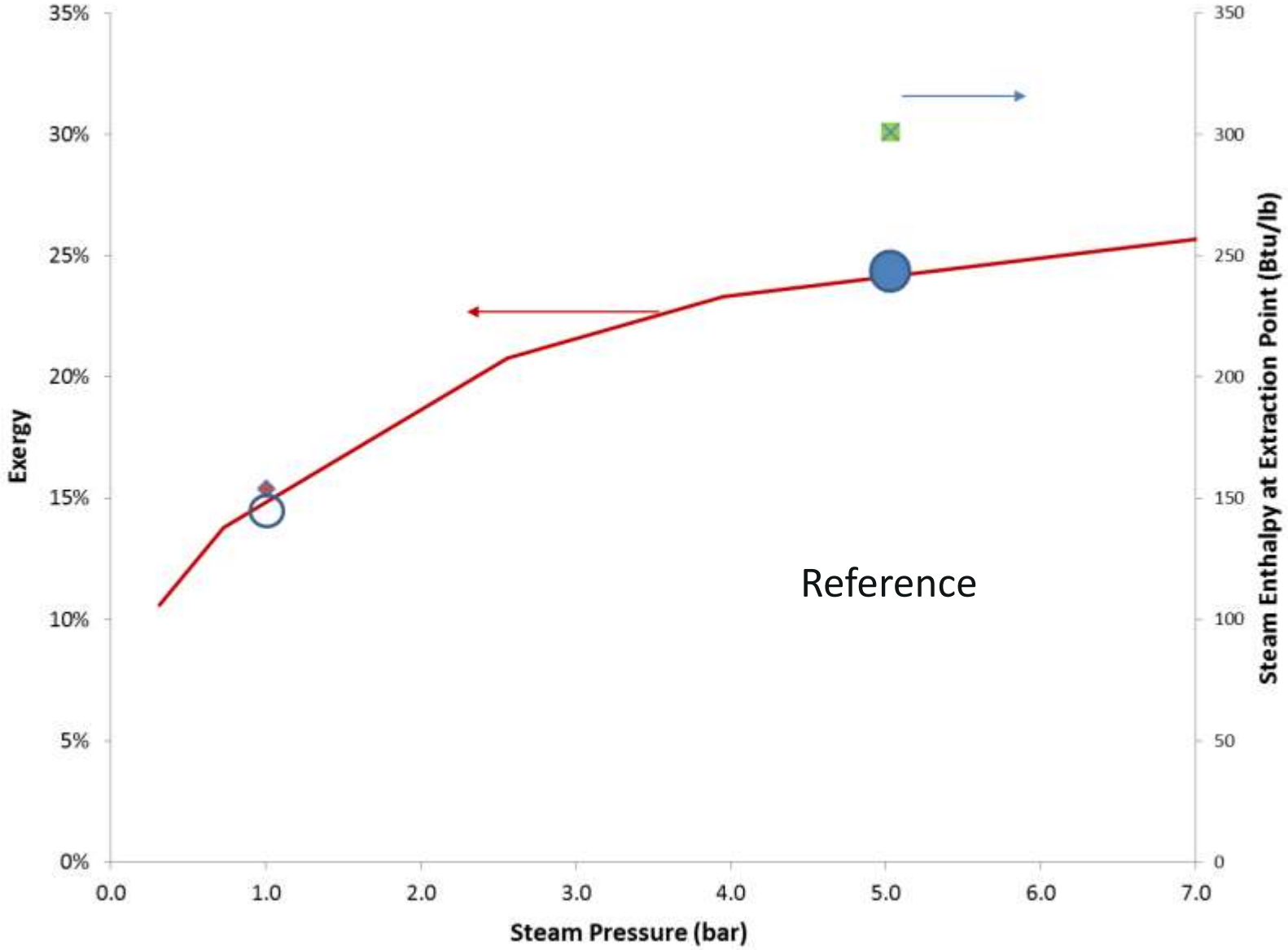
Large-scale Study Takes Years



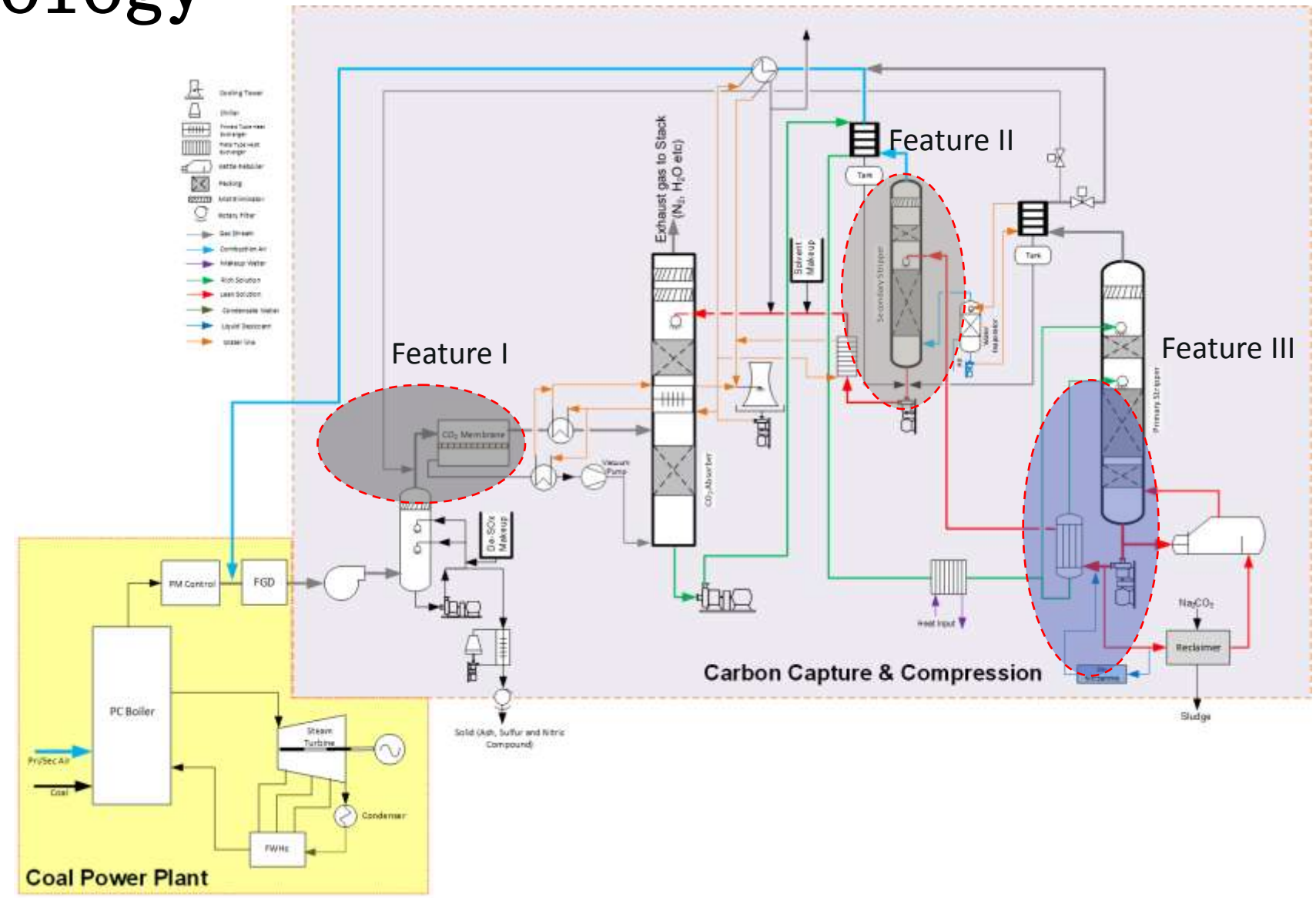
The Motivation



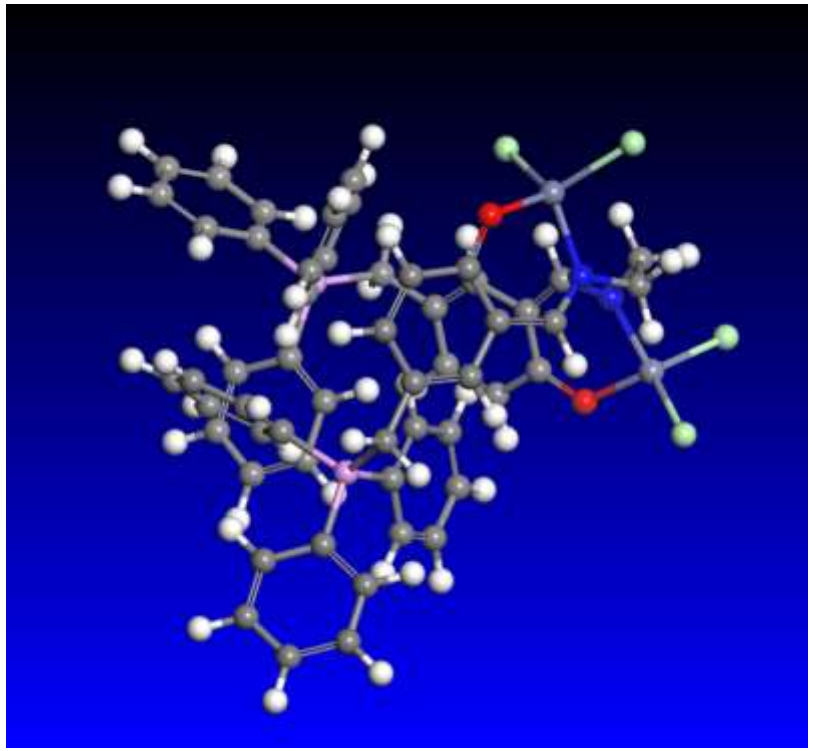
Benefits from Carbon Loading

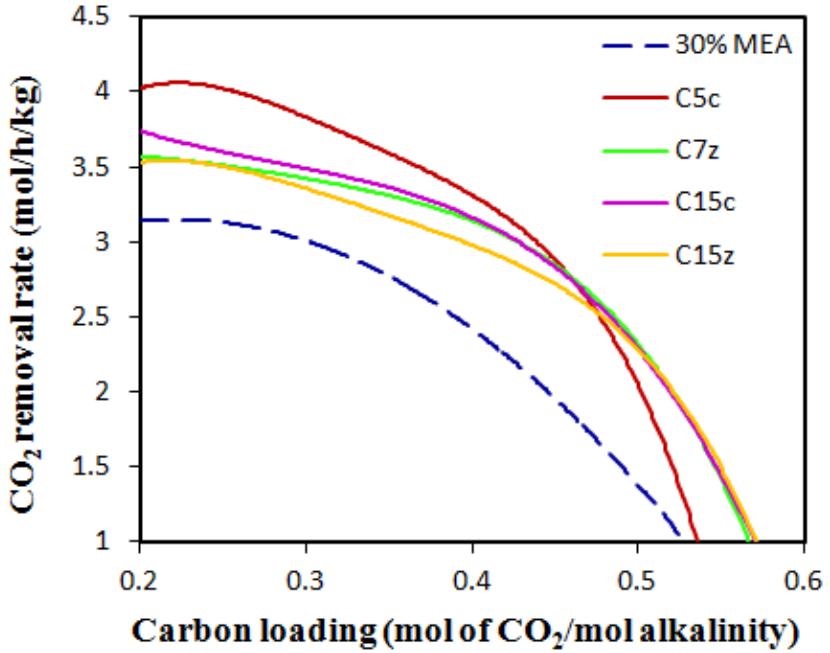


CAER's Post-combustion CO_2 Capture Technology



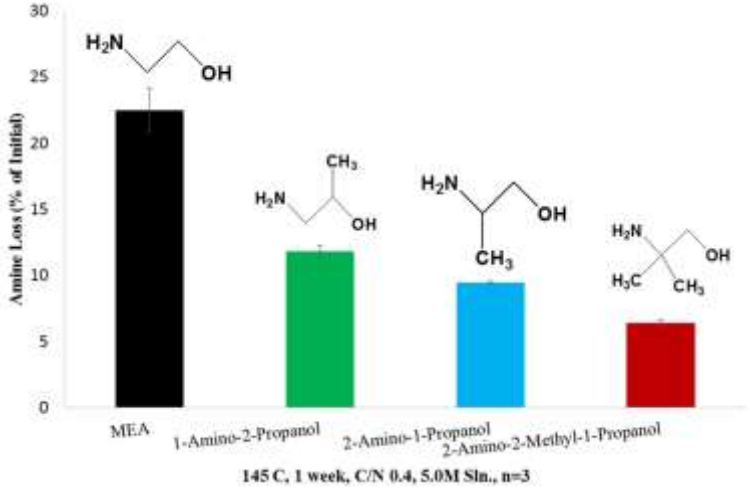
Kinetic Improvement to Reduce Capital Cost



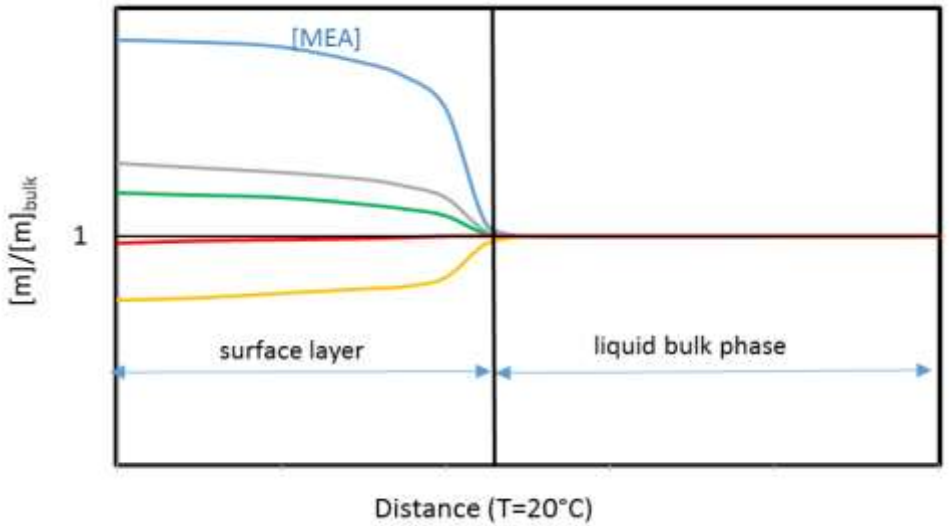


CO_2 Capture Solvent Properties

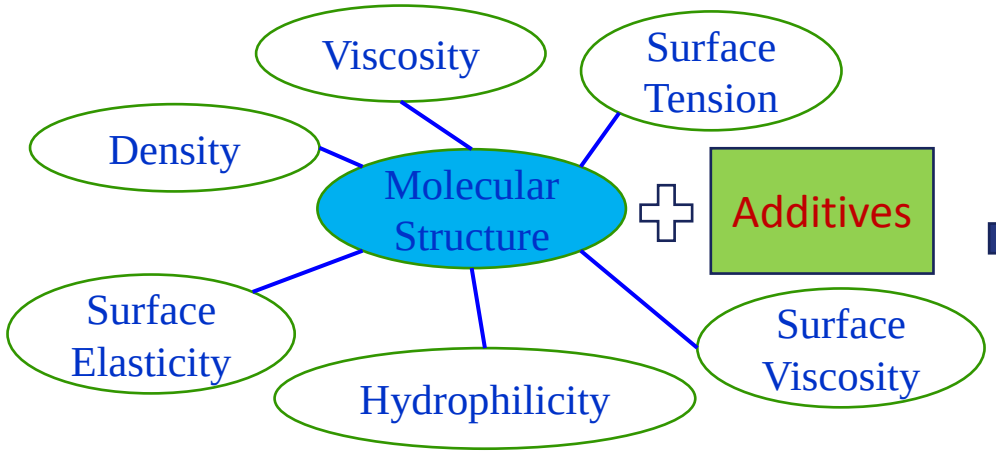
Minimizing solvent degradation



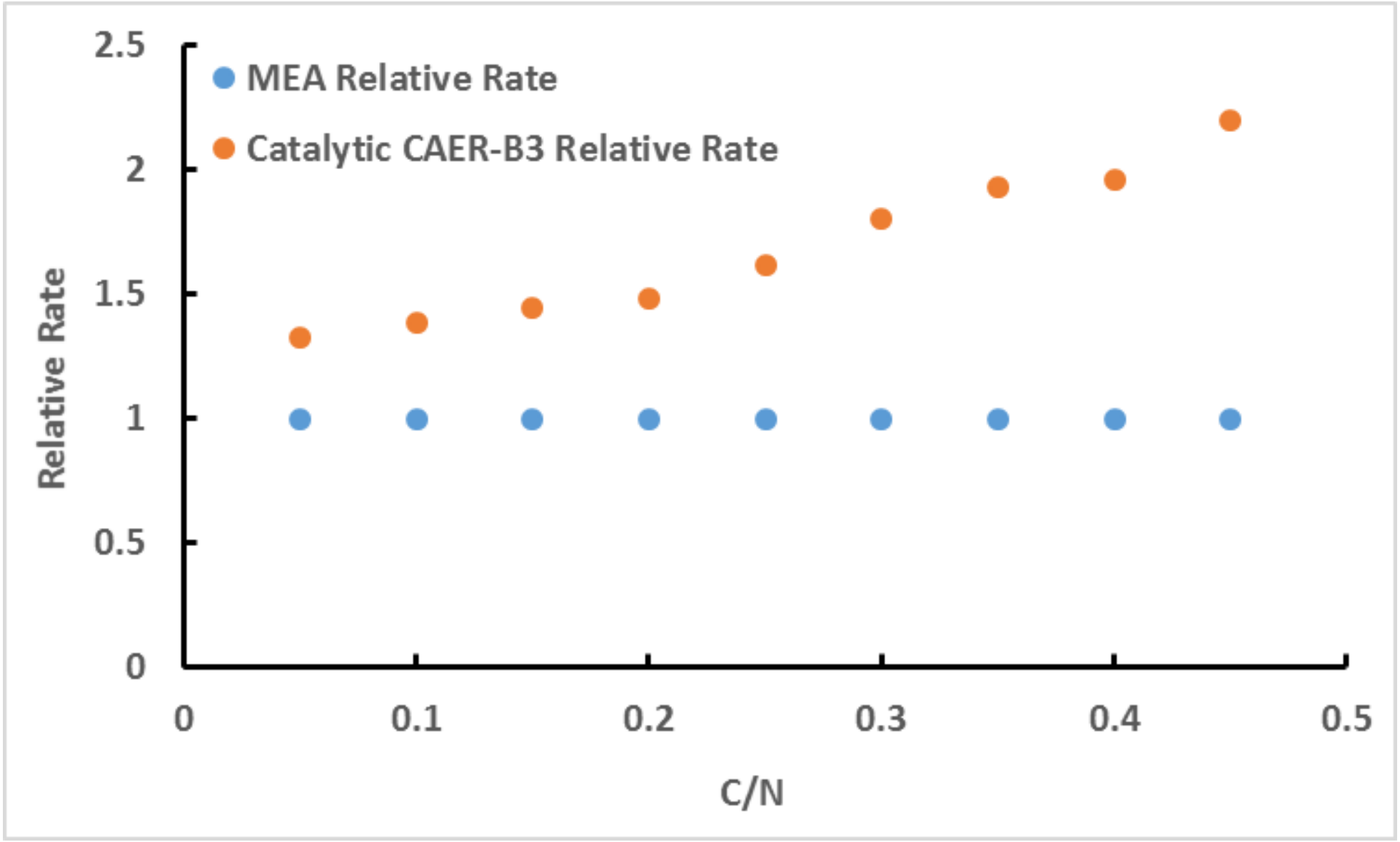
Solvent speciation at the gas/liquid interface



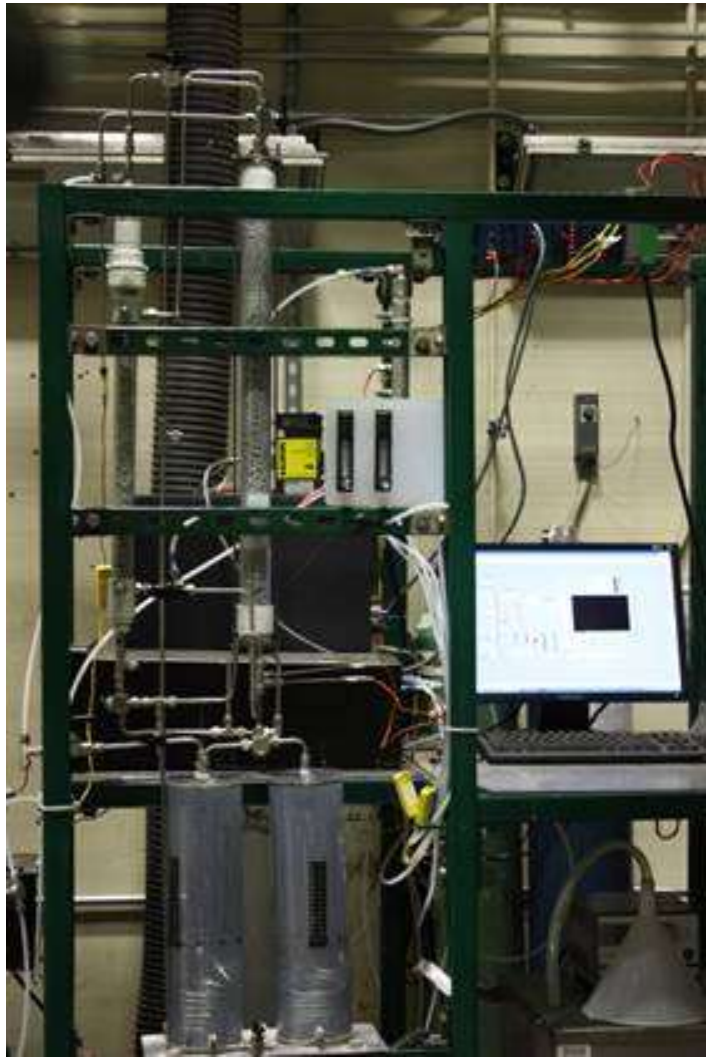
Tuning solvent physical properties

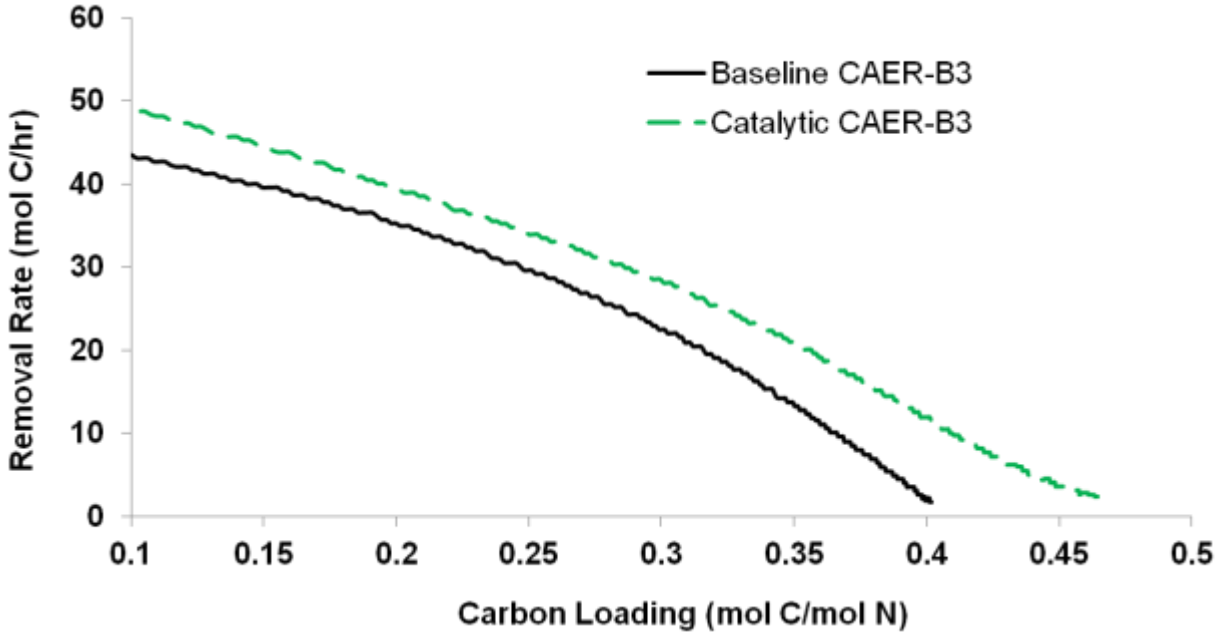


Basic Data: Thermodynamics & Rate



Flowability on a 1.5” Column

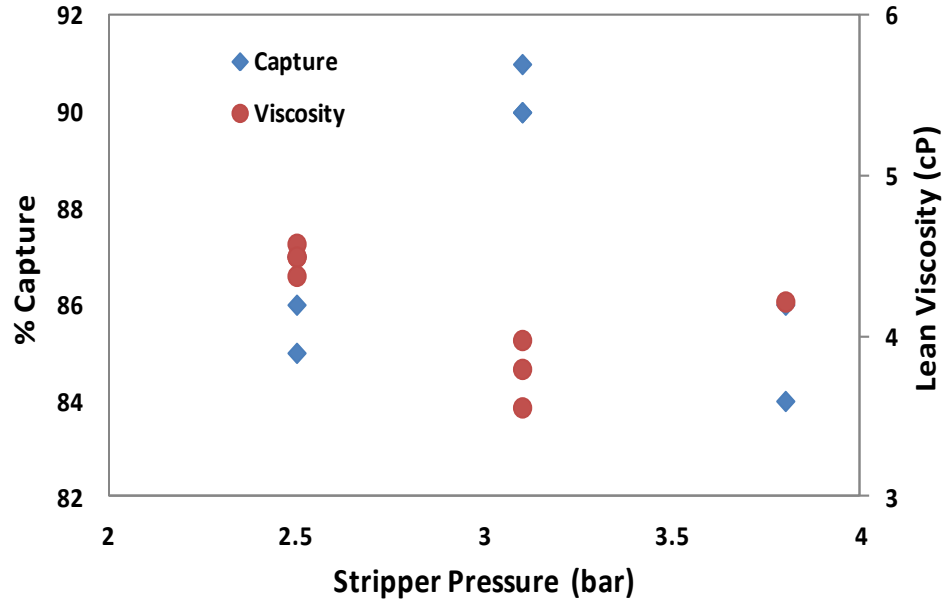


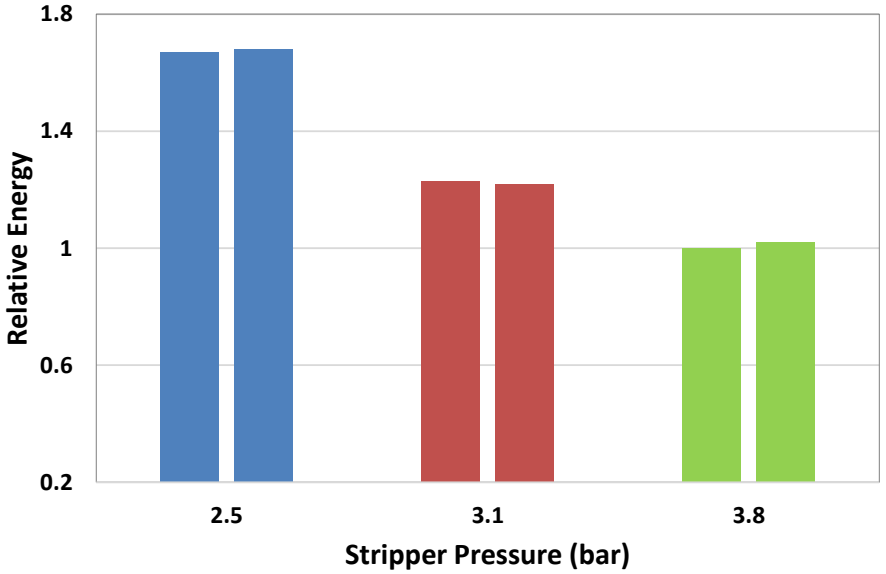


Evaluation on a Complete System Using Simulating Flue Gas

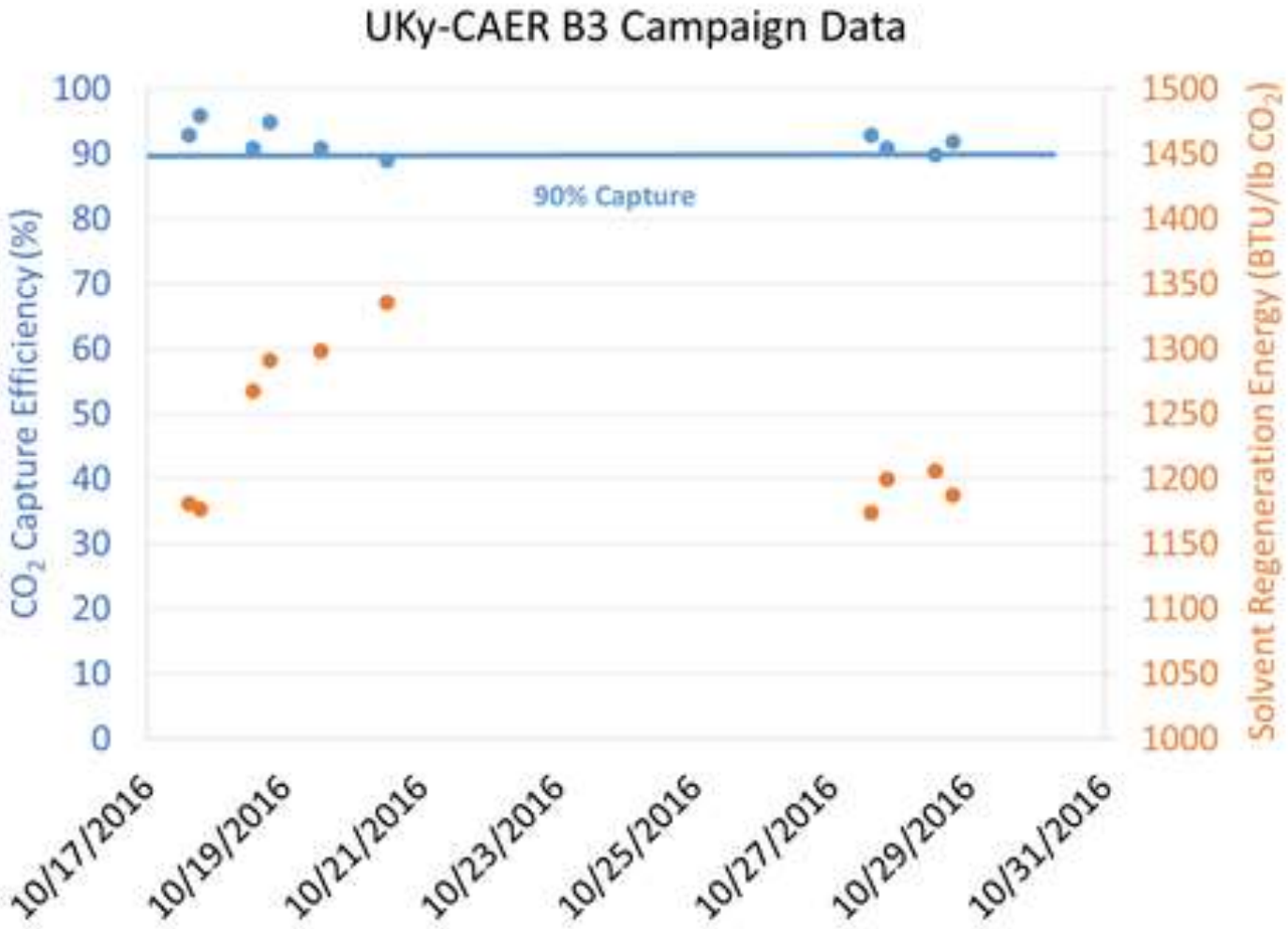
Catalytic CAER-B3			
Parameter	**Run 1**	**Run 2**	**Run 3**
Energy Demand (kJ/mol CO_2)	154	151	144
Liquid Flowrate (mL/min)	60	60	60
Cyclic Capacity (mol CO_2/kg soln)	1.37	1.31	1.42

Study on the 0.1MWth Unit with Coal-derived Flue Gas



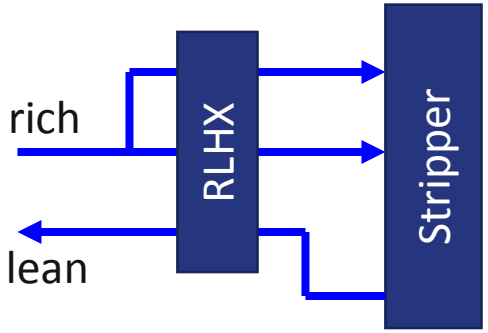


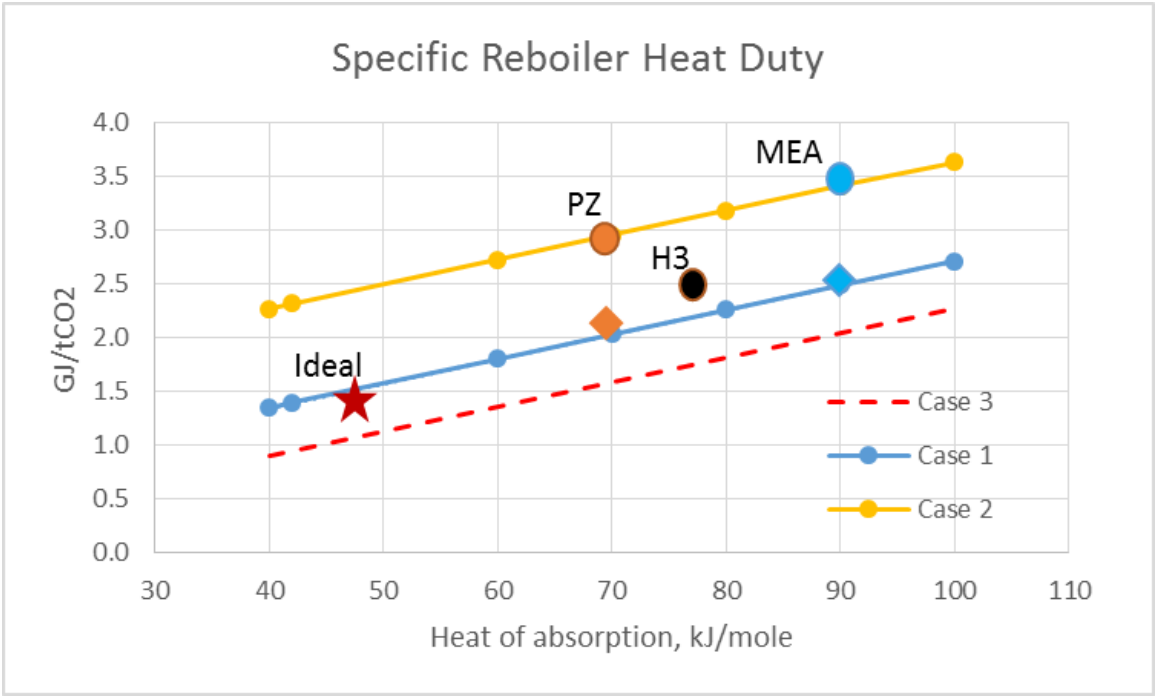
Scale-up Study on a 0.7MWe Facility at Power Plant



Advanced Stripping

- MEA can reach 2.5 GJ/tCO_2 with
  - Cold end dT = 5 C
  - Y(H_2O)/Y(CO_2) = 0.3
  - Advanced stripper configuration (right)
    - Q(Cond): 134 → 39 MWth; 95 MWth reduction
    - Q(Reb): 405 → 301 MWth; 104 MWth reduction





- Case 3: Minimum reboiler duty
- Case 2: The conventional RLHX
- Case 1: With advanced stripper (rich amine split)

Carbon Management Research Group

- Formed in 2008
- Focused on advanced combustion/gasification; and CO_2 separation at power plant

Center for Applied Energy Research

LG&E KU
PPL companies

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative

DUKE ENERGY

EPRI ELECTRIC POWER RESEARCH INSTITUTE

DEDI

AEP KENTUCKY POWER
A unit of American Electric Power

Carbon Management Technology Conference
http://fscarbonmanagement.org/cmtc/2017

Conference Topics

- Carbon Capture (Transformational and 2nd Generation)
- Storage / EOR
- Monitoring and Characterization Protocols and Technologies
- Carbon Utilization
- Demonstration / Pilot Scale Projects
- Industry and Energy Sector CCUS Projects
- Environmental Investigations
- Economic Analysis and Modeling
- Laboratory Investigations
- Risk Assessment
- Sustainability Options to Climate Change
- Energy-Water Nexus
- Business / Financial Approaches
- Policy / Legislation / Permitting Approaches
- Country / Regional Climate Change

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