CO2 Capture Large-scale Pilot Test

FE0026498 Presentation at CO2 Capture Meeting
August 9, 2016

Imagination at work.

Acknowledgment:

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The GE Global Oil & Gas Technology Center

130 technical professionals
$125MM investment
9th global research site
Locally designed and locally built
Moved in in July 2016

Photo: Simon Hurst Photography

Mongstad CO2 Capture Test Facility

Host site partner

Excellent facility and supporting functions

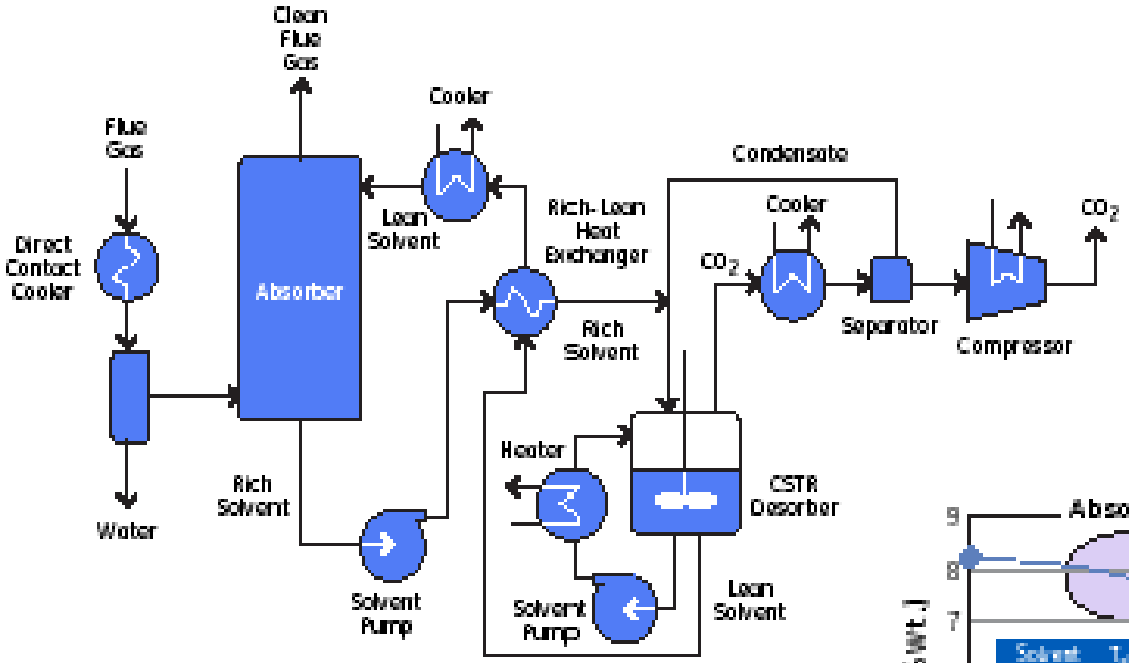
Deep dive evaluation process

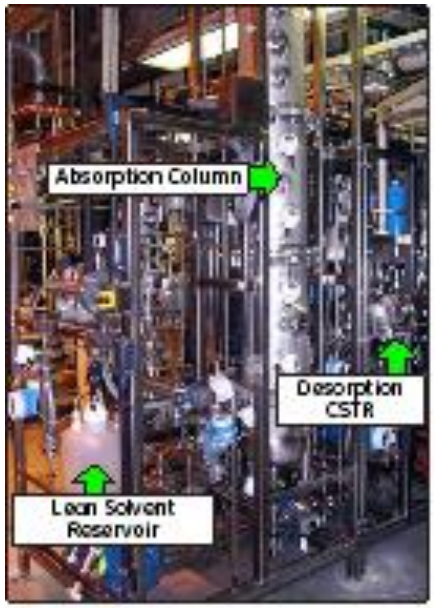
Information management

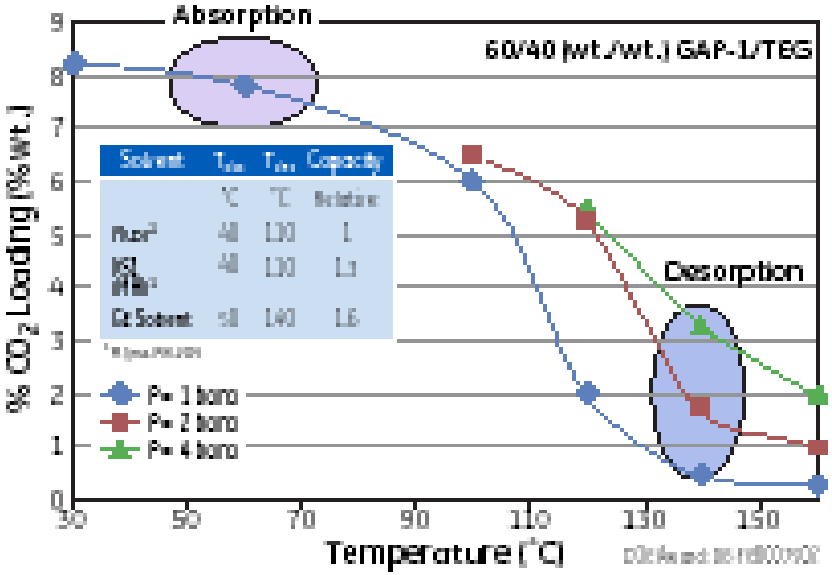
Current Status

- Because of the delay in pilot test at NCCC, GE could not support a TRL6 claim in March 2016 and declined to submit a Phase 2 renewal application
- After the NCCC pilot test is complete, GE will develop the deliverables for Phase 1. They will provide a guide for future scale up projects
- The Phase 1 systems analysis effort and retrofit project design spurred developments and identified challenges that will influence technology efforts going forward

Background (first task 2008)







Project Objectives and Approach

Primary Objective: two months of continuous operation@ 10 MW scale with sustained 90% capture and performance consistent with $40/mtCO2 capture cost.

Secondary objectives: demonstrate low solvent loss rate and establish diversity of solvent supply

Phase 1 Approach:

- Site evaluation and selection
- Technology gap analysis
- Techno-economic analysis
- Environmental, health and safety report
- Cost estimate and schedule for the phase 2 project

Accomplishments

Completed solvent supplier qualification process

Built a preliminary HYSIS model of AS @ Mongstad

Completed the Mongstad project evaluation process

Designed and estimated the cost of a retrofit project to accommodate the GE solvent at the Mongstad facility (will revise with information from NCCC)

Conceptualized and validated at bench scale a steam-driven desorption process that lowers solvent degradation rates (work performed using GE internal monies)

Measured at bench scale that lower absorber temperatures can lower oxygen degradation.

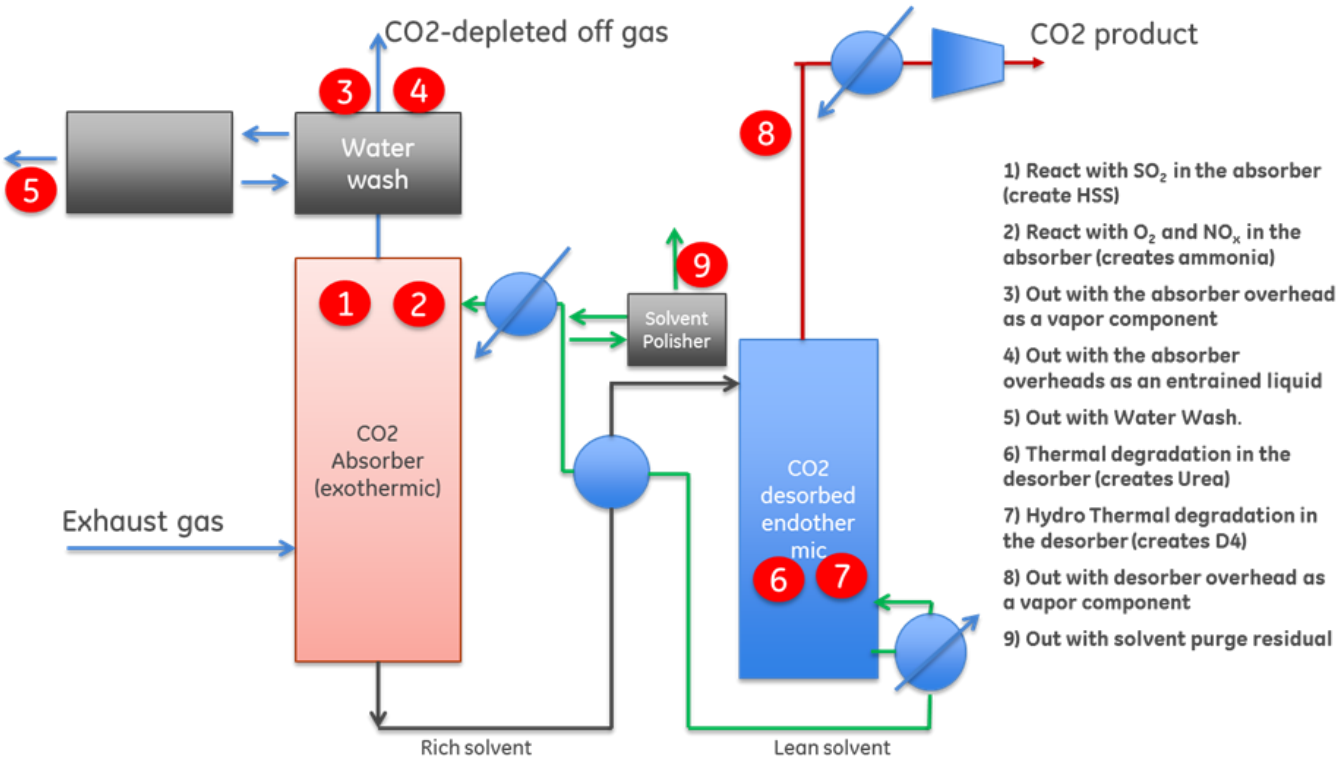
Solvent Qualification

GE has qualified a major chemical manufacturer as the supplier of the chemical solvent

We received a 100 kg sample and performed a number of glass ware experiments to measure properties and also conducted an extended run on the bench scale test rig to verify CO2 absorption and desorption properties

The solvent sample was highly pure and met GE's specifications

Systematic Analysis of Solvent Loss Identifies Areas for Technology Development

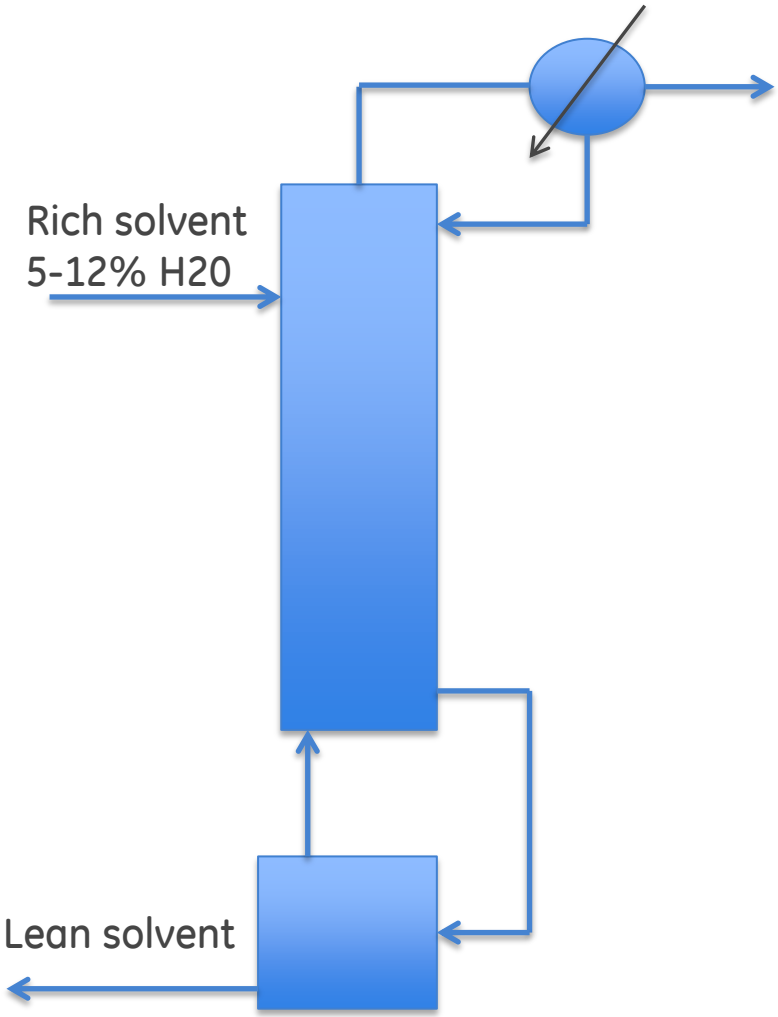


Multi-stage, steam-driven desorption process

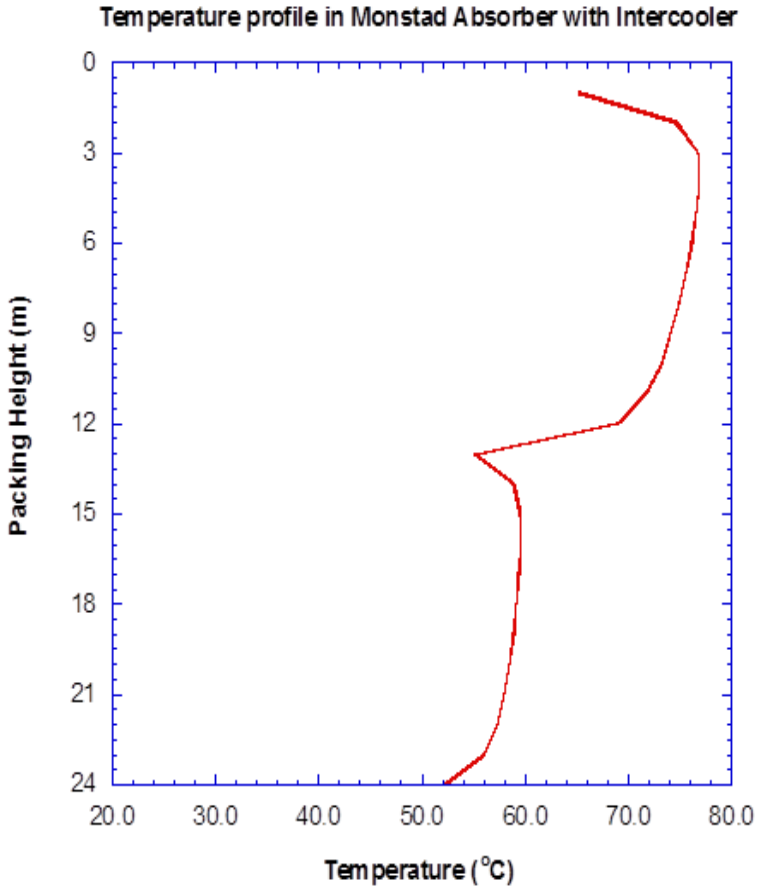
Concept: Water is added to solvent. Desorber bottoms are heated in reboiler, vaporizing entrained water. Steam flows up the tower, lowering the partial pressure of CO2 in the vapor phase and providing heat of desorption. Excess steam is condensed overhead

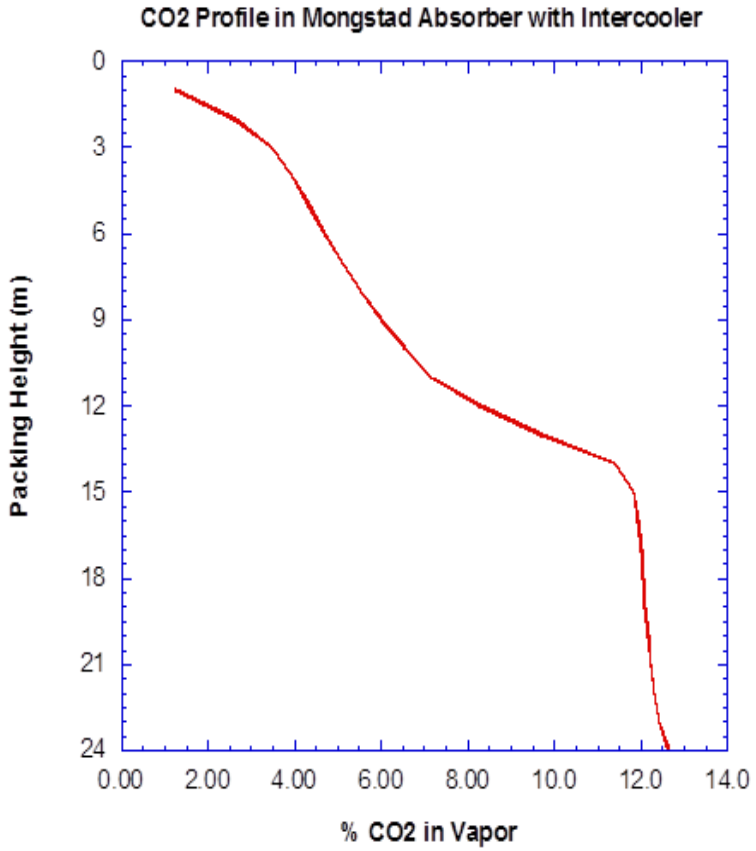
Progress: GE modified the bench scale test rig to add a stripper column. Experiments demonstrate near complete solvent desorption at 110C max stage temp

Impact: Significant reduction in solvent thermal degradation rate and increase in carrying capacity. Lowers cost of project as steam stripper can be utilized.

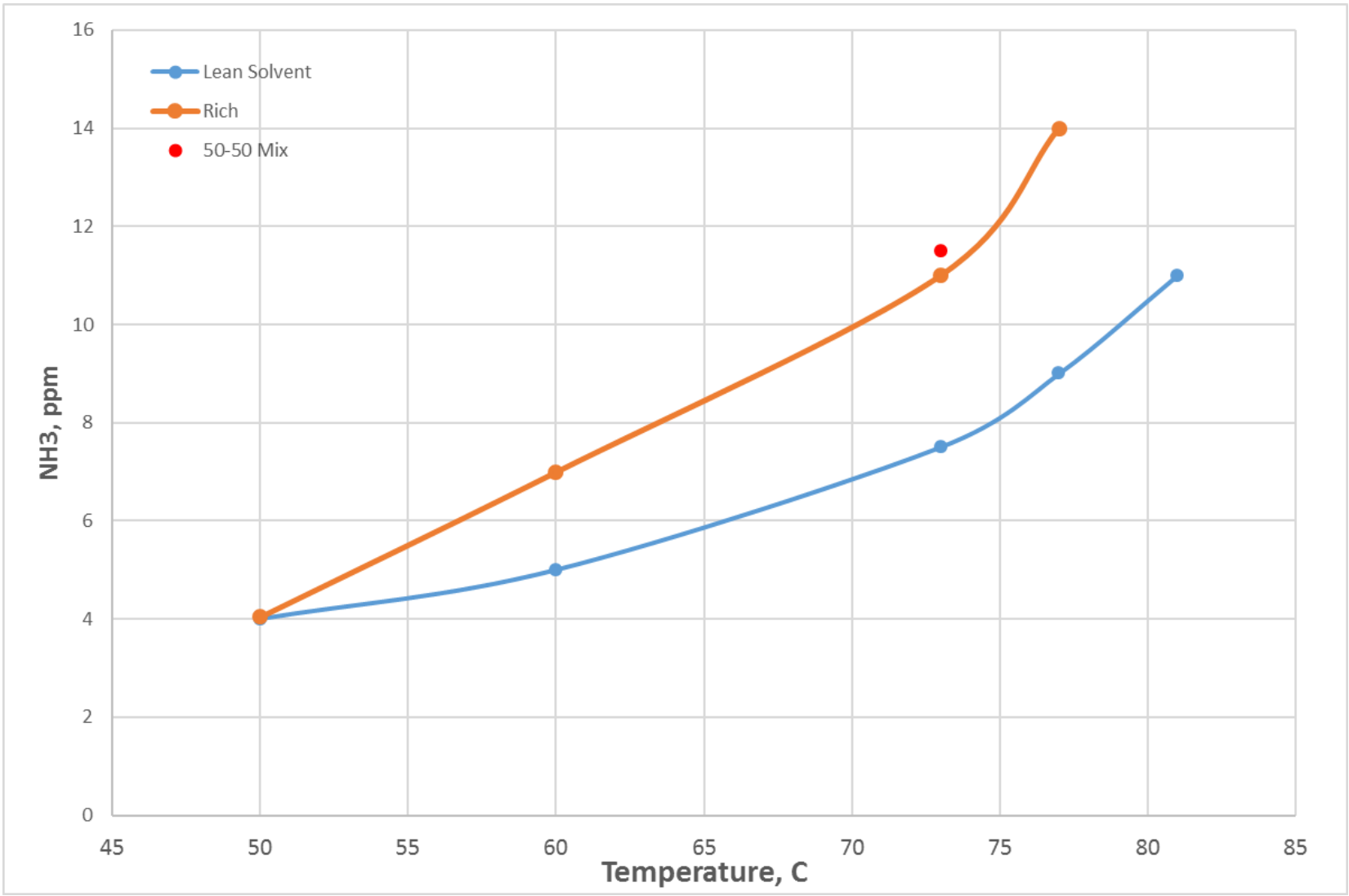


Modeled Absorber Temperature Profile at Mongstad





Low Absorber Temperature Slows Ox. Degradation



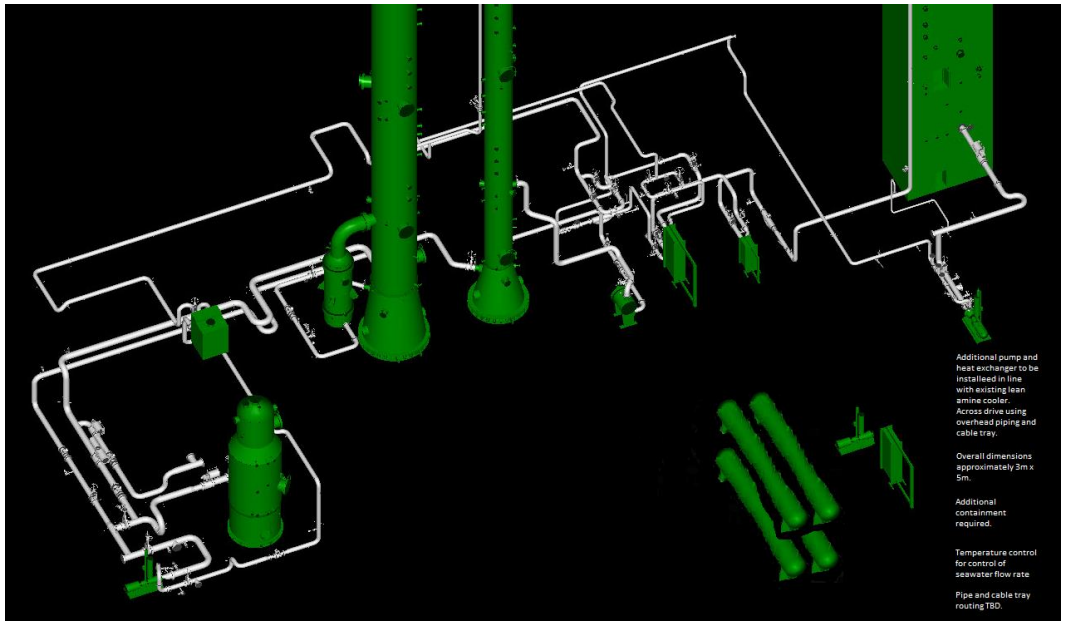
HX Biggest Item for Retrofit at Mongstad

Intercooler required between first and second packed bed in the absorber column

Plate and Frame Rich/Lean HX will not work for viscous AS fluid

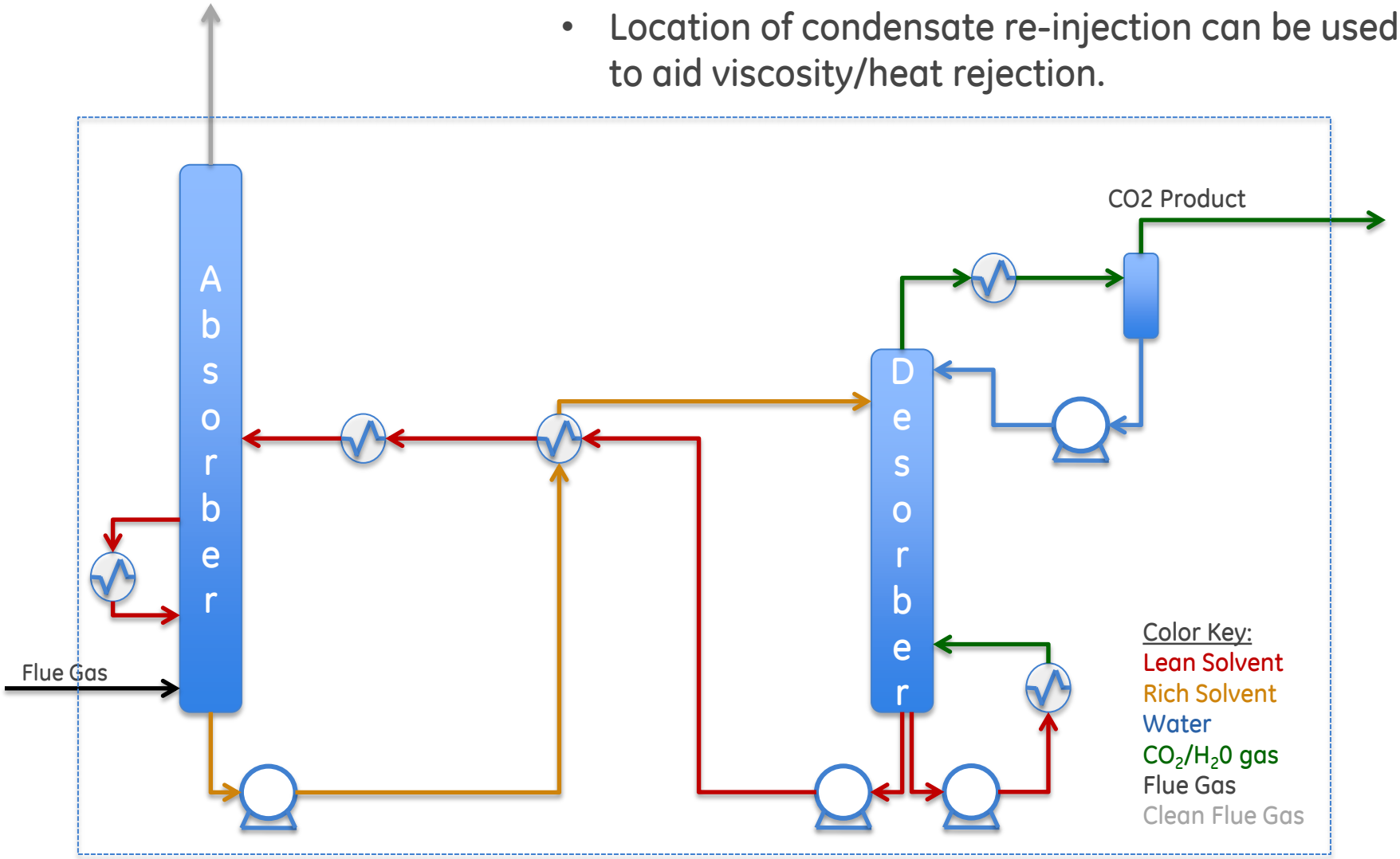
Lean solvent cooler should be adequate

Turbulator tube inserts enable reboiler to be utilized



Water Balance

- Temperature delta between absorber inlet/outlet will cause process to gain/lose water.
- Location of condensate re-injection can be used to aid viscosity/heat rejection.



Future Plans

Will resume work on the Phase 1 deliverables in October or when we have a vetted data set from the NCCC test

Will complete the deliverables by March 2017 (we have requested a contract extension)

Thank You