Fall 4-11-2016

Novel advanced solvent-based carbon capture pilot demonstration

Nathan Brown
ION Engineering, nathan@ion-engineering.com

Greg Staab
ION Engineering

Tyler Silverman
ION Engineering

Grayson Heller
Vista Engineering Group

Alfred Brown
ION Engineering

Follow this and additional works at: http://dc.engconfintl.org/co2_summit2

Part of the Environmental Engineering Commons

Recommended Citation

This Abstract and Presentation is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in CO2 Summit II: Technologies and Opportunities by an authorized administrator of ECI Digital Archives. For more information, please contact franco@bepress.com.
Novel Advanced Solvent-based CO$_2$ Capture Pilot Demonstration – *Fast-tracking the development & scale-up*

Erik Meuleman, PhD – CTO
Nate Brown, Greg Staab, Tyler Silverman, Grayson Heller, Buz Brown
ION Engineering, Boulder CO, USA

ECI CO$_2$ Summit II: Technologies & Opportunities
Santa Ana Pueblo, New Mexico
April 11, 2016
Outline

• Overview of ION Engineering
• ION Technology
• Development Track
• Capture System Evaluation at National Carbon Capture Center, Wilsonville AL, USA
• Path Forward
ION Engineering

- Founded in 2008 in Boulder, CO, USA
- Cost-effective solution for CO$_2$ capture
- Exclusive rights to proprietary ‘solvent’ technology
- Market focus: Climate change mitigation via CO$_2$ capture & CO$_2$ commercial sale for industrial processes
ION has developed a patented liquid absorbent technology that produces a more efficient & lower cost way to capture CO$_2$ than traditional methodologies.
ION Technology

- **Solvent Based Technology**
- **Reduced CAPEX**
  - Smaller Columns, HXs and Footprint
- **Reduced OPEX**
  - Lower Energy Requirements
  - Less Maintenance
  - Lower emissions
- **Lower Parasitic Load**
- **Scalability**
  - Established Engineering Process

- **Basis of Performance**
  - < 1,090 Btu/lbCO₂ captured (2.5 MJ/kg)
  - Fast kinetics (faster than MEA)
  - Working capacity (higher than MEA)
  - Low heat capacity (much lower than MEA)
  - Low tendency for corrosion (much lower than MEA)
**Development Fast Track**

*ION is developing its technology by leveraging off existing facilities with several global and local partners*

- More than a dozen partners have provided > $36M (2008 – 2016)
- ION is expanding relationships internationally

- $4M Proof of Concept
- 0.05 MWe Pilot (in-house)
- Began Q1 2010; Completed 2012

- $14M Pilot Project
- 0.6 MWe Coal - Fired Pilot
- Q4 2013 to Q2 2016

- $2M Proof of Principle
- 0.25 MWe Coal & NGCC - Fired Pilot
- Completed 2013

- $16M Demonstration Project (est.)
- 13 MWe Pilot Demonstration
- Q4 2015 to Q2 2017
PILOT SCALE DEMONSTRATION

National Carbon Capture Center – Wilsonville, Alabama, USA
Operational Considerations

NCCC plant was designed and built for MEA. ION and NCCC successfully implemented a few mods and, whilst operating at a point different than ION’s optimal Process Design, campaign priorities were:

- **1st Priority** – Maintain Process & Water Balances
- **2nd Priority** – Flue Gas treating to meet DOE goal of 90%+ removal of CO₂
- **3rd Priority** – Operational Stability & Efficiency
Water Balance

![Graph showing deviation from control point (rel%) over dates from 6/25 to 8/14. The graph indicates two phases: Parametric Testing and Steady State.](image-url)
CO₂ Capture Performance

Specific Heat BTU/lb CO₂

- ION NCCC
- 1,090 ION Design Case
- 1,350 Best Claim at NCCC
- 1,600 ION at NCCC
- 2,300 MEA at NCCC
Metals and Corrosion

- Process coupons show minimal impact to 304, 304L, or 316L under harsh conditions of regenerator for over 1,100 hours
  - As expected the carbon steel coupon shows corrosion

- Better Stainless Steel compatibility than MEA

- Key Compounds (SS Corrosion)
  - Chromium
  - Nickel
  - Silicon (pending results)
  - Iron (fly-ash can convolute data)

- ION solvent accumulates significantly less metal ions than MEA
NCCC Campaign Summary

- 1,100+ hrs Testing in Real Process Environment
- Achieved 95+ % Capture of CO₂ Start to Finish
  - 1,600 Btu/lbCO₂ at Steady State on NCCC facility (oversized for ION solvent)
- Evaluated L/G: 2.0-3.5
  - Control of absorber temperature profile, i.e. emissions
  - Maintained water balance & capture targets
- Solvent Loss Evaluated for Parametric & Steady State Conditions
  - Computed from Level Balances & Lab Analytics
  - Excellent Accuracy / Sensitivity evaluated during periods of solvent addition
- Validated ProTreat® simulation model
  - 1,090 Btu/lbCO₂ (2.5 MJ/kg) captured for ION technology optimized plant
- Fastest kinetics → low CAPEX
Next steps

ION is developing its technology with several global and local partners commercially, technically and fundamentally.
THANK YOU

www.ion-engineering.com

Erik.Meuleman@ion-engineering.com