CO2 Capture Large-scale Pilot Test Using Aminosilicone Solvent

FE0026498 GE Kick-off Meeting
November 2, 2015
Acknowledgment:
This material is based upon work supported by the Department of Energy under Award Number DE-FE0026498.

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Presentation Outline

• Project Background
• Project Objectives
• Project Team
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• Current Project Status
• Questions & Closing Comments
Project Background

Oil & Gas Technology Center

The newly established OGTC, located in Oklahoma City, Oklahoma, is GE’s first industry-specific global research site.

The OGTC seeks to develop solutions and new products for GE customers by advancing early TRL technologies and applying GE technologies from other GE business areas.

The mission of the CO2 capture and separation team is to develop CO2 supply solutions for GE customers in the Oil and Gas Sector.
Strategic Research Interdependencies

Strategic themes emerging from cross-program priorities

- Production Systems
  - Production Optimization
  - Completions
  - Distributed Power

- Well Construction Systems
  - Advanced Drilling Systems
  - Artificial Lift
  - Produced Water Management

- CO₂ Systems
  - Facilities Optimization
  - Emissions Mitigation & Management
  - Gas monetization

- Energy Systems
  - Emissions Mitigation & Management
  - Sustainability

- Water Systems
  - Water Reuse

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GE Global Research, located in Niskayuna, New York, (Figure 20) is one of the world's largest and most diversified industrial research laboratories and has more than 100 years of history in science and technology. It is the cornerstone of GE’s commitment to technology leadership and serves all of GE’s businesses.

GRC has facilities and competency to conduct laboratory experiments, chemical analyses, bench scale pilot tests, and ASPEN process simulations.

The center has the ability to design, fabricate and assemble process equipment.
CO2 Capture Test Facility at Mongstad

Support from Berit Fostas, Bjorn-Erik Haugan, Hans Jorgen Vinje, Laila Helgesen and others

Facility Expertise

CO2 capture expertise

Process Evaluation, benchmarking
Research Leading To This Award

Aminosilicone Cumulative Investment, MM$
Research Leading to This Award

Figure 7. Photographs of the completed bench-scale test system.
Project Objectives

The overall objective is to demonstrate aminosilicone as a viable commercial process capable of 90% CO2 capture, 95% CO2 purity, and a CO2 capture cost of $40/tonne.

The objective of phase 2 is to demonstrate two months of continuous operation and sustained performance at 10 MW scale (## kgCO2 captured per hour) at the CO2 Capture Test Facility in Monstad, Norway.

Secondary objectives are to demonstrate low solvent loss rate and diversity of solvent supply.

The objective of phase 1 is to plan the phase 2 project and develop a renewal application. The renewal application will include:

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

Phil Di Pietro
- Principal Investigator
- CO2 Capture and Separation Technical Manager at GE’s Oil and Gas Technology Center
- B.S. Chemical engineering

Charles Womble
- Site Assessment and Technology Gap Analysis
- EOR and natural gas operations, 25 years experience
- Designing and managing CO2 separation (solvent and membrane) technologies, recompression and reinjection facilities

Robert J. Perry, PhD
- Solvent Supply and EHS
- Synthetic Organic Chemist with 20+ year experience
- Project Leader for DOE NT-0005310, DE-AR0000084

Jamison Shaffer
- TEA, Cash flow model
- Financial, economic, and commercial analyst with 10 years Oil & Gas experience

Surinder Singh, Ph.D
- Process modeling, system optimization
- Led systems modeling development for Hollow Fiber CO2 Membrane (DE-FE0007514)
Project Team
Team Advisors & Performance Of Supporting Efforts

Benjamin R. Wood, Ph.D.
- Process Design Engineer with 10+ year Experience
- PI for DE-FE0013755 (GAP-1/TEG bench) and DE-FE0007502 (GAP-1/TEG pilot)

Sarah Genovese
- Material Development Engineer for GAP-1/TEG
- Process Engineer for designing the lab, bench & pilot-scale CO₂ process

Wei Chen, Ph.D.
- Chemical Process Engineer with 15+ year Experience
- Program Management, Process Development, Modeling, Design & Scale Up

Dan Hancu, Ph.D.
- Organic Chemical Process Engineer with 15+ year Experience
- 10+ years project leadership in chemical material systems development

Joseph R. Moate, Ph.D.
- Low Power CO₂ removal process development
- Development of numerical models describing multi-phase absorption equilibria
Project Structure

Budget Period 1
- September 2015 through September 2016 totaling $1,213,880

Project Management Task
- Coordinate Multidisciplinary Project Execution

Host Site Evaluation & Test Planning Task
- Evaluate Existing Equipment And Develop Process Concept

Basic Design of Pilot-Scale System Task
- Complete Preliminary Design Of Retrofit And Conduct TEA & TGA

Technology EH&S Assessment Task
- Perform Technology EH&S Study

Solvent Manufacturability & Scale-up Task
- Conduct Solvent Degradation Study
Project Schedule – Phase 1

- September 14, 2015: TCM KO Mtg
- Nov 2, 2015: NETL KO Mtg
- December 1, 2015: GE Briefing
- Feb 1, 2016: Go/No-Go Decision
- March 31, 2016: Phase 2 Renewal Application Due

- September 18, 2015 - January 15, 2016: Host Site Evaluation & Equipment Design
- September 18, 2015 - January 15, 2016: Basic Design & Competitive Assessment
- September 18, 2015 - December 31, 2015: Technology & EHS Assessment (Solvent Degradation Experiments)
- September 18, 2015 - January 15, 2016: Solvent Manufacturability & Scale Up
- December 7, 2015 - March 25, 2016: Draft Phase 2 Renewal Application
# Project Management Plan

## Milestones

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## Deliverables

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<td>Phase 1 Environmental Health &amp; Safety Study</td>
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Current Project Status

• GE visited the Mongstad facility on September 14 and gathered data to perform the site assessment (Phil DiPietro, Maggie Lelak, Dan Hancu, Morten Wiencke, Chad Yates)

• GE is performing lab scale tests of a change in the desorption process that will suppress solvent degradation.

• GE is assessing what data can be acquired from the NCCC test,

• GE has developed an ASPEN process simulation of the aminosilicone GAPm applied to the Mongstad facility.

• GE has conducted a preliminary assessment of the process equipment at Mongstad and each piece of equipment’s amenability to the aminosilicone solvent

• GE has engaged a supplier of the aminosilicone chemical and begun the qualification process

• GE has engaged a laboratory facility to conduct degradation experiments of the aminosilicone solvent and test for degradation products

• GE has developed a preliminary cash flow model of the aminosilicone process at commercial scale
Questions
Closing Comments