Illinois Industrial Carbon Capture & Storage Project

Eliminating CO₂ Emissions from the Production of ADV Bio Fuels - A 'Green' Carbon Process

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scott.mcdonald@adm.com



Acknowledgements



- The Industrial Carbon Capture and Storage (ICCS) project is administered by the U.S. Department of Energy's Office of Fossil Energy and managed by the National Energy Technology Laboratory (award number DE-FE-0001547) and by a cost share agreement with the ADM, U of I (ISGS), SLB, & RCC.
- The Intelligent Monitoring System (IMS) Project is administered by the U.S. Department of Energy's Office of Fossil Energy and managed by the National Energy Technology Laboratory (award number DE-FE-0026517) and by a cost share agreement with the ADM, LBNL, Silixa, SLB, U of I (ISGS), & RCC.
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- The MGSC is a collaboration led by the geological surveys of Illinois, Indiana, and Kentucky

Illinois Basin Decatur Project (IBDP)

LLINOIS INDUSTRIAL CARBON CAPTURE & STORAGE

Program Objective

Large scale geologic test to inject 1.0 million tons of CO₂ over a three year period (1,000 MT/day).

Project Team Members



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Knowledge Base

- Site Geological Characterization
- Risk Assessment & Reservoir Modeling
- Engineering Design & MVA

Nov 2014-Completed goal of injecting and storing 1,000,000 tons of CO_{2.}







Program Objectives

- Target & Demonstrate Advanced CCS Technologies at Industrial Scale Facilities
- Inject and Store One Million Tons of CO₂ Annually (3,000 tons/day)

Project Team Members



Knowledge Base

- Site Geological Characterization
- Risk Assessment & Reservoir Modeling
- Engineering Design & MVA
- Education and Public Outreach

Study the interaction between the CO_2 plumes from two injection wells within the same formation.





Intelligent Monitoring System (IMS)



Program Objectives

- Develop and validate software tools that advance CCS-specific IMS by enabling access, integration and analysis of real-time surface and subsurface data for decision-making and automation of process
- Demonstrate integration of system components to validate feasibility of real-world application to CCS.





Decatur Site Overview



ADM Facility



VW#2

GM#2

CCS#2

NSEC

VW#1

CCS#1

GM#1

Compression & Dehydration

1.1 10

CO₂ Collection Blower Area



ADM

Site Selection



Regional Geologic Characterization CAPTURE & STORAGE

- Cratonic basin
- 60,000 square mile area
- Structurally complex to the south with faulting and seismicity

- ADM Decatur facility is located near the center of this geologic formation
- Estimated CO₂ storage capacity between 27 to 109 billion metric tons



ADM

Site Characterization Seismic Acquisition







Test Well Construction







Coring and Well Logging











ADM

Geophysical Model Framework









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Environmental Monitoring Near Surface Monitoring





- Near infrared aerial imagery will be used to evaluate plant stress
- Soil resistivity characterized shallow depths for identification of optimum GWM locations
- GWM for baseline conditions and operational surveillance
- Surface soil CO₂ flux monitoring





Environmental Monitoring Deep Subsurface Monitoring





- Deep P/T monitoring
- Distributed Temp Sensor
- Distributed Vibration Sensor
- Multi-level fluid sampling ports
- P/T monitoring above the seal formation
- Deep geophones arrays allowing vertical seismic profiling (VSP)
- Pulse neutron well logging



Seismic Monitoring USGS ADN **USGS Site Monitoring** science for a changing world 1 km ADEC12 ADEC11 ▲DEC13 39.90 N ADEC06 ♦VW#2 DEC02 ADEC10 ADEC03 DEC01 ▲DEC04 GM#1 ●CCS#1 ▲DEC09 ADEC14 ADEC05 ADEC07 DEC08 39.85 N Surface station Borehole station Well geophone Well vertical DAS

88.88 W



Deep Seismic Monitoring

- 3 Geophone Arrays in CCS1
- 24 Active Geophones in GM1
- 5 Level Geophone Array in GM2
- 7 Borehole Stations (500 ft)
- 14 Surface Stations

ADA







IMS Equipment Layout



Technologies Developed under DOE Core R&D are incorporated into the IMS



Rotary Orbital Source



Broadside Sensitive Cable



IMS Data Acquisition Architecture



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Seismic Monitoring Data

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CO₂ Based Chemicals

Carbonates

- Glycerol Carbonate
- Propylene Carbonate
- Dimethyl Carbonate
- •Fertilizers
- Alcohols
- •Fuels
- •Acids
- Others



Transformation of Carbon Dioxide, Sakakura, Choi, & Yasuda, 2007

Enhanced Oil Production

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http://www.youtube.com/watch?v=azLVjYij5U4



Cross-section illustrating how carbon dioxide and water can be used to flush residual oil from a subsurface rock formation between wells



Illinois Basin Potential



(1) BASIN ORIENTED STRATEGIES FOR CO2 ENHANCED OIL RECOVERY: ILLINOIS AND MICHIGAN BASIN OF ILLINOIS, INDIANA, KENTUCKY AND MICHIGAN; Advanced Resources International, February 2006

Thank You!



Industrial Carbon Capture and Storage Project:

- U.S. Department of Energy Award No. DE-FE-0001547
- Administered by the DOE's Office of Fossil Energy
- Managed by the National Energy Technology Laboratory

Cost Share Agreements:

- Archer Daniels Midland Company
- University of Illinois through the Illinois State Geological Survey
- Schlumberger Carbon Services
- Richland Community College

Project Team Members Contacts:

- Dr. Sai Gollakota (NETL-DOE) <u>Sai.Gollakota@NETL.DOE.GOV</u>
- Dr. Sallie Greenberg, (ISGS) greenberg@isgs.illinois.edu
- John Medler, (Schlumberger Carbon Services) jmedler@slb.com
- Dr. Douglas Brauer (RCC) <u>dbrauer@richland.edu</u>

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