Carbon Capture Utilization and Storage (CCUS) as a Regional Development Tool: Planning and Design Considerations

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Prairie Research Institute: Illinois-focused Resource Research and Service

*Addressing societal challenges that impact Illinois and the global community*
Overview

Examining from a state-wide perspective

• Status of large scale CO₂ capture pilot
  – Phase 2 proposal submitted to DOE for 15 MW large scale capture pilot

• Select utilization options synergistic with regional economy
  – Preferred options can vary throughout one state or region

• Identify relevant workforce development partners
  – Related to utilization options and part of CO₂ value chain

• Develop tools to connect CO₂ utilization with existing economy
  – Tools to examine dispatching of CO₂
Phase 2 proposal (Design, Build, Operate) submitted

STATUS OF LARGE SCALE PILOT
Host Site: Abbott Power Plant

*Ideal site for large scale pilot testing of coal and natural gas*

- Seven boilers total: three are coal based (Chain-grate stoker design) others natural gas
- **Coal side has completely separate treatment system from natural gas side**
- For testing will run two coal boilers
- Illinois high sulfur coal is burned
- Electrostatic precipitators and a wet Flue Gas Desulfurizer (FGD) in place
- **Tradition of evaluating new emission technologies**
- **Tradition of showcasing technologies to other power plants and education groups**
Overview of Capture System for Large Pilot Plant

Technology features
Overview of Phase 2 Project Schedule

More than just a design, build, operate project

- **Stakeholder Engagement helps educate, understand market needs, and propagate technology**
- **Education**: workforce development for existing and future operators and engineers
- **Demonstrating not only the technology but how to create jobs and drive regional economies**
Phase 2: Project Organization Chart

*Added expertise in aerosols, OSBL procurement / construction, and dry-bed emissions reduction*

**University of Illinois**
- Program & Stakeholder management, host site

**International Advisory Board**
- ISBL EPC, operations, testing

**Linde Engineering North America**

**Affiliated Engineers**

**ACS**

**Washington University**
- OSBL design, build

**Linde AG, Engineering Division**

**Linde LLC**

**BASF**

**Technology owner and patented dry-bed emissions reduction technology**
Site for Carbon Capture Plant Established and Evaluated

Located close to Abbott Power Plant

Extract flue gas POST CEMS Unit
Region & Global Test Bed for CCUS

Concentration of natural resources and intellectual capital

- Capture of CO₂: Abbott Power Plant UIUC
- Storage of CO₂: ADM Project
- Utilization of CO₂: Enhanced Oil Recovery (EOR)
- Operator Training
- Coal combustion

Locations:
- Champaign-Urbana
- Decatur
- Mattoon
- Fairfield, Olney, Robinson, Mt. Carmel
- Carbondale
Important to consider regional economy

SYNERGISTIC UTILIZATION OPTIONS
CarbonSAFE ILLINOIS

*Funded to match carbon “sources” with carbon “sinks”*

$12M funding - Commercial-scale CCS opportunities for 50+ million tonnes CO$_2$ capture and storage in the Illinois Basin

- Geological characterization and utilization options such as EOR
  - drilling, core, modeling
- Source suitability, options, and proximity to storage
- Transportation needs
- Business case scenarios
- Pre-Feasibility and Feasibility studies
Connection Between Coal-Fired Plants and Agriculture

Long standing relationship in Illinois
CO₂ Utilization with Algae

Synergistic with agricultural economy in Illinois
Nutrient Loss Reduction: Critical to Illinois Agriculture

Plan required to reduce nutrients (N and P) carried in rivers and to the Gulf of Mexico

Nutrient sources in Illinois contributing to riverine nutrient export from the state

Annual nitrate-nitrogen and total phosphorus loads from Illinois
SoyFACE: Evaluating Elevated CO$_2$ Levels on Crop Growth

*Free Air Concentration Enrichment (FACE) approach requires no enclosure*

FACE ring. Wind Direction and velocity are measured in the center, then a computer controls the release of gases to simulate future possible conditions.

Fumigation ring is 30 m in diameter. At the center of the ring, wind speed and direction is monitored in real time.

[http://soyface.illinois.edu/](http://soyface.illinois.edu/)
Partners connected into relevant supply chains

WORKFORCE DEVELOPMENT
Training Operators and Engineers

Partners already connected into existing supply chains
# ACKNOWLEDGEMENTS

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