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CCUS as a Regional Economic Development Tool: Planning and Design Considerations

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CCUS as a Regional Economic Development Tool: Planning and Design Considerations

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Interim Director: Illinois State Water Survey

*CO2 Summit III: Pathways to Carbon Capture, Utilization, and Storage
Deployment*

May 22-26, 2017

Grand Hotel, San Michele, Calabria, Italy



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Prairie Research Institute: Illinois-focused Resource Research and Service

Addressing societal challenges that impact Illinois and the global community



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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

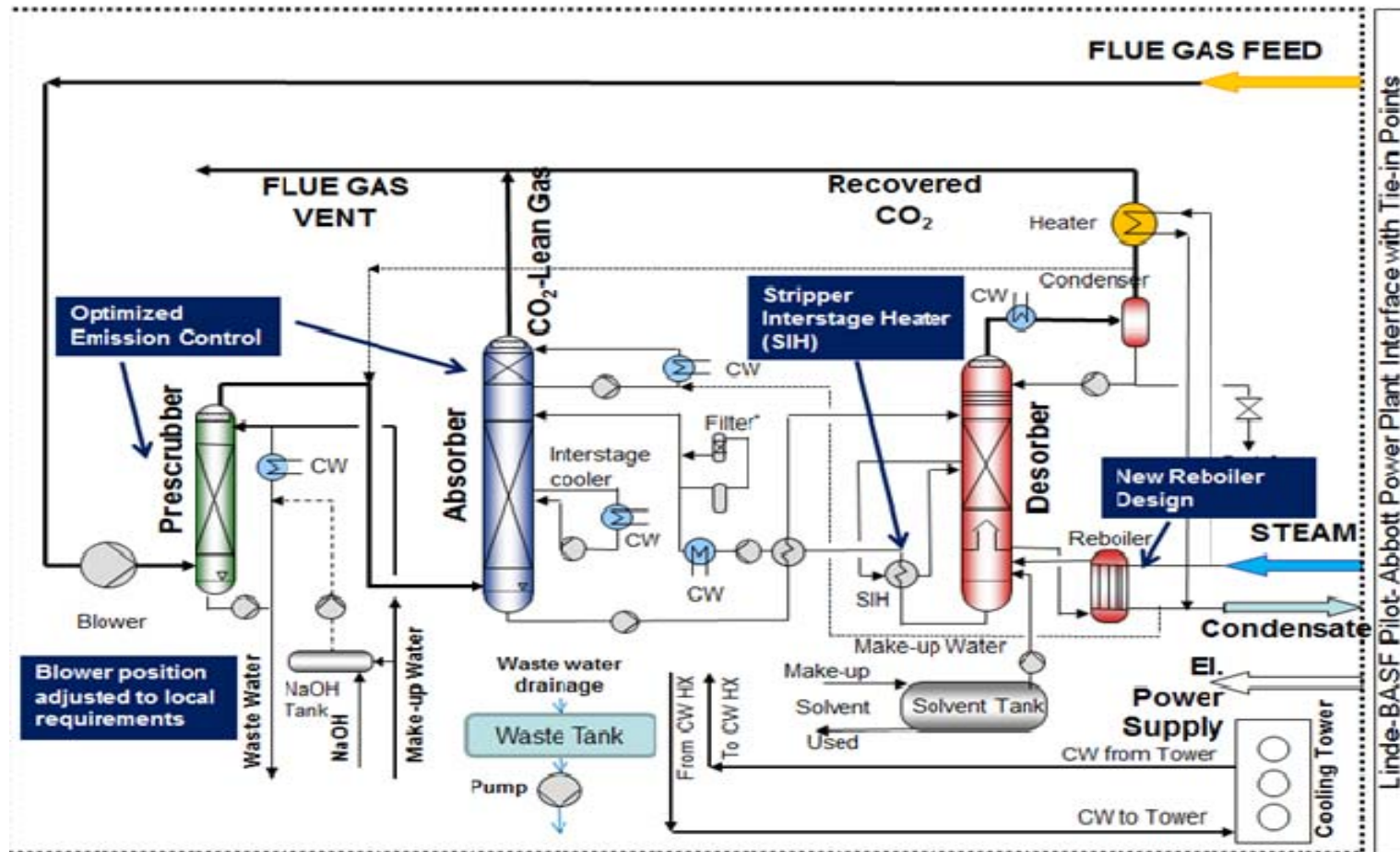
- Seven boilers total: three are coal based (Chain-grate stoker design) others natural gas
- **Coal side has completely separate treatment system from natural gas side**
- For testing will run two coal boilers
- Illinois high sulfur coal is burned
- Electrostatic precipitators and a wet Flue Gas Desulfurizer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



Major advantage that
University owns and operates
Host Site

Overview of Capture System for Large Pilot Plant

Technology features



Overview of Phase 2 Project Schedule

More than just a design, build, operate project

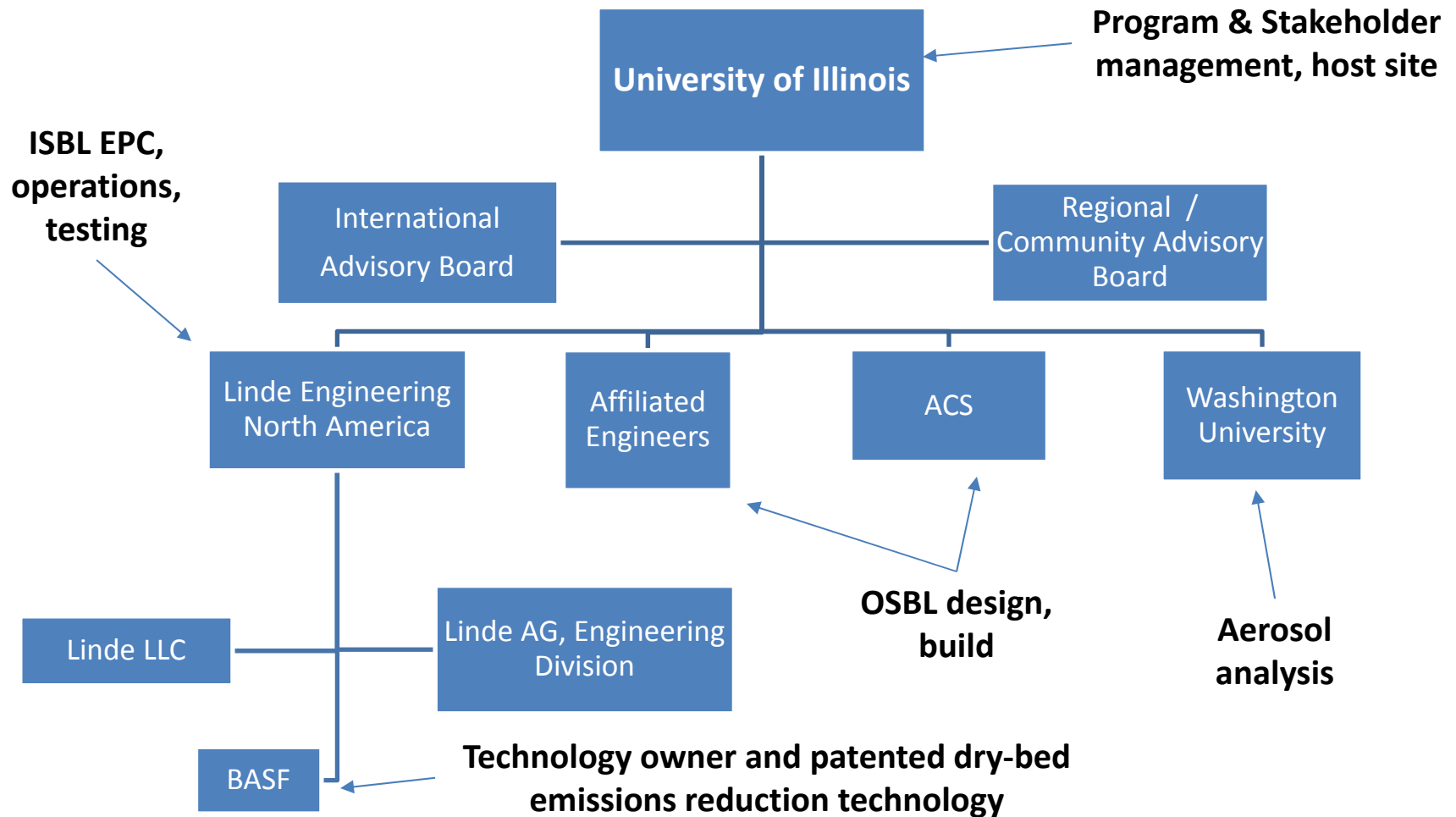


- ***Stakeholder Engagement helps educate , understand market needs, and propagate technology***
- ***Education: workforce development for existing and future operators and engineers***
- ***Demonstrating not only the technology but how to create jobs and drive regional economies***



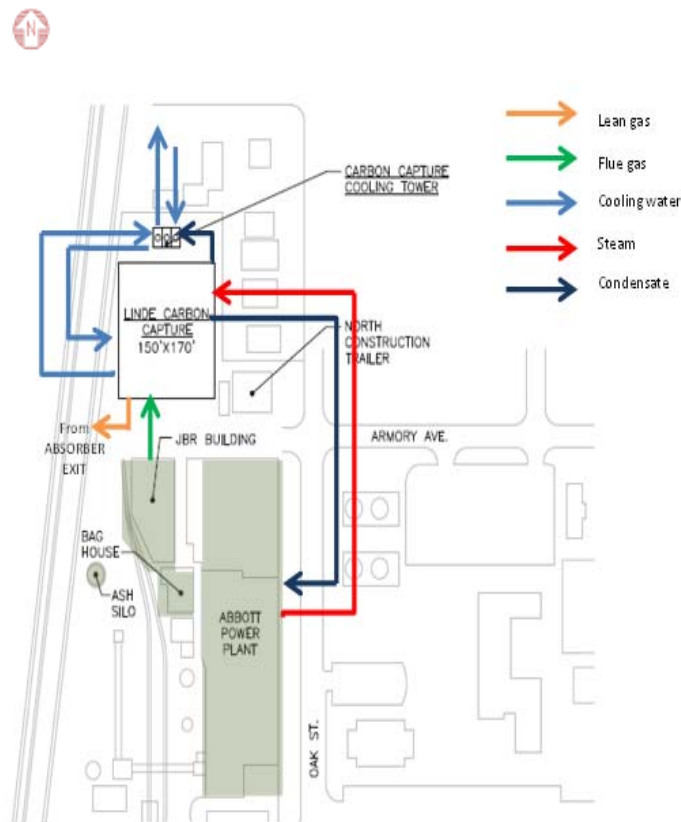
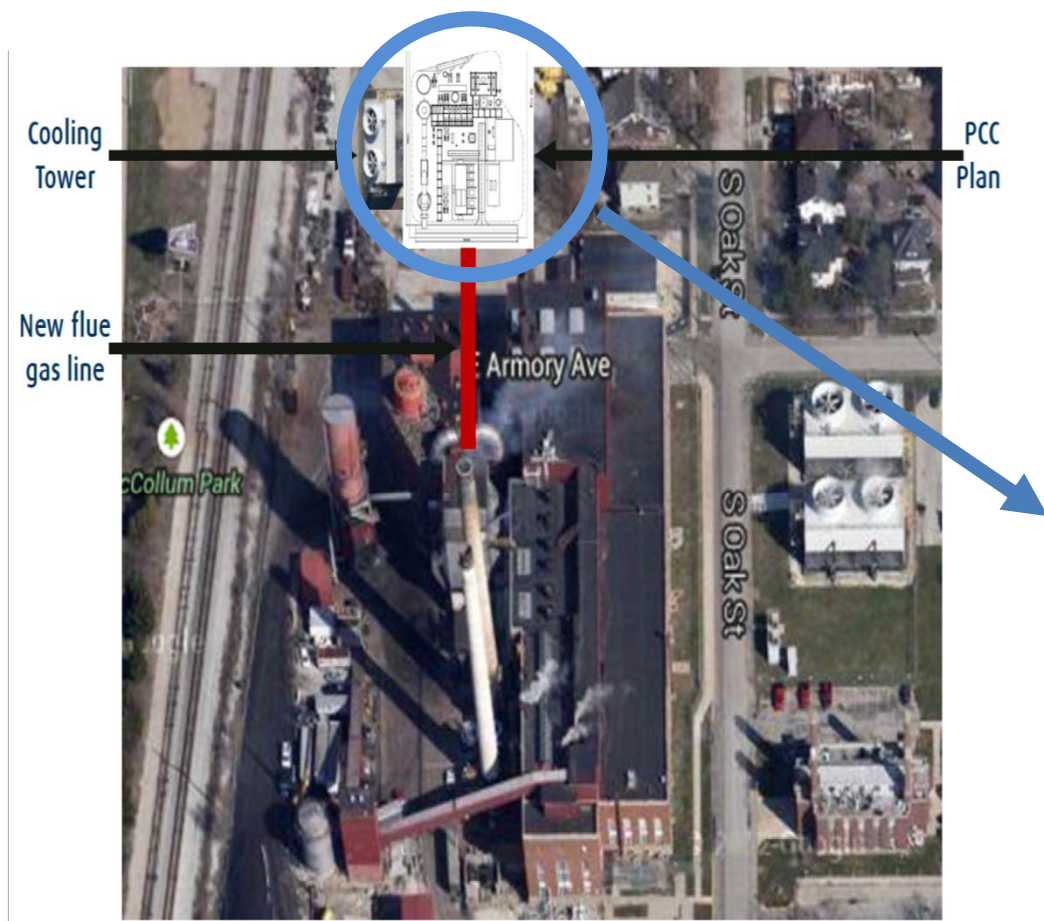
Phase 2: Project Organization Chart

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



Site for Carbon Capture Plant Established and Evaluated

Located close to Abbott Power Plant

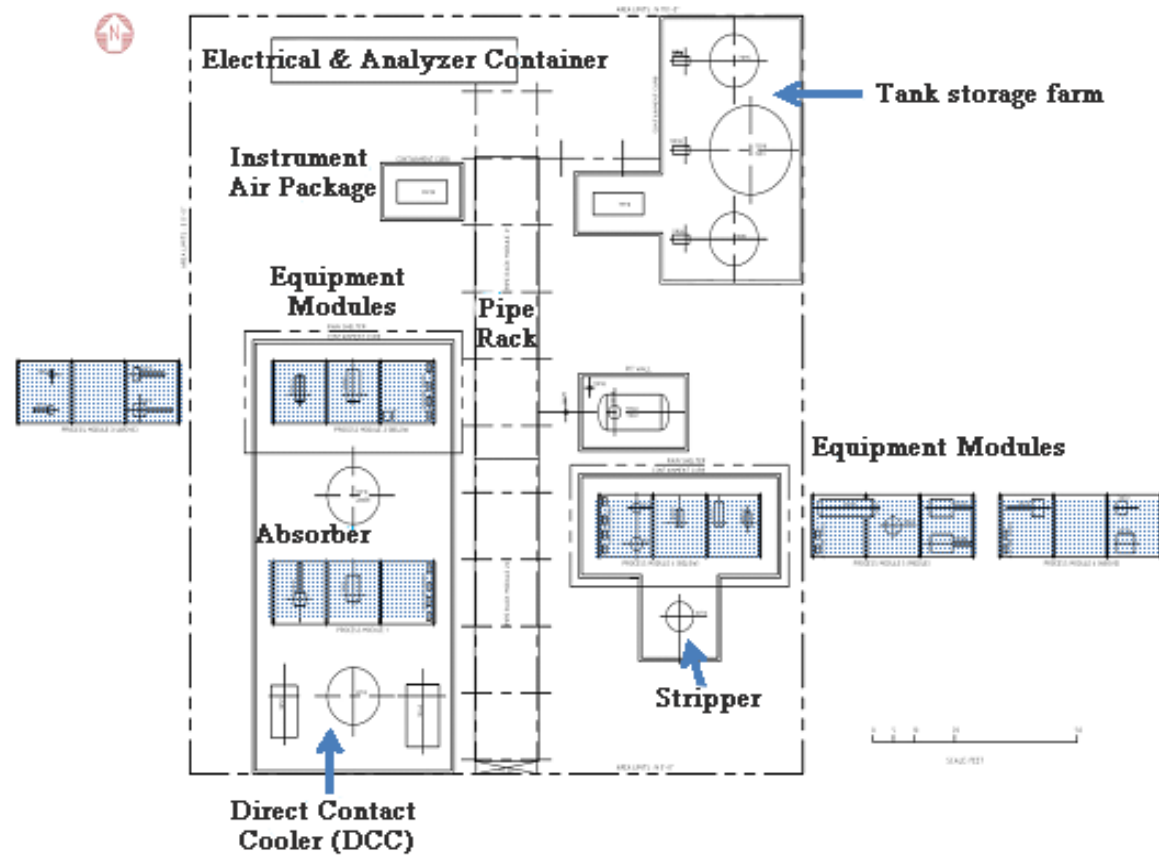


Extract flue gas POST CEMS Unit

Plot Plan for Capture Plant

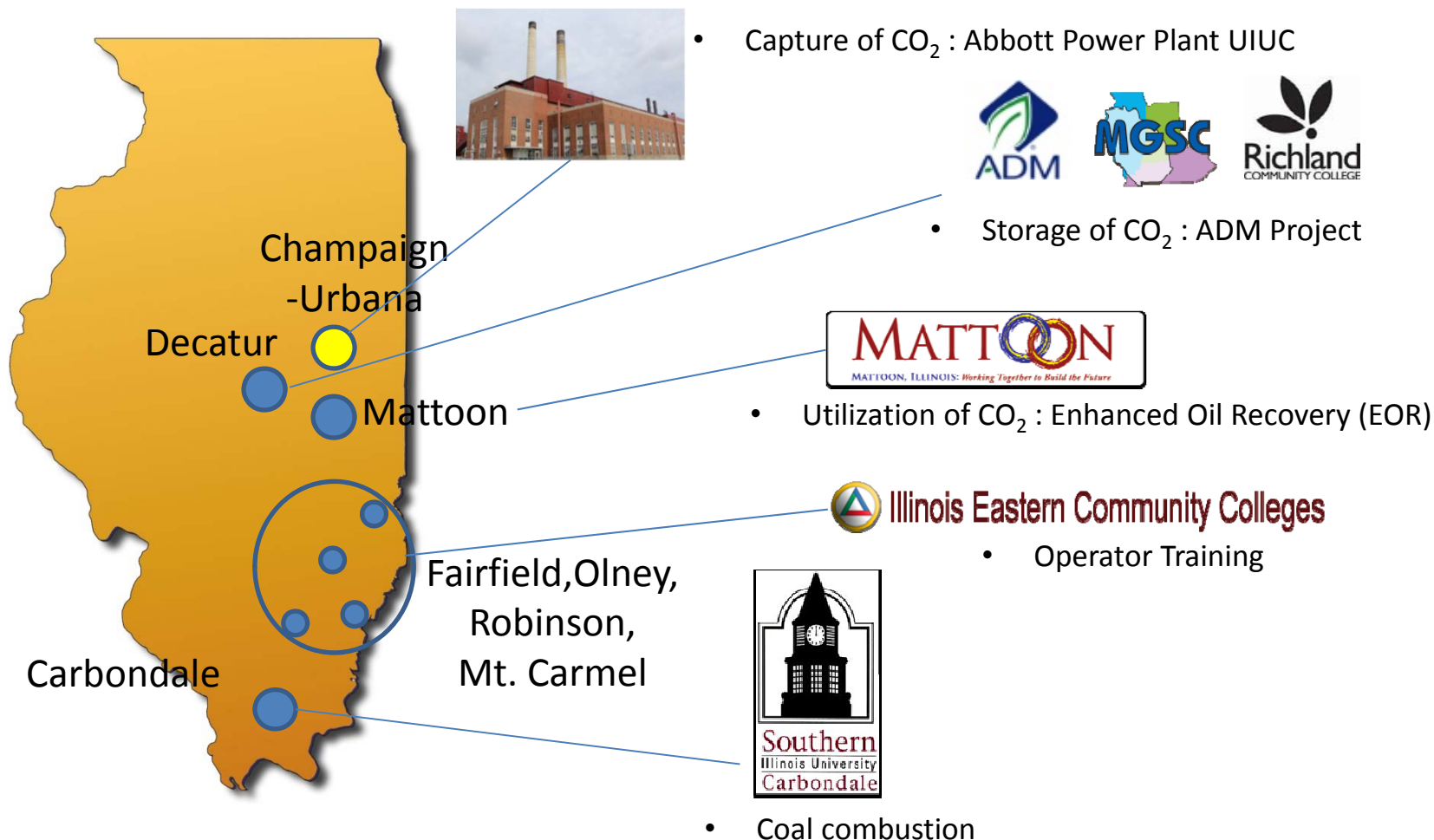
49 m x 46 m (160 ft. x 150 ft.) footprint

No modifications to existing plant combustion system (i.e. boilers) considered a major risk reduction by Abbott Power Plant



Regional & Global Test Bed for CCUS

Concentration of natural resources and intellectual capital



Important to consider regional economy

SYNERGISTIC UTILIZATION OPTIONS



Illinois Legislation Relevant to CCUS

Commitment to CCUS and potential impact on regional economic development

HR 1501

"Carbon capture, utilization, and storage (CCUS) technologies provide a key pathway to address the urgent U.S. and global need for affordable, secure, resilient, and reliable sources of clean energy"

SR 2462

"A central element of a clean energy strategy for Illinois is continued research and development of carbon reduction strategies, such as carbon dioxide (CO₂) capture, utilization, and storage through emerging technologies such as geological sequestration, mineral carbonation, and the beneficial use of captured CO₂, in order to maximize environmental benefits and economic opportunities..."

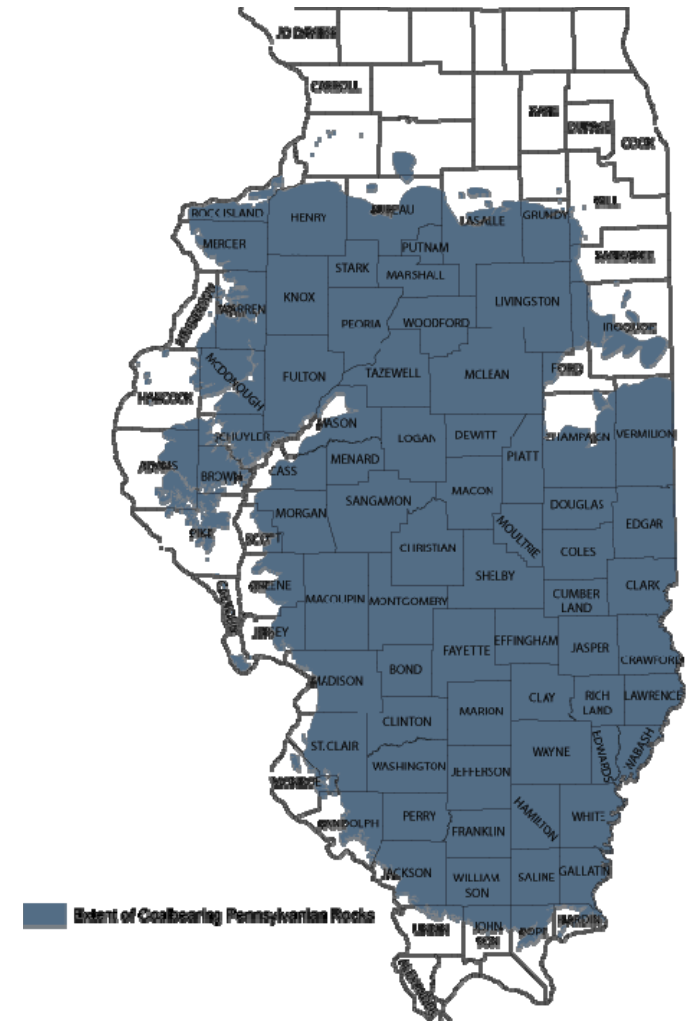
"Illinois institutions such as the Prairie Research Institute at the University of Illinois, Southern Illinois University, Illinois Eastern Community Colleges, Richland Community College, and others strive to address climate, health, education, and economic impacts, through collaborations on applied CO₂ research, practical applications, workforce development and public education.."



COAL: A SIGNIFICANT RESOURCE FOR ILLINOIS

Underlies 95,830 m² (37,000 mi²) or 68% of Illinois

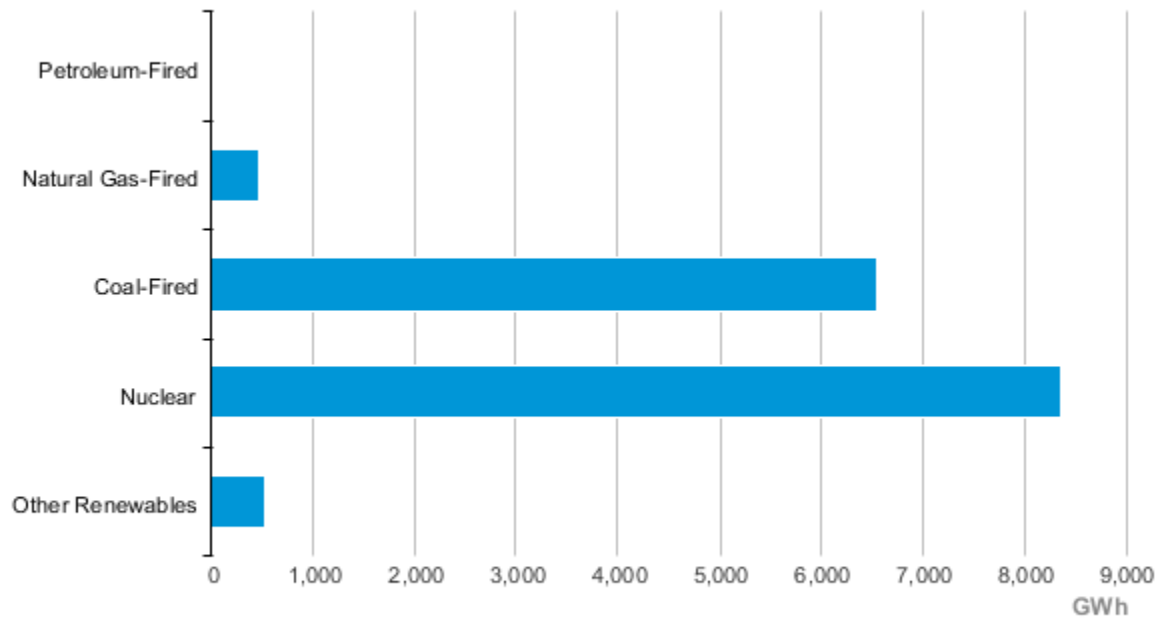
- More than 211 billion tons of identified resources are currently estimated to lie beneath the state
- Demonstrated reserve base is 112 billion tons, as defined in terms of minimum thickness and some geologic assurance of coal's presence
- Demonstrated coal reserve base is the second largest in the United States and, for bituminous coal, is the largest in the nation
- Over \$2.5 billion in annual economic activity within the State,
- Employing approximately 5,000 miners with an average annual salary of \$85,000
- Higher than both the United States and Illinois median household incomes



Illinois Energy Portfolio

Nuclear and coal are key

Illinois Net Electricity Generation by Source, Sep. 2014



 Source: Energy Information Administration, Electric Power Monthly



Other Relevant Illinois Metrics

Factors considered when evaluating CO₂ Utilization options


- Leads the Midwest in crude oil refining capacity and ranked fourth in the nation (January 2015)
- Second in the nation in recoverable coal reserves at producing mines (2013)
- Third largest producer of ethanol (production capacity of 1.5 billion gallons per year)

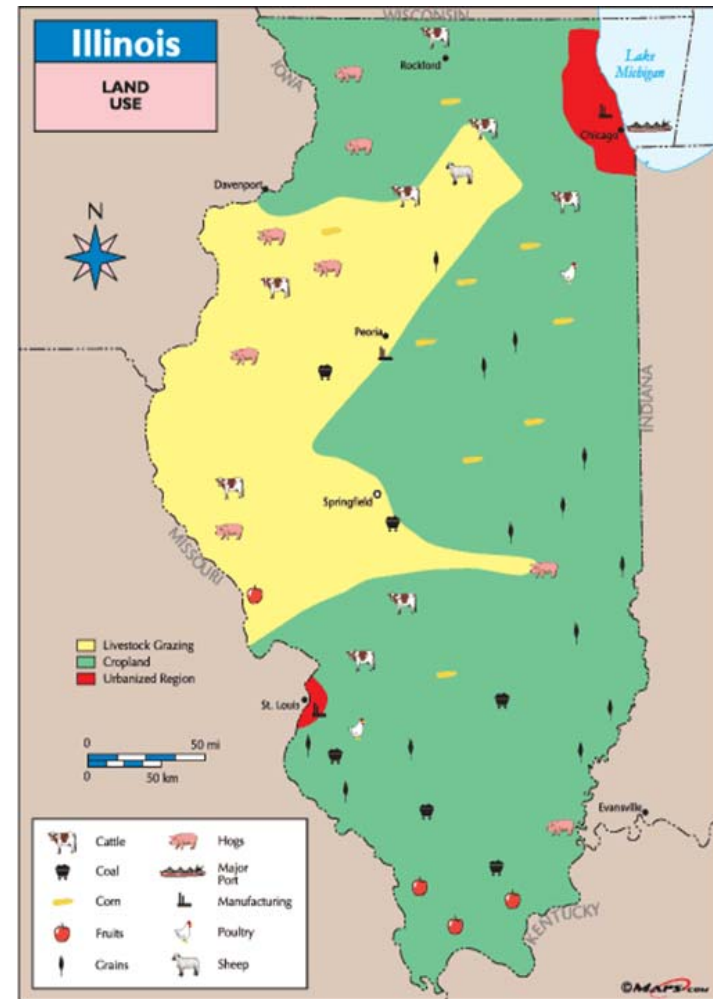
Source: <http://www.eia.gov/state/analysis.cfm?sid=IL>



Connection Between Coal-Fired Plants and Agriculture



Long standing relationship in Illinois

 Coal fired Power Plants



Coal-Fired Power Plants and Refineries / Chemicals

Focus on more urban areas

-  Coal fired Power Plants
-  Refineries



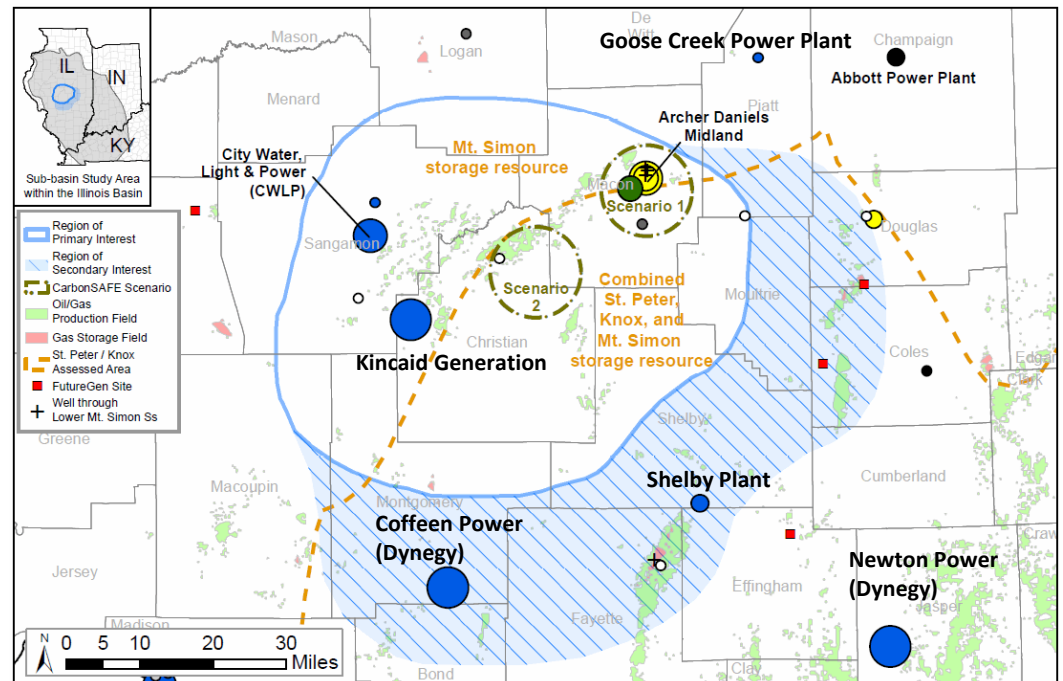
Source: <http://www.eia.gov/state/analysis.cfm?sid=IL>

CarbonSAFE ILLINOIS

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

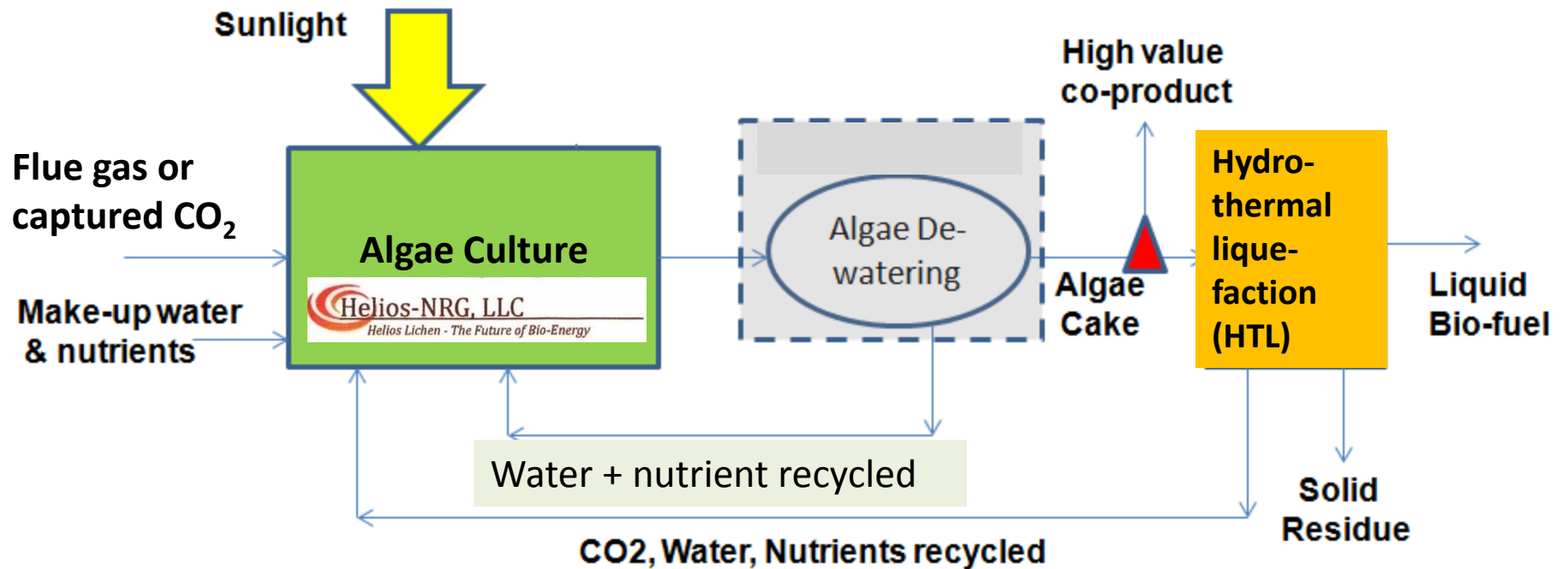
\$12M funding - Commercial-scale CCS opportunities for 50+ million tonnes CO₂ capture and storage in the Illinois Basin

- 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

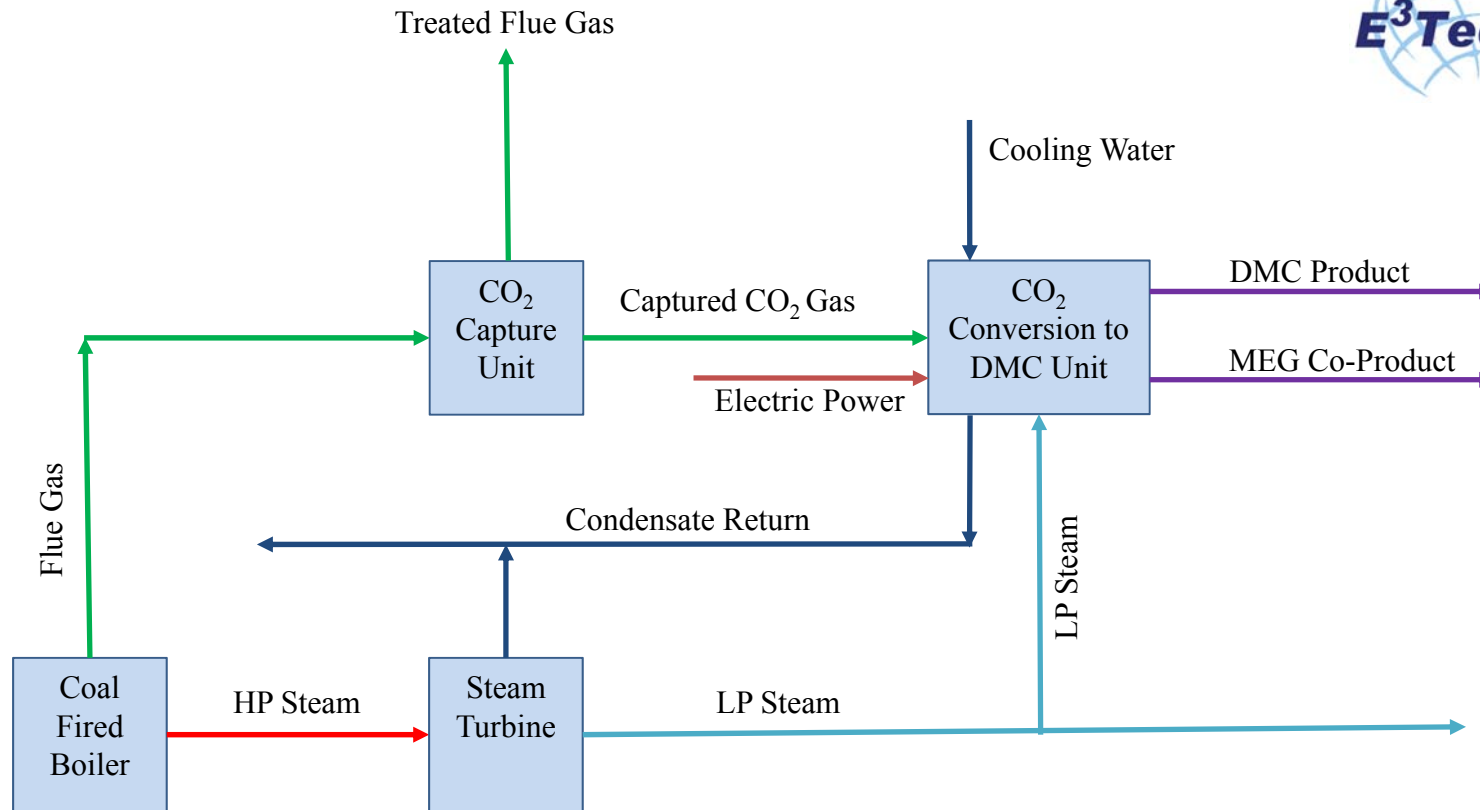


CO₂ Utilization with Algae

Synergistic with agricultural economy in Illinois



Manufacturing Di-Methyl Carbonate (DMC) with co-production of Mono Ethylene Glycol



Partners connected into relevant supply chains

WORKFORCE DEVELOPMENT



Training Operators and Engineers

Partners already connected into existing supply chains

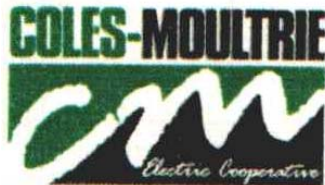


ILLINOIS EASTERN
COMMUNITY COLLEGES



Association of Illinois
Electric Cooperatives

Your "Integrate Energy" Partner 



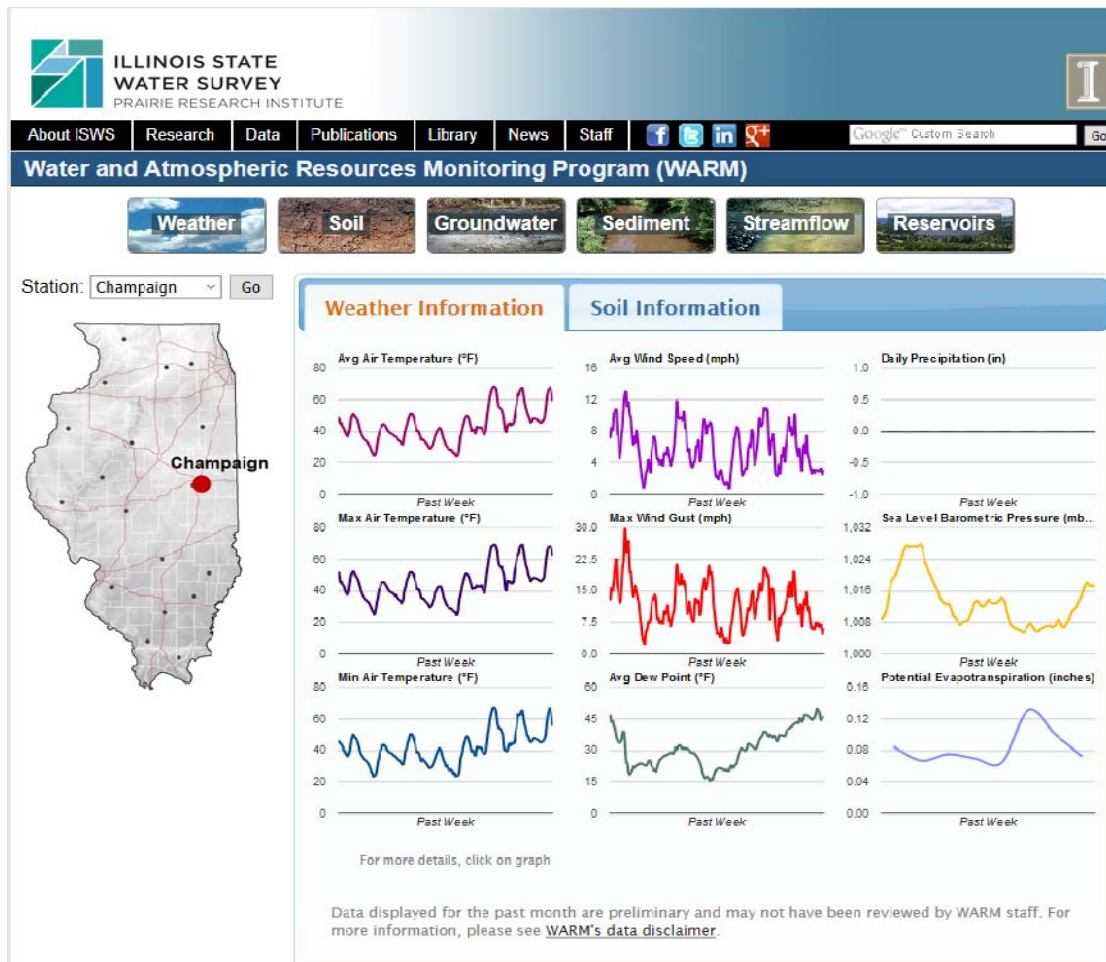
Enable connection of utilization with existing infrastructure

APPLYING EXISTING TOOLS



Weather and Atmospheric Monitoring Program (WARM)

Weather, soil, groundwater, streamflow, and reservoir data relevant for agriculture



- Data collected at 19 stations
- Five (5) minute, hourly, and daily data available
- Daily maps, weekly trends, and historical daily data at <http://www.isws.illinois.edu/warm/weather/>
- Towards a model of "dispatching" CO₂

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