Emerging Illinois Industry: Carbon Capture, Utilization, and Sequestration

✓ Decatur is home to the Illinois Industry Carbon Capture & Storage (IL-ICCS) Project and Illinois Basin-Decatur Project (IBDP).

✓ Project sponsor is U.S. Department of Energy, National Energy Technology Laboratory.

✓ Industrial-scale demonstration project.
Project Objectives

- Establish ability to collect, compress, dehydrate 3000 metric tons of CO₂ per day
- Store 1.0 M metric tons annually up to 2.5M metric tons
- Implement & validate monitoring, verification, and accounting plan
- Study effects of 2 simultaneous well sites (reservoir conditions, plume development, pressure wave interactions)
  - 1) IDBP and 2) IL-ICCS
- Demonstrate technology applied to commercial biofuels production
Illinois Industrial Carbon Capture & Storage (IL-ICCS) Project

- This is an industrial-scale demonstration project that targets to capture and store CO$_2$ at a rate of one million tons per year by 2015. The CO$_2$ will be stored 7,000 ft. below ground in the Mt. Simon Sandstone rock formation.

- One million tons of CO$_2$ is equivalent to the annual CO$_2$ emissions of more than 200,000 automobiles.
Mount Simon Sandstone and Shale Seals

Mount Simon Sandstone
• porous rock formation (10-25% pore space) at more than a mile below the surface in Decatur, IL
• 1,600 ft. thick in Decatur, IL
• liquid CO$_2$ injected into pore spaces

Shale Seals
• multiple cap rocks hundreds of ft. thick in Decatur, IL
• low porosity
• act as a cap or seal for the injected CO$_2$
Mount Simon Sandstone and Shale Seals

Mount Simon Sandstone

- Top photo shows sand grains (white structures) and pore spaces (blue structures).

Shale Seals

- Bottom photo shows no visible pore spaces.
- Red dot shows the size of a pin head.
RCC Project Role

- Construction and establishment of the National Sequestration Education Center (NSEC)
- Development of sequestration technologies higher education degree curriculum
- Acquisition and development of working laboratories with demonstration technologies
- Coordination of community outreach activities for local, regional, and global audiences
Generic CCUS Outreach Guidelines
(National Energy Technology Laboratory, U.S. Dept of Energy, 2013)

- Best Practice 1: Integrate Public Outreach with Project Management
- Best Practice 2: Establish a Strong Outreach team
- Best Practice 3: Identify Key Stakeholders
- Best Practice 4: Conduct and apply Social Characterization
- Best Practice 5: Develop an Outreach Strategy and Communication Plan
- Best Practice 6: Develop Key Messages
- Best Practice 7: Develop Outreach Materials tailored to the audiences
- Best Practice 8: Actively Oversee and Manage the Outreach Program throughout the Life of the CO2 Storage Project
- Best Practice 9: Monitor the Performance of the Outreach Program and Changes in Public Perceptions and Concerns
- Best Practice 10: Be Flexible – refine the Outreach Program as Warranted
Focus on Social Characterization

- Local Economic Conditions
- Local Empowerment
- Underlying views
- Environment
- Energy

- Trust
  - Media
  - Local Education
  - Local Traffic Conditions
  - Local Hazards
Trust......is everything.

Two considerations in getting it:

1. Psychodynamic considerations for “working team”
   - Basic Assumption Theory...Wilfred Bion
   - Focuses attention on team effectiveness as a collective function of individual team members

2. Learning and Affect of the “message”
   - Two Factor Theory......David Stagg
   - A learning and satiation factor have additive, antagonistic roles in determining the effects of repeated exposure on affect.
Advancing Sustainability

As a Total Solution.

Getting to what makes sense for College, Community, and Region.
Richland Proximity to project site facilitates CCS training and outreach.
Connecting with regional partners to let Science and Society meet solutions

Build on existing RCC academic programs

- Business & Technology
  - Agribusiness & Agriculture
  - Engineering Technology
- Continuing & Professional Education
  - Community Education
  - Professional Development & Business Training
- Mathematics and Sciences
  - Science
  - Technology
  - Engineering
  - Mathematics
Creating a series of “firsts”…..

• Higher Education Degrees in Sequestration Technology
• Real-time, live sequestration well data analysis and monitoring
• NSEC uniquely adjacent to two CCS projects.
• STELA and Green Guide Series

US Department of Energy - National Energy Technology Laboratory
Archer Daniels Midland Company
Richland Community College
CCUS Curriculum Development

AAS degree in Engineering Technology with a Sequestration Specialty

AS degree with a Sequestration Concentration (university transfer degree)

University of Illinois at Urbana-Champaign has accepted AS degree for transfer to a BS degree in Earth, Society, and Environmental Sustainability
CCUS Curriculum Development

Articulation for CCS 115 and CCS 275

CCS 115 - Introduction to Carbon Capture and Storage
CCS 275 - Advanced Sequestration Applications

CCS 115 and CCS 275 are accepted as elective courses at

Eastern Illinois University
Southern Illinois University
Illinois State University
Millikin University
University of Illinois at Urbana-Champaign
CCUS Coursework

CCS 115 - Introduction to Carbon Capture and Storage
• Global Climate Change, Carbon Cycle, CCUS Process, and U.S. DOE-sponsored CCS Projects in Decatur, IL

CCS 275 - Advanced Sequestration Applications
• Lab component: Seismic Survey, 2D and 3D Ground Penetrating Radar, and Groundwater, Soil, and Atmospheric CO₂ Sampling

BIOL 210 - Environmental Biology
• Fossil Fuels (coal, oil, natural gas), Renewable Energy (hydroelectricity, geothermal, solar, wind), and Nuclear Energy
AAS Degree in Engineering Technology

Core Courses

- CCS 115 – Introduction to Carbon Capture and Storage
- CCS 275 – Advanced Sequestration Applications
- BIOL 210 – Environmental Biology
- ENGT 101 – Motor Control Fundamentals
- ENGT 231 – Piping Fundamentals
- ENGT 234 – Pump Applications
- MATH 104 – Technical Mathematics
BS Degree in Earth, Society, and Environmental Sustainability

Core Courses

- CCS 115 – Introduction to Carbon Capture and Storage
- CCS 275 – Advanced Sequestration Applications
- BIOL 210 – Environmental Biology
- EASCI 210 – Physical Geography
- EASCI 220 – Introduction to Physical Geology
- ECON 231 – Macroeconomics
- MATH 190 – Calculus for Business and Social Science
National Sequestration Education Center
(www.nsec.richland.edu)

- Training and education center for Richland’s AAS & AS degrees in Sequestration Technology
- Focal point for community outreach activities such as workshops, conferences, and public information sessions.
The facility also includes a Visitor Center for CCUS outreach to K-12, higher education, scientists, and community members.

The NSEC Visitor Center includes the Sequestration Technology Education Learning Array (STELA), which is an interactive presentation to learn about CCUS technologies.
**Sustainability Tour Walkway**

The Sustainability Walkway is designed to provide a variety of educational experiences within a natural and aesthetic setting. As you traverse around the course, you are greeted by living displays of native prairie grasses, some in natural diversity clusters, others sprinkled out in grassland settings. A backdrop of Giant Switchgrass provides a natural wind break. A Native berm throughout the center of the walkway provides an educational display for the native plantings. Nestled among the plantings are informative exhibits on fossil and renewable energy and plots of native and improved species of grasses. Seating areas allow for visitors to take and absorb the experience. We hope you enjoy the experience.

**EDUCATION**
The walkway (300 yards long) provides multiple learning opportunities for all ages in all season plots of native & improved species of grasses, forbs (prairie wildflowers) displays, seed collection, biomass collection, photography, and vandalized wood displays.

**PLANT LIST**
Big Bluestem
Little Bluestem
Switchgrass
Indian Grass
Cord Grass
Meadowfoam
Blazing Star
Obedient Plant
Bar Balm
Prairie Coneflower
Black-eyed Susan

**DESIGN DECEMBER**
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**ADDITIONAL INFORMATION**
- Native berm throughout the center of the walkway provides an educational display for the native plantings.
- Nestled among the plantings are informative exhibits on fossil and renewable energy and plots of native and improved species of grasses.
- Seating areas allow for visitors to take and absorb the experience.

**DESIGNER**
Oklahoma State University

**SCALE**
1:130

**NATIONAL SEQUESTRATION EDUCATION CENTER**
Richland Community College

**ILLINOIS INDUSTRIAL CARBON CAPTURE & STORAGE**
Linking renewable energy with CCS and Sustainability

- With the NSEC: 4 wind turbines, 3 solar arrays, 2 biomass furnaces, 1 biodiesel production center, and 48 geothermal wells.
- NSEC built with sustainable construction practices.
- Educational and research opportunities in renewable energy.
- Adjacent to Renewable Energy Laboratory and Sustainable Walkway.
Innovation Signature (1st wind turbine on an Illinois Community College Campus)
Leveraging the Richland…..

**Agribusiness Applied Technology Park**

- Bridging education and business....and community
- Progress City USA as permanent demonstration site
- CCS bridges with stated target investments in future
  - International Business Education
  - Energy Process Technology
  - Applied Research
  - Policy
- CCS fits in with energy technologies approach to applied research in biodiesel, ethanol, biomass, solar, wind, geothermal, and nuclear
In terms of educational and business development, technical concepts associated with CCS, topics may include:

✓ Regional Geologic Characterization
✓ Future Commercial Potential
✓ Types of Carbon Sequestration
CCUS Outreach
2011 CCUS Outreach

- Illinois State Fair
- Farm Progress Show
- Camp Connections
- WAND Television
- WSOY Radio
- Additional presentations at conferences and local community events
2012 CCUS Outreach

- Illinois State Fair
- Camp Connections, ISU’s Family Science Day
- NSEC Ribbon Cutting Ceremony
- WSOY and Cromwell Radio
- Additional presentations at conferences, webinars, teachers’ workshops, career fairs, and NSEC tours
- Dalian, China CCUS Conference
2013 CCUS Outreach

- 8th Grade Career Fair
- Mobile STELA
- WICS Television
- WEZC & WSOY Radio
- NSEC Tours
- Clinton Business Expo
- Midwest Lifelong Learning Conference
- ISU’s Family Science Day
- U.S.-Canada Clean Energy Dialogue
- 12th Annual CCUS Conference
- Camp Connections
- Illinois State Fair
- Farm Progress Show
- Decatur Area College and Career Fair
- Xian, China CCUS International Conference
• Senator Durbin Visit to NSEC
• Community Environmental Council CCUS Panel
• ISU’s Family Science Day
• Richland iCon
• 8th Grade Career Fair
• Camp Connections
• SMASH Camp
• 13th Annual CCUS Conference
• 17th Annual Coal Education Conf
• Bioenergy Workshop
• WSOY & WZUS Radio
• Green Guide
• International CCUS Workshop
• USEA Technology Series Briefing
• Freiberg, Germany International Conference
Outreach Totals

- Conference presentations, teachers’ workshops, K-12, public activities, NSEC tours, etc. >50,000 attendees
- WSOY, WZUS, WEZC Radio 15,000 listeners
- WAND, WICS, WCIA Television 3,496,000 viewers
- 2011 – 2015 Total Outreach 3,560,202
Benefits

- 900 domestic jobs
- 250 local jobs
- 10 permanent jobs

- Added local economic impact estimated to be over $30,000,000 USD.
- Advancing national and global CCUS practices and policy
- Global centerpiece for CCUS research, economic, and educational value.
Acknowledgement

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“Richland’s investments in the future embrace our commitment to enabling sustainable ecological, social, and economic systems.”

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