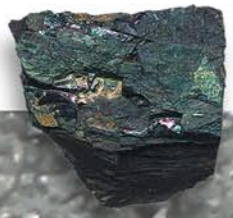
Illinois
Department of Commerce
& Economic Opportunity
Pat Quinn, Governor



Office of Coal Development

ANNUAL REPORT • FISCAL YEAR 2013

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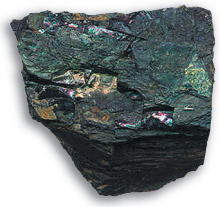

Office of Coal Development

Annual Report • Fiscal Year 2013

DCEO's Office of Coal Development is dedicated to promoting the development and use of Illinois' extensive coal resources. In FY 2013 Coal Competitiveness Program grants leveraged $7.1 for every $1 of grant dollars issued. The Coal Education Program underwent an extensive evaluation that will revitalize it and make it more integrated. Coal technology research and development projects made strides in miner safety, more efficient mining technologies, improved air emissions and advanced carbon management.

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Highlights -- Fiscal Year 2013

- **$7.1 to $1**
  - Private investment dollars leveraged by grantees for every state dollar issued through the Coal Competitiveness Program for improvements in miner safety, coal industry infrastructure and coal transportation
- **25 student winners**
  - Recognized at an award ceremony in the Governor's Mansion for the 25th Annual Art & Essay Contest
- **100 educators**
  - Gained first-hand knowledge of the Illinois coal industry during the Coal Education Conference
- **$5.1 million**
  - Dollars leveraged through 21 lab-scale coal research projects and two coal technology development projects
- **Report recommendations or findings**
  - Coal Education Program Evaluation
    - DCEO should take a phased approach to revitalize the Coal Education Program and implement the recommendations over the next 24-months
    - The Coal Education Conference, coal curriculum, and Art & Essay Contest should be integrated to create a coherent program and maximize impact.
  - Realizing Illinois Coal Export Potential
    - Enhance competiveness
    - Support marketing efforts
    - Expand global awareness
  - Economic Impacts of FutureGen 2.0 to Illinois and Local Economies, 2012-2037
    - In Morgan County, FutureGen 2.0 would generate $7.3 billion in business volume, $318.69 million in wages and salaries and 1.52 jobs elsewhere in the county
    - In the regional area (including Morgan, Cass, Scott, Sangamon, Macoupin and Greene Counties) FutureGen 2.0 would generate $8.78 billion in business volume, $435.71 million in wages and salaries and 1.67 jobs elsewhere
    - In Illinois, FutureGen 2.0 would generate $11.90 billion in business volume, $655.09 million in wages and salaries and 2.59 jobs elsewhere in the state
- **109,000 feet**
  - The amount of 48-inch fire retardant conveyor belt installed at Lively Grove Mine in a Demonstration Program project this year.

Annual Report

The Coal Competitiveness Program

The Coal Competitiveness Program encourages businesses to improve coal miner safety and expand the coal extraction, preparation and transportation systems within Illinois. The program is aimed at improving the efficiency of the Illinois coal industry, enhancing the competitive position of Illinois coal in domestic and international markets and opening new markets for Illinois coal and coal byproducts.

In Fiscal Year 2013, DCEO awarded 14 Coal Competitiveness Program grants for a total of $5.9 million. The projects leveraged $41.7 million in private investment in the coal industry within Illinois. Notable projects include:

- Site work, boreholes and ventilation shafts to allow access to new coal reserves
- Purchase of state-of-the-art mine rescue apparatus, carbon monoxide monitoring, fire-fighting equipment and miner tracking equipment for on-site rescue teams and miner safety
- Purchase of additional surface mining equipment that will increase coal production
- Construction of a compacted clay-lined refuse impoundment, seeding, pumps and wetland mitigation to protect the environment from run-off at the mine site
- Retrofitting existing miner rescue chambers with new fittings as required by federal regulations
- Purchase of a new, larger tug, extending the truck staging area and making road enhancements at a river loading terminal to improve throughput and efficiency while positioning the facility to accommodate coal targeted for international markets
- Purchase and installation of proximity detection equipment for underground mining and hauling machines to improve miner safety
- Adding office to expand an existing coal equipment manufacturing plant
- Purchase and installation of dry screening equipment, and storage silo for the separation of bed ash combustion byproduct for manufacturing of concrete
- Purchase of underground mining equipment for a new mine and to improve efficiencies

DCEO also awarded an interagency agreement of $3.7 million to the Illinois Department of Natural Resources Office of Mines & Minerals. The funds will be used for personnel and contractual services, safety and lab equipment and electronic data processing equipment needed to implement miner safety and training within the state.

Reports

The Coal Education Program Evaluation

All facets of the Coal Education Program produced and conducted by the Department of Commerce & Economic Opportunity's Office of Coal Development underwent a detailed, independent, multi-disciplinary analysis by the Illinois Science, Technology, Engineering, and Mathematics Education Initiative (I-STEM) and the Advanced Energy Technology Initiative (AETI) (University of Illinois at Urbana-Champaign) in fiscal year 2013. The analysis by I-STEM and AETI consisted of reviewing materials, consulting experts in various fields and seeking the input from a broad base of stakeholders.

I-STEM and AETI overall recommendations:

- DCEO should take a phased approach to revitalize the Coal Education Program and implement these recommendations over the next 24 months.
- The Coal Education Conference, Coal Curriculum, and Art & Essay Contest should be integrated to create a coherent program and maximize impact.
- The Coal Conference should continue in a stream-lined format that emphasizes the mine tours and applications to the classroom.
- The current Coal Curriculum should be retired and new or existing curriculum should be utilized. This curriculum should provide high-quality scientific content, a balance of perspectives and present coal as part of an energy portfolio in national and global contexts.
- The Art & Essay Contest should continue with several enhancements. The Contest should engage more teachers and students from different regions of the state. Suggested topics should be aligned with educational learning standards and reflect a balance of perspectives on coal and its impacts.
- DCEO should utilize existing resources that provide high-quality scientific content and a balance of perspectives.

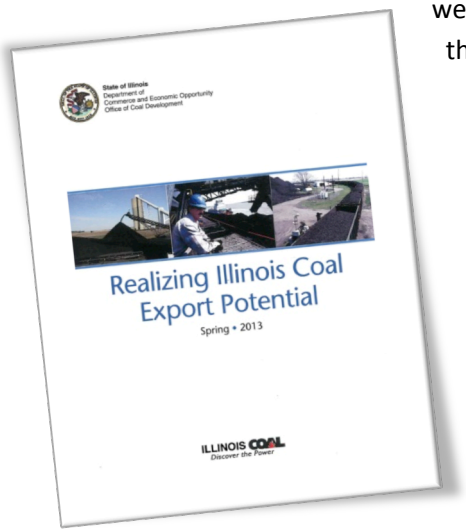
The Office of Coal Development (OCD) has adopted the recommendations from the review team and has begun a 24-month, phased approach to revitalize the Coal Education Program. OCD will enlist professionals with science and curriculum backgrounds to direct the process. The old curriculum has been retired. OCD staff is looking forward to revitalizing the Coal Education Program while enhancing the experience for the learner and encouraging the critical thinking that is required when making choices in energy fuels for our technologically-dependent lives.

DCEO should take a phased approach to revitalize the Coal Education Program and implement these recommendations over the next 24 months.

■ *I-Stem and AETI Coal Program Evaluation*

Realizing Illinois Coal Export Potential

Illinois, which has the largest reserves of bituminous steam coal in the U.S., has the capability to produce significant quantities of coal in excess of domestic demand. This coal is well-suited to the large and growing global coal market due to its low cost structure, access to the U.S. Gulf for vessel loading, and the worldwide increased use of advanced technologies that reduce emissions from coal combustion.



In order to sustain and grow exports of Illinois coal, OCD engaged Energy Ventures Analysis, Inc. to review what activities DCEO could pursue to support this goal. The recommendations fell into three categories:

- Enhancing the competitiveness of Illinois coal exports
- Supporting smaller producers in their marketing efforts, and
- Expanding global awareness of Illinois coal.

The competitiveness of Illinois coal is enhanced by the ability of producers to efficiently transport Illinois coal to markets throughout the world.

Three potential cost-cutting areas were identified during the study:

- Loading efficiency through improved rail or truck-barge loading terminals in Illinois
- Maintaining navigation on the lower and upper Mississippi River during drought and flood conditions
- Support the Dredging for Restoration and Economic Development for Global Exports Act of 2012 (DREDGE Act) to operate and maintain a navigational channel of 50-foot depth from Baton Rouge, LA to the Gulf.

Two areas of marketing support for small producers were noted:

- Develop counter-party guidelines to assist small producers
- Identify known and reputable traders of Illinois coal

State of Illinois overseas trade representatives, working for the DCEO International Trade Office can perform an important function in expanding global awareness of Illinois coal.

Also recommended was a well-thought-out plan for a series of high-level coal trade missions in 2013-2015, held in conjunction with industry market-development meetings. These efforts could be timely in:

- raising the profile of the Illinois coal industry
- finding emerging overseas markets
- assessing enhanced opportunities with installation of new emissions control technologies at overseas power plants, and
- accessing market improvements with the expansion of the Panama Canal in 2015.

Economic Impacts of FutureGen 2.0 on Illinois and Local Economies

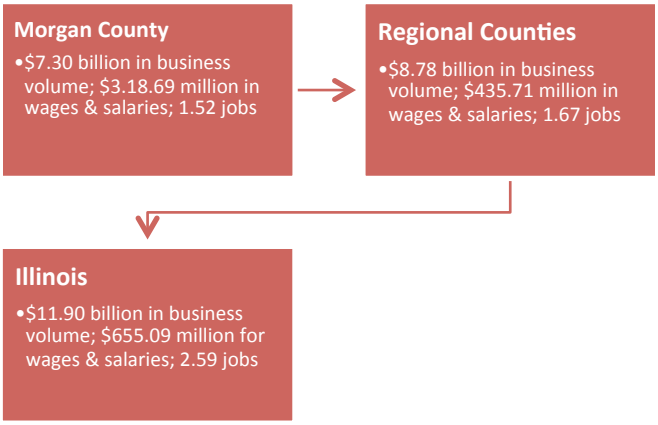
FutureGen 2.0 is the world's first large-scale, integrated test of oxy-combustion advanced clean coal technology with carbon dioxide capture and storage. The project includes retrofitting a 200-MW boiler located at the Meredosia Energy Center in western Morgan County, Illinois, building a 30-mile dedicated under-ground carbon dioxide pipeline and 4,000 acre injection site and constructing a visitor, research and training facility.

Phase I of the project has been completed. Phase II has been conditionally approved by the U.S. Department of Energy. Phase III is anticipated to begin in mid-2014, with Phase IV commencing in 2017.

The Regional Economics Applications Laboratory (REAL) at the University of Illinois at Urbana-Champaign analyzed the economic impacts of $1.2 billion FutureGen 2.0 project on three economies: all of Illinois, grouped counties surrounding Morgan County and Morgan County itself.

Based on the data provided by the FutureGen Alliance on capital expenditures, the initial impacts for each geographical region and each project component are estimated. The estimates were then entered into an economic model of the appropriate region to generate the direct and indirect impacts of the expenditures on employment, income, production and state and local taxes.

From 2012 to 2037 the total expenditures of FutureGen 2.0 will generate approximately $7.30 billion of business volume in the economy of Morgan County. Wages and salaries will account for approximately $318.69 million. It is estimated that each dollar invested in FutureGen 2.0 will generate an additional $1.42 worth of activity and each job in FutureGen 2.0 would generate another 1.52 jobs elsewhere in Morgan County.



It is estimated that FutureGen 2.0 will generate approximately $8.78 billion of business volume into the regional economy of Morgan, Cass, Scott, Sangamon, Macoupin and Greene Counties. Wages and salaries will account for approximately $435.71 million. Each dollar invested in FutureGen 2.0 will generate and additional $1.50 worth of activity and another 1.67 jobs elsewhere in the grouped counties.

From 2012 to 2037 in which the total expenditures from FutureGen 2.0 project are estimated to be $5.87 billion, approximately $11.90 billion of business volume will be generated in Illinois' economy. Of this $655.09 million is for wages and salaries. This implies that each dollar invested in FutureGen 2.0 would generate an additional $2.03 worth of activity distributed through the Illinois economy and each job in FutureGen 2.0 would generate another 2.59 jobs elsewhere in Illinois.

Coal Education Program

The Coal Education Program aims to educate teachers, students and the wider public about coal, the coal industry and issues surrounding the use of coal. With much debate concerning climate shifts and greenhouse gases, rising energy prices, proposed emission regulations, stability of the electric grid and clean energy targets it is challenging to sort truth from fiction.

The coal office strives to provide an unbiased voice, presenting the facts on coal production, mine employment, coal-fueled electricity prices, current research and development of emission-reduction technologies, baseload electric generation from coal, coal mining history and the importance of mining to the economies of small, rural communities.

The 25th Annual Art & Essay Contest

This year the Office of Coal Development celebrated the 25th Annual Art & Essay Contest. The contest is open to all Illinois fifth- through eighth-grade students and provides the students the opportunity to learn about coal, one of Illinois' natural resources.

The visual and written entries demonstrate the students' understanding of how coal is formed, mined or transported, as well as its impact on daily life.

In recognition of the 25th year of the Coal Calendar Art and Essay Contest, the Illinois Clean Coal Institute (ICCI) and the Illinois Coal Association (ICA) presented laptops and projectors to Pleasant Valley School in Peoria and New Simpson Hill School in Tunnel Hill for having the most participants and the highest percentage of participants in the contest. The ICCI also presented monetary awards to Galatia Elementary School in Galatia and Century Junior High School in Orland Park for their students' first-place rankings.

2014 Calendar Contest Poster Winners

The ICA awarded each of the first-place winners $100, and the other 12 poster winners and 11 essay winners $50 each. Winning students also received complimentary copies of the 2014 Illinois Coal Calendar in which their artwork/essays are displayed. Approximately 1,700 students, representing schools from throughout Illinois, participated in this year's contest, submitting either an essay or a poster.

2014 Calendar Contest Essay Winners

1st Place Essay 2014 Calendar

Illinois History: A Journey Fueled by Coal

Did you know the first recorded discovery of coal in North America was in Illinois in 1673? That is when two French explorers, Marquette and Joliet first saw coal along the banks of the Illinois River. It was over 100 years later that the first underground coal mining began in 1810 in Southern Illinois. The new coal mining industry spread easily along shipping routes like St. Louis and Chicago, but it was in the later 1800s when Illinois railroads grew quickly that coal mining in Southern Illinois developed into a major industry.

Coal mining was a booming business, and towns grew quickly around coal mining areas. My community of Harco in Southern Illinois was founded because of the discovery of coal in the area. The Harrisburg Colliery Coal Company Mine was sunk in November 1916, and the town of Harco soon grew up around it. The Harco name came from the first three letters of Harrisburg and the first two letters of Colliery, spelling "Harco". Later this mine was also known as Peabody no. 47. Miners and their families moved to coal mining areas such as Harco and lived in tents just so they could work.

Coal mining was a dangerous job, even more so in older days, and Southern Illinois had its share of disasters. It is listed that 134 men lost their lives in accidents at the Harco mines, Peabody no. 47, and west of Harco, Peabody no. 40. There were eleven killed in an explosion on August 31, 1921 and eight killed in an explosion December 28, 1941. The Harco mine was closed April 25, 1951, but the coal washer continued to process coal until 1954. The mine was then dismantled. When the Harco mine closed, families living in the company houses were given evacuation notices. People had to move out of the Harco area and on to other areas to find work.

There continues to be many work opportunities for coal miners today. With over thirty-seven thousand square miles of coal under our state, coal has been mined in seventy-three counties of Illinois. More than 4,500 coal mines have operated since commercial mining first began in Illinois. Even though fewer than twenty-five mines are currently active, there were five new mines under development in 2012 compared to three in 2010. According to Federal Energy Information Administration numbers, Illinois had slightly more than 46 million tons of coal mined in 2012. That compares to 36.5 million tons a year earlier and slightly more than 33 million tons in 2010.

There is ongoing work to help secure the future of coal in Illinois, such as the FutureGen Industrial Alliance, formed to partner with the U.S. Department of Energy on the FutureGen 2.0 project. This project involves the construction of a near zero-emissions coal-fueled power plant to produce hydrogen and electricity, and also to reduce carbon emissions from existing coal-fired power plants. This groundbreaking project will help pave the way for other cleaner and more sustainable advanced coal-burning power plants. Coal continues to be the most valuable resource in Illinois. I hope our journey into the future continues to be fueled by coal.

By Mason Ratliff, 5th Grade
Galatia Elementary School

Joe Hirschi of the Illinois Clean Coal Institute explains modern-day ventilation systems in underground coal mines to a group of conference participants.

The Coal Education Conference

The Coal Education Conference is held each summer in Southern Illinois in proximity to both surface and underground coal mines. Each year approximately 100 people attend the conference.

The conference is designed with two goals in mind: first, to provide participants with background information that will enhance their understanding of the Illinois coal industry, and secondly, to give educators the first-hand knowledge and resources needed when teaching about Illinois' most abundant fuel resource, coal. All educational resources are aligned with the Illinois Learning Standards, Common Core and the Next Generation Science Standards and encourage exploration and critical thinking.

Conference presenters come from the Illinois Department of Natural Resources Office of Mines and Minerals, the Illinois Clean Coal Institute, the Illinois State Geological Survey, and the Rend Lake College Mining Training Center. Experts in their field, the presenters provide detailed information on the formation and geology of coal, the underground and surface coal mining process, reclamation, permitting and regulation of mines, miner safety, clean coal technologies, generating electricity, and the economics and environmental impacts of coal.

Conference participants tour a working surface coal mine, travel underground to watch the mining process in an underground coal mine and visit a power plant equipped with clean coal technologies to reduce emissions from Illinois coal. This first-hand experience provides an understanding of the coal extraction process and electricity generation. During the drive to the various stops, geologists on board the buses point out rolling hills, farm fields, and recreational lakes where coal has been mined and the land reclaimed. Along the way participants ask questions of the hosts and further their understanding of the mining process.

Sizing-up a Caterpillar 2-78 during the surface coal mine tour gives participants a feel for the immensity of the equipment used in mining.

On the last day of the conference, group leaders present hands-on, coal-related lessons and activities they have used with their own classes and facilitate the discussion of additional ways to bring what they have learned about coal into the classroom.

The Office of Coal Development is an approved authorized provider of professional development through the Illinois State Board of Education. Conference participants earn Continuing Professional Development Units for attending the sessions at the conference.

The teachers' evaluation at the end of the conference show they value the field trips to the mines and the information about advances in safety, technology and career opportunities related with coal mining. Conference participants provided comments such as:

"Talking with professionals in the field and seeing the actual mine, I learned so much. This was one of the best conferences I have been to that included real-life applications."

"Tie-in with the Illinois Learning Standards was the best I've seen from any of the scores of workshops I've attended!"

"Underground! Fascinating."

"The hands on activities were fantastic. I so appreciate all the ideas. Wow! We are excited! We think we are going to suggest a Coal Expedition (Science & Math Night) for our whole school!"

Wendy Anderson took the information she learned from her experience at the conference and added a large chunk of coal to her Paleozoic classroom. She taught her students how coal was formed millions of years ago from plants buried in the swamp. The sun's energy was captured in the plants and can now be changed into heat energy to make steam to generate electricity that powers their computers and appliances at home.

Teachers value the field trips to the mines and the information about advances in safety, technology and career opportunities related with coal mining.

-DCEO Program Evaluation

The Coal Research & Development Program

In FY2013 OCD issued $1.8 million in funding to coal technology research and development projects. Twenty-one lab-scale research projects were funded along with two development-scale projects. In all $5.1 million in private investment was leveraged. A few of the noteworthy projects are described below.

Dust Control Strategies for the Continuous Miner in Underground Coal Mines

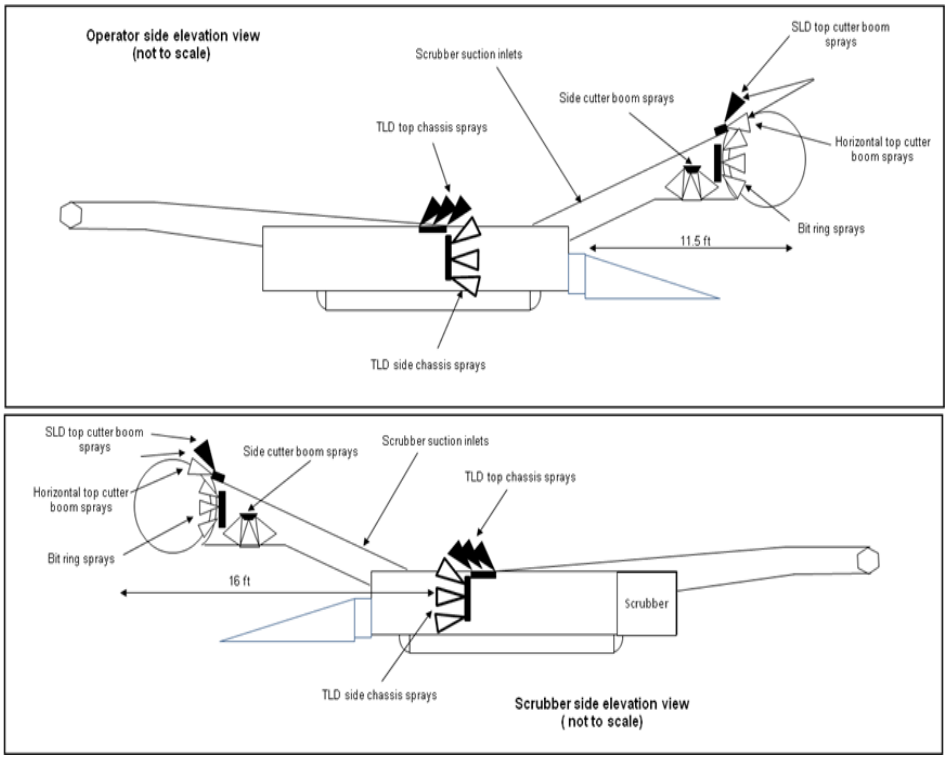
In the area of improving coal miner safety and health, the Illinois Clean Coal Institute (ICCI) provided $149,644 for a cooperative field demonstration of dust control strategies for continuous miner sections. The project was developed by a research team from the Department of Mining and Mineral Resources Engineering at Southern Illinois University Carbondale (SIUC).

A spray system developed by the team has produced successful results in various field and laboratory trials, leading officials with the US Mine Health and Safety Administration (MSHA) to recommend the technology to multiple mine operators in the Illinois Basin.

For this project, the SIUC research team developed and provided a dust control training program, assisted with implementation of engineered dust control strategies at the host mine, and evaluated the performance of the SIUC spray system on continuous miners developing longwall gate entries with higher than normal dimensions.

SIUC researchers believe the suppression and control of fine dust particles generated by a continuous miner can be improved with scientifically designed spray systems. These include better location and orientation of water sprays, creation of hydraulic curtains to improve dust capture and minimization of dust rollback on the operator, and better wetting of airborne dust.

By carefully designing spray locations and orientation, more effective control is achieved using minimal water volume and pressure.



SIUC's innovative spray system design for continuous miners reduces coal dust in the underground environment and improves air quality.

Automated Control System for Coal Spirals

In the area of coal preparation technology, the ICCI awarded $164,993 to Southern Illinois University Carbondale to demonstrate the automated control system developed for coal spirals. Coal spirals are the most common technology used in coal preparation plants to clean fine coal in the 1 x 0.15 mm size range.

Coal spirals are capable of providing excellent clean coal recovery at reasonably low ash content. However, the splitter arrangement that determines the spiral's performance is manually controlled and its position is rarely adjusted despite the fact that feed quality and solids content are constantly changing in a typical preparation plant environment.

The goal of this project is to demonstrate the functionality of a proprietary automation system for a coal spiral developed with previous ICCI funding in a real-life plant environment. The automation system will be able to adjust the splitter position automatically as feed characteristics fluctuate and maintain a desired density cut point at all times.

Compound Coal Spiral Used to Test Automated Control System

Successful implementation of an automated system will maximize the overall plant yield for fine coal, reduce waste and increase product quality.

Hot Carbonate Absorption Process for Post-Combustions Capture of Carbon Dioxide

In the area of carbon management, ICCI contributed $200,000 in cost-sharing support to the Energy and Environmental Engineering Section of the Illinois State Geological Survey at the University of Illinois at Champaign/ Urbana for bench-scale development of a hot carbonate absorption process (Hot-CAP) for post-combustion capture of carbon dioxide (CO_2).

The 3-year project leveraged $1.3 million from the US Department of Energy (DOE) to explore a less expensive and more efficient alternative to mono-ethanol-amine (MEA) for carbon capture.

Project objectives include process engineering and scale-up data to advance the technology to the pilot-scale level. Lab and bench-scale experiments will provide thermodynamics and reaction engineering data for evaluating technical feasibility, performance and scale up, as well as, commercial competitiveness of the Hot-CAP as a viable post-combustion CO_2 capture technology.

Results from experimental studies will be used to create a process flow diagram, perform equipment and process simulations, and conduct a techno-economic analysis study for a

conceptual 500 MWe high-sulfur coal-fired power plant retrofitted with the Hot-CAP. Results from experimental and process simulations studies will be used to identify optimal process conditions of the Hot-CAP to meet or exceed DOE-prescribed goals of greater than 90% CO_2 removal with a limited increase of 35% in the cost of electricity.

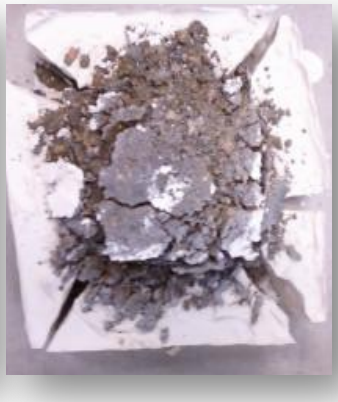
Paste Backfilling of Mine Waste in Room and Pillar Mining Sections

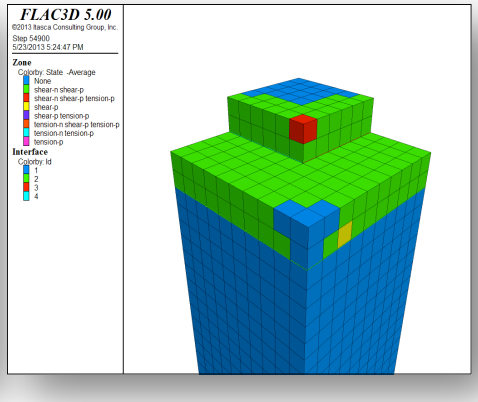
In the area of Coal Mining Technology, ICCI awarded $99,903 to the Department of Mining and Mineral Resources Engineering at Southern Illinois University Carbondale (SIUC) to investigate the conceptual design and financial implications of using paste backfilling of mine waste in room-and-pillar mining sections.

Backfilling of coal plant waste in coal mines may become the most viable disposal method if and when new legislation is finalized by the US Environmental Protection Agency (EPA) possibly driving up surface disposal costs.

Earlier research showed that backfill with the desired properties could be placed underground; however, the cost was considerably more than current surface disposal costs. That research did not take into account one of the potential benefits of backfilling – the possibility that backfill could provide pillar support and increase extraction. Backfilling may also eliminate any possibility of future subsidence.

This research will consider the potential for increased extraction and the financial benefit that would result. The research will be a combination of numerical modeling based on input parameters determined from site evaluations and physical modeling to identify the qualitative support benefits of paste backfill. Cost analyses will also be conducted to compare conventional mining without backfill to mining with paste backfill in terms of both technical feasibility and productivity enhancement.





Above Left: Physical Modeling Set-up for Low Confinement Test for Paste Backfilling;
Above Middle: Typical Failure Mode during Physical Testing for Paste Backfilling;
Above Right: Example of Computer Modeling Results for Paste Backfilling

Oxidative Hydrothermal Dissolution for Converting Coal to Chemicals

In the area of coal chemistry and syngas reactions, ICCI funds were allocated to a Southern Illinois University Carbondale (SIUC) spin-off company, Thermaquatica Inc. In continuing a development project from 2011, funds are being used to advance the commercialization objective of Oxidative Hydrothermal Dissolution (OHD), a novel coal conversion technology.

This processing technology is an entirely novel approach to convert coal directly into chemicals using only water and oxygen. The process does not go through the usual gasification (syngas) route or use expensive or proprietary catalysts.

Southern Illinois University Carbondale (SIUC) has filed for intellectual property protection of OHD technology. Thermaquatica now holds the exclusive license to the OHD technology.

The current project is developing full engineering designs and specifications for a 5-10 lb/hour, fully continuous Process Design Unit that will allow energy balances and economics to be better refined, and to construct and operate the pilot plant to produce OHD chemicals at a scale necessary for evaluation and testing by potential end users and possible investors in the company.

In a separate development in March 2013, Greenpower Energy of Australia (ASX: GPP) has signed a Memorandum of Understanding to

Side view of the Oxidative Hydrothermal Dissolution Process Design Unit being assembled before delivery to the Thermaquatic laboratory at the Southern Illinois Research Park in Carbondale.

jointly test and develop the Oxidative Hydrothermal Dissolution (OHD) process for the conversion of coals to liquids. In return for an exclusive license on OHD in Australia and New Zealand, Greenpower will directly finance research and development OHD work by Thermaquatica.

Molten-bed Combustor for Oxy-coal Combustion

The ICCI provided $50,000 to Gas Technology Institute (GTI) as cost-share in support of a National Energy Technology Laboratory (NETL) funded project developing a pressurized, oxy-coal combustion process using a molten bed combustor.

The molten bed combustor potentially offers higher efficiency than other oxy-coal combustors by reducing flue gas recirculation up to 90% and by operating at an elevated pressure. The unique combustion and heat transfer design employs a smaller and less expensive combustor and a gas-phase heat exchanger surface area. Downstream exhaust gas handling and cleaning equipment is reduced in size and cost as well.

The project objective is to conduct engineering design and economic analysis based on the pressurized, oxy-coal molten bed combustor at GTI following NETL protocol, with comparisons to a baseline supercritical steam power plant burning Illinois #6 bituminous coal.

The goals of the project include coal injector testing, engineering designs, mass and energy balance calculations around this advanced combustor, energy and exergy (the maximum useful work that can be obtained from a system at a given state in a given environment), and corrosion assessment.

Sorbent Activation Process Technology for Removal of SO_3 and HCl in Coal Combustion Flue Gas

Illinois State Geological Survey was awarded $115,000 to continue development of a patented, on-site calcium-based sorbent production technology (Sorbent Activation Process, SAP) for removal of SO_3 and HCl in coal combustion flue gases.

In the SAP technology, sorbents are prepared at the utility site and directly injected into the flue gas.

Coal-fired power plants using SAP technology could potentially cut costs by 15% to 30%, versus the conventional dry sorbent injection technologies to control SO_3 and HCl emissions.

A bench-scale SAP unit along with a batch furnace reactor will be used to produce highly reactive, promoter-enhanced lime sorbents, which will be tested for their ability to remove SO_3, vaporous H_2SO_4, and HCl in a typical Illinois coal flue gas.

Multi-element Sorbent Trap Sampling Method for Trace Metals and/or Halogen Emissions

Using Southern Illinois Power Cooperative's Lake of Egypt power plant as a host site, the University of North Dakota Energy & Environmental Research Center (EERC) was awarded $170,000 to evaluate the applicability and validity of the EERC developed multi-element sorbent trap sampling method for trace metals and/or halogen emissions,.

Results will be compared to U.S. Environmental Protection Agency (EPA) Methods 29 and 26a procedures, and provide stack emission data for the power plant.

The objective of this project is to reduce costs associated with compliance testing to meet EPA-promulgated Mercury and Air Toxics Standards (MATS) for coal-fired power plants. Increased costs associated with stack emission testing to verify continuous emission monitors and/or to determine emission concentrations are a significant part of the cost impact because of the expensive sampling methods needed to perform such testing.

The EERC sampling procedure reduces personnel hours for sampling and eliminates the need for chemicals and solvents in the field, resulting in a method which is much easier and robust, while also offering significant cost savings over comparable reference EPA methods.

This project is leveraged by funds provided by the US Department of Energy, the Electric Power Research Institute and the Southern Illinois Power Cooperative.

Southern Illinois Power Cooperative's Lake of Egypt Power Plant
(Source: www.sipower.org)

The Coal Demonstration Program

The Coal Demonstration Program provides partial funding for selected large-scale demonstration of advanced coal systems for utility and industrial use. There were five active coal technology demonstration grant projects during the first quarter of FY2013. Two of the projects closed in the first quarter and another closed during the third quarter of FY2013. No new Demonstration Program grants were issued during FY2013.

Sterling Energy: Enhancement of Water Cooled Oscillating Grate System at SIUC

A retrofit of the Southern Illinois University at Carbondale Boiler #2 was initiated in 2007 with the installation of a Water Cooled Oscillating Grate (WCOG) which was designed to use run-of-mine coal (ROM). The retrofit proved the efficacy of using this technology to burn less costly and more widely available, non-stoker grade coal.

The initial grant did not include funds to enhance the efficiency and performance of the unit. Now that the use of the WCOG in burning these alternative fuels has been proven, the expenditure of additional funds was warranted. A modification of the grant in the amount of $382,000 was awarded during the third quarter.

The project meets another important objective in creating a new market for Illinois coal and coal byproducts by finding practical and viable uses for ROM and waste coal. Included in the project is a study to determine the optimal parameters for the use of stoker coal, ROM coal, and waste coal in Boiler #2, so they can be used based on availability and price.

The project aims to upgrade the performance of the boiler by improving combustion controls,

Replaced tubes inside Boiler #2 at Southern Illinois University at Carbondale

mechanical designs and operational systems. The automation of controls for the combustion air and the grate cooling water will enable the operators to have full control of the combustion process. Other improvements include the replacement of grate material and boiler tubes where necessary and the installation of testing and monitoring equipment. These improvements will serve to provide better control of the boiler and to maximize boiler efficiency thereby lowering emissions.

Prairie State: Installation of New Flame Retardant Underground Conveyor Belt at Lively Grove Mine

Lively Grove Mine provides coal to the adjacent Prairie State Energy Campus, located in Lively Grove Township, Washington County, Illinois. The power plant is a 1600 MW, pulverized coal-fired generating station using super-critical technology and state-of-the-art environmental equipment. It is one of the newest and most efficient coal plants in the U.S.

This project involved the purchase and installation of approximately $10 million of new flame retardant, underground conveyor belt required by Mine Safety and Health Administration (MSHA). The new conveyor belt is made of a higher grade rubber and has increased fire retardant additives.

This fire retardant belt places an emphasis on preventing an ignition and propagation of fire on the conveyor belt system rather than just being fire resistant. The new technology increases the fire resistant capability from one minute to five minutes resulting in increased miner safety.

Approximately 109,000 feet of 48-inch fire retardant conveyor belt and approximately 43,000 feet of 60-inch fire retardant conveyor belt was purchased and installed in five working continuous miner sections in the Lively Grove Mine.

New 48-inch fire retardant conveyor belt ready to be installed at the Lively Grove Mine

Gas Technology Institute (GTI): Comparison of Carbon Dioxide Removal by Morphysorb Solvent from Coal Gasification Operations

GTI is an independent not-for-profit organization in Des Plaines, Illinois serving research, development, and training needs of the natural gas industry, transportation, and energy markets. GTI, the owner-operator of the selected pilot plant site, has been operating pilot facilities in the areas of gasification, catalytic and non-catalytic gas treatment, and acid gas removal, as well as power generation, boiler technology, industrial combustion, and many other technologies since the 1970s.

The objective of this project is to obtain process performance and scale-up information for carbon dioxide removal by the Morphysorb solvent, with experimental comparison to the state-of-the-art solvent technology applied to

syngas from coal gasification operations being conducted at GTI by third parties.

The work involves integration of the Acid Gas Treating Pilot Plant (AGTPP), previously refurbished and erected at the site with DCEO funding. This integration involves the addition of equipment, piping, control systems, and dedicated analytical equipment (gas chromatograph and associated electrical and insulation work, heated sample lines, and liquid sampler setups).

The data gathered will be analyzed and used to improve and update the software simulation of the Morphysorb process, to be in a position to predict the performance of commercial Morphysorb systems. GTI will perform a technoeconomic evaluation based on such predictions and compare the results to those predicted for the state-of the art solvent, in the context of an Illinois coal-based Integrated Gasification Combined-Cycle (IGCC) plant.

FutureGen Advanced Oxy-Combustion Technology with 90% CO_2 Capture & Storage

The FutureGen Industrial Alliance, Inc. (Alliance) is a non-profit membership organization committed to benefiting the public interest, and the interest of science through the research, development and demonstration of near zero-emission coal technology.

The Alliance will repower an idle 166-MWe power plant in Meredosia, Illinois with advanced oxy-combustion technology, 90%+ CO_2 capture, and CO_2 storage in a deep, saline, geologic formation resulting in one of the world's first near-zero emission coal-fueled power plants that uses primarily Illinois coal. The Alliance will also design and construct visitor, research, and training facilities.

The learning from this first-of-a-kind plant will provide the technological basis for improving the performance and economics of near-zero emission, oxy-combustion power plants throughout the world.

The project is being conducted in four phases. Phase 1 involves preliminary design. It is broken into Phase 1A, 1B, 1C, and 1D. Phase 1A and 1B involved developing a preliminary design (also called pre-FEED) for the project and the drilling of a geologic characterization well. Phase 1A and 1B are complete as of December 30, 2011.

Phase 1C, which involved value engineering (i.e., refinement of the preliminary design to reduce cost) and continued geologic characterization work is now completed. Phase 1C and 1D also include maintaining the Meredosia power plant in retrofit-ready condition as commercial operations at the plant ceased on December 31, 2011. Phase 1D is a transition phase where the design continues to be refined.

The project is in Phase 2 which is more than $160 million worth of advanced design (also called FEED and final design). Phase 3 is construction. Phase 4 is operations.

In parallel to Phase 1C, 1D, and early Phase 2 is an activity termed "novation". Ameren Energy Resources, the owner of the Meredosia power plant, has elected to move from a lead role on the power plant activities of the FutureGen 2.0 to a support role. The Department of Energy requires a formal transfer of Ameren's roles and responsibilities to the Alliance. This transfer is called a "novation". It involves both a legal transfer as well as associated environmental due diligence at the power plant.

In Conclusion

The Office of Coal Development strives to deliver an informed voice into the discussions taking place that will determine our energy future and ultimately the future of our environment.

The perfect energy supply would be abundant, accessible, reliable, affordable and not harm the environment. Coal has four of the five attributes. Our mission here at OCD is to continue reducing the adverse effects of using coal until the issues surrounding other energy sources are solved.

Farmland and coal are Illinois' two greatest natural resources. According to the U.S. Energy Information Administration (EIA) Illinois has 2.3 billion short tons of recoverable coal at producing mines. The recovery percentage is 61.23. EIA estimates that there are 38 billion tons of recoverable reserves suitable to mining in Illinois.

The top-three most productive longwall mines in the nation and four of the top-five most productive underground mines in the nation are located in Illinois. While other states are seeing declining production, Illinois coal production is on the rise.

Coal production in Illinois increased nearly 30 percent in 2012 and continued to increase throughout the rest of the fiscal year, June 30th. This increase can be contributed to the visionary owners and producers who have invested heavily in the Illinois coal industry since 2006.

Seven years later, Illinois has a robust coal industry employing thousands of workers in rural communities. Miners work hard and play hard. They are boaters, hunters, coaches, mayors, fire-fighters and church leaders. The money they earn filters back into their communities to restaurants, schools, gas stations and grocery stores.

DCEO Office of Coal Development continues to advance the technology that will reduce emissions from coal use. According to the EPA's website between 1980 and 2012, gross domestic product increased 133 percent, vehicle miles traveled increased 92 percent, energy consumption increased 27 percent and U.S. population grew by 38 percent. During the same time period, total emissions of the six principal air pollutants dropped by 67 percent.

Projects like Prairie State Energy Campus (PSEC) in Washington County, Illinois are reducing emissions. POWER Magazine named PSEC one of the top five coal-fired plants in the world. The supercritical plant's state-of-the-art, emissions controls result in emissions that are one-fifth the national average for coal-fueled plants.

Energy issues often require an understanding of civics, history, economics, sociology, psychology, and politics in addition to science, math and technology. We are but one voice in the discussion.

We encourage you to investigate the resources that provide the facts on energy fuels, to protect our air and water resources, and to use the facts and critical thinking when formulating your opinion on the best strategies for the U.S. to move forward with a secure, balanced and diverse energy policy and emission regulations.

Copies of the aforementioned reports are available online at www.illinoiscoal.biz .

Questions and comments will be received at:

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