

FINAL TECHNICAL REPORT
February 1, 2006 through March 31, 2008

Project Title: **PERMIT REQUIREMENTS AND CHARACTERIZATION OF
POTENTIAL SITES FOR FUTUREGEN PROJECT**

ICCI Project Number: DEV05-3
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ABSTRACT

Patrick Engineering, Inc. (Patrick) provided engineering, technical and project coordination support to the Illinois Department of Commerce and Economic Opportunity (DCEO) and the Illinois State Geological Survey (ISGS) in an effort to select and propose potential site locations for a near-zero emission, integrated gasification combined cycle (IGCC), coal power plant incorporating geological carbon dioxide (CO₂) sequestration. Patrick gathered the necessary geographic, socioeconomic, environmental, geological, regulatory information and legal and technical incentives to respond to site requirements put forth by the FutureGen Industrial Alliance – a not-for-profit consortium of coal and utility companies coordinating development of the facility under a grant agreement with the United States Department of Energy (USDOE).

EXECUTIVE SUMMARY

On December 2, 2005, the United States Department of Energy (USDOE) entered into a cooperative agreement with the FutureGen Industrial Alliance, Inc. to begin the site selection process and prepare a conceptual design for the facility. FutureGen is a government-industry, cost-shared project to design, build, and operate the world's first coal-based, near-zero emission power plant. The plant will also produce hydrogen (H₂) and byproducts for use by other industries. The project was intended to not only demonstrate the state-of-the-art in coal-fired power plants and carbon capture and sequestration, but also to act as a research and development test bed for further advanced concepts.

Shortly after the announcement of the agreement, the Illinois Department of Commerce and Economic Opportunity (DCEO) began searching the State for sites that would optimally support the construction of an IGCC power plant equipped for CO₂ capture and geological sequestration; and to develop and provide convincing information and incentives to the FutureGen Alliance that these sites were eminently suitable environmentally, technically and financially for the proposed project. From an initial pool of 35 sites, site proposals were prepared for four Illinois sites: Mattoon, Tuscola, Effingham and Marshall.

The Alliance received twelve sites' proposals nationwide. Its preliminary site selection review reduced the field to four finalists: two from Illinois - Mattoon and Tuscola, and two from Texas - Jewett and Odessa. The Alliance and USDOE intended to list all four finalist sites as optional locations for the FutureGen project in the Environmental Impact Statement. The Alliance also indicated the other two Illinois sites were rated fifth and sixth in the national ratings, resulting in Illinois placing four in the top six slots nationally.

Acting as the prime engineering consultant to the State of Illinois for the site proposal process, Patrick assimilated the necessary geographic, socioeconomic, environmental, geological, regulatory, legal and technical information to create an Environmental Information Volume (EIV) necessary for USDOE to prepare the required Environmental Impact Statement (EIS). Subsequently, Patrick reviewed several drafts of the EIS to ensure that the information provided was interpreted correctly and fairly.

Concurrently with the EIS development, Patrick assisted the State and the site proponents in preparing the Best and Final Offers (BAFO). These submissions highlighted the site specific characteristics and incentives that related directly to the proposed capital and operating costs of the FutureGen Project. The BAFO also provided proof of control of the property (titles, options, easements, etc.) necessary for the plant site and utility

corridors. Patrick developed various engineering cost estimates for both Illinois and Texas sites to assess Illinois' competitive position.

The final site selection was announced December 18, 2007 as Mattoon, Illinois. Immediately following the announcement, Patrick, the local site proponents and DCEO met with the Alliance to discuss the schedule of activities that need to be completed in the following few months.

After the site selection, Patrick continued to assist both the City of Mattoon and the State in further site development activities including process water pipeline design, preliminary seismic survey, land survey of plant site, slag marketing analysis and other State-approved activities.

The project, although with federal funding uncertainties, remains an important component of the State's and country's quest for a stable, long-term environmentally suitable energy source. The amount of coordination required among State, local and business communities was extraordinary, indicated by Patrick's primary project coordinator's tally of 15,600 e-mails sent and received during the project life.

OBJECTIVES

The objectives of the project were to select sites available in Illinois that would optimally support the construction of an IGCC power plant equipped for CO₂ capture and geological sequestration; and to develop and provide convincing information and incentives to the FutureGen Alliance that demonstrated these sites are eminently suitable environmentally, technically and financially for the proposed project.

INTRODUCTION AND BACKGROUND

On December 2, 2005, the U.S. Department of Energy (USDOE) entered into a cooperative agreement with the FutureGen Industrial Alliance, Inc. to begin the site selection process and prepare a conceptual design for the facility. FutureGen is a government-industry, cost-shared project to design, build, and operate the world's first coal-based, near-zero emission power plant. The plant will also produce hydrogen (H₂) and byproducts for use by other industries. The project was intended to not only demonstrate the state-of-the-art in coal-fired power plants and carbon capture and sequestration, but also to act as a research and development test bed for further advanced concepts.

The FutureGen project will be conducted at commercial power-plant scale and sized to produce nominally 275 MWe. FutureGen will also be designed with a goal to capture at least 90% of CO₂ and sequester a minimum of one million metric tons of CO₂ into a deep saline aquifer and to inject any remaining captured CO₂ into geological or other subsurface formations.

The Alliance implemented a highly structured, openly competitive siting process to identify the site that could best meet the goals of the FutureGen project. This process involved the issuance of a Request for Proposals from potential site hosts, a rigorous evaluation of the 12 proposals received, and the identification of four candidate sites for full consideration by the Alliance and USDOE.

RESULTS AND DISCUSSION

Phase 1- Site Selection:

Shortly after the announcement of the USDOE-Alliance cooperative agreement, DCEO began searching the coal-producing regions of southern Illinois for possible sites, anticipating the requirements of the Alliance. This project was initiated shortly before the Alliance released the draft Request for Proposals on February 14, 2006 for comment.

Upon release of the draft RFP, Patrick began screening the sites previously identified by DCEO against the qualifying criteria identified in the RFP. Two criteria had the effect of eliminating nearly all of the sites identified by DCEO – a requirement for 400 or more acres and a seismic activity (earthquake potential) restriction (a requirement for a probability of less than 2% in 50 years that seismic activity would exceed 30% of the acceleration of gravity). Comments were prepared on the draft RFP objecting to the size of the required site and the overly restrictive seismic activity requirement.

On March 8, 2006, the Alliance released the final RFP with a May 4, 2006 deadline for proposals. The minimum site size requirement had been reduced to 200 acres but the seismic requirement was essentially unchanged.

As DCEO continued to seek additional potential sites outside the southern portion of the state that would be disqualified by the seismic requirement, Patrick coordinated with ISGS to evaluate all of the identified sites against the RFP requirements. Screening maps were prepared for each site showing the relevant geographic, infrastructure, environmental and geological features - concentrating on the critical “qualifying criteria” and what were thought to be the most critical “scoring criteria”. Patrick also prepared an over-sized spreadsheet of the immediately available data on each site. This matrix was integral in assessing and tracking relative scores of all Illinois sites.

On April 12, 2006, Patrick met with the Illinois FutureGen Task Force to review the 35 available sites. Using the screening maps and the matrix spreadsheet, sites were eliminated first on their inability to meet one or more of the “qualifying criteria”. Others were rejected for less than ideal subsurface geology for CO₂ sequestration. Four areas were selected for potential site applications: Effingham, Marshall, Mattoon and Tuscola. Several of these areas had proposed multiple sites. Additional meetings and negotiations with local officials, developers and land owners were conducted to optimize the site offerings in accordance with the RFP criteria. For example, the Tuscola site needed to acquire a remote CO₂ injection site to avoid conflict with nearby Class 1 injection wells. The negotiations resulted in four finalist sites - one at each location.

Phase 2 – Proposal Preparation:

Patrick assisted and coordinated the efforts of DCEO, ISGS, the local officials, and several other state agencies including the IEPA, IDNR and IHPA in preparing responses to the RFP. Narratives were written and reviewed for each of the 35 qualifying criteria, 29 power plant scoring criteria, 14 geological scoring criteria, and 13 best value criteria. The topics addressed included land ownership and control, topographic and geographic information; proximity to wetlands, endangered species, parks and public areas; proximity to transportation and transmission infrastructure, population and workforce data, fuel and water availability, geological suitability for CO₂ storage; and tax and

regulatory information. Patrick created maps as necessary to supplement the narratives, and additional supporting documentation was included where available.

Patrick prepared six hard copies and 30 electronic copies (on CD) of each of the four site proposals. Two hard copies and 15 CDs of each proposal were shipped to the Alliance and arrived on May 3, 2006. Eight other sites were proposed by other states: two each from Texas and Ohio and one each from Kentucky, North Dakota, West Virginia and Wyoming.

Between the submission date and the selection of the finalist sites, Patrick responded to several requests for clarifying or additional information from the Alliance and participated in providing a tour of the four sites to an Alliance engineering team.

On July 21, 2006, the Alliance announced its decision on four finalist sites – Mattoon and Tuscola in Illinois, and the two Texas sites. The Marshall site lost points on distance to utilities and proximity to public access areas. The Effingham site scored lower because of a narrow site profile, which would have made siting a rail loop difficult, and the proximity of residential developments. The scoring did indicate, however, that Effingham and Marshall ranked fifth and sixth.

The scoring also indicated that the two Illinois sites selected scored lower than the Texas sites on site size. Consequently the local developers added acreage to their offerings.

Phase 3 – EIV preparation:

On August 1 and 2, 2006, Chris Burger and Ron Swager of Patrick Engineering, with representatives from DCEO and the Mattoon and Tuscola sites attended a training workshop in Pittsburgh, PA regarding the preparation of an Environmental Information Volume (EIV) for each site. The workshop was conducted by the Alliance (and subcontractor Battelle) and USDOE (and subcontractor Potomac-Hudson Engineering (PHE)).

Since the FutureGen project relies on substantial funding from the USDOE, the National Environmental Policy Act (NEPA) requires the preparation of an Environmental Impact Statement (EIS). The EIV provides the detailed, site-specific environmental data necessary for the USDOE's contractor, PHE, to prepare the EIS.

The Illinois team received a draft outline of the EIV data package request at the Pittsburgh meeting, and the final data package request on August 15, 2006. The EIV submission deadline was set for August 31, 2006 for the subsurface geology section and September 15, 2006 for the remainder, with the following two months until November

17th reserved for clarifying and verifying information and gathering additional information as necessary.

The EIS process also included local scoping meetings to gather input on local concerns. Patrick participated in the public scoping meetings at Tuscola on August 29th and Mattoon on August 31st.

Again Patrick coordinated the data gathering and preparation of the EIV. Patrick had direct responsibility for conducting field studies (as necessary) and preparing sections on soils, air quality, climate and meteorology, ground and surface waters, wetlands, aquatic and terrestrial ecologies, cultural and visual resources, noise and vibration, non-potable water supplies, electrical transmission load capacity and waste management. Patrick also assisted the ISGS in preparing the subsurface geology sections by developing a CO₂ Release Mitigation Program Plan and contracting for a seismic line analysis at each site.

The EIVs were uploaded to Battelle's FTP site electronically on the deadlines. The EIVs consisted of over 4,000 pages of information for each site. Additional copies of the EIVs, with the addition of the Geographic Information System (GIS) data coverages used to create the maps included in the EIVs, were shipped to the Alliance on portable hard drives.

Two portions of the EIV were still outstanding on the September 15th deadline – completion of the archeological field study and the analysis of the seismic line data. They were completed by November 15th, in time to be incorporated into the EIS. These efforts were initially delayed by weather and/or the need to have crops harvested.

Phase 4 – EIV follow-up and EIS reviews.

After the submission of the EIVs, Patrick responded to numerous requests to clarify or expand upon information submitted in the EIV and assisted in providing site tours to visiting PHE and Alliance personnel.

On January 8, 2007, USDOE provided the site proponents a preliminary draft of the EIS for review and comments. Patrick coordinated the response for the Illinois team, preparing 17 pages of error corrections, clarifications of misinterpreted or misrepresented data, and requests for additional information. A second draft followed on February 5, 2007 and the process repeated.

The Final Draft Environmental Impact Statement was published for public comment on May 25, 2007. Patrick also attended the public hearings on the final draft held on June 26, 2007 in Mattoon at the Riddle Elementary School; and on June 28, 2007 in Tuscola at the Tuscola Community Building.

On August 9, 2007, USDOE provided the site proponents with copies of all the public comments received on the Draft EIS along with USDOE's draft responses to the comments. The site proponents were asked to review the draft responses and to provide corrections or further comments. Again, Patrick coordinated and prepared comments from the Illinois team.

The Final EIS was published on November 17, 2007. Preliminary indications were that all four sites had passed the environmental review and a Record of Decision was expected before the end of 2007. However, as of March 31, 2008, the USDOE has not released its Record of Decision on the EIS.

Phase 5 - Best and Final Offer

On May 30, 2007, the Alliance released a draft of the "Best and Final Offer (BAFO) Directions for Site Offerors" with the final version following on June 15, 2007. The Alliance sought information on site characteristics that would differentiate the costs of building and operating the FutureGen facility at each competing site, including any offerings of legal and financial incentives. During this phase, Patrick was diligent in preserving the confidentiality of the local incentive offers from the two competing Illinois sites.

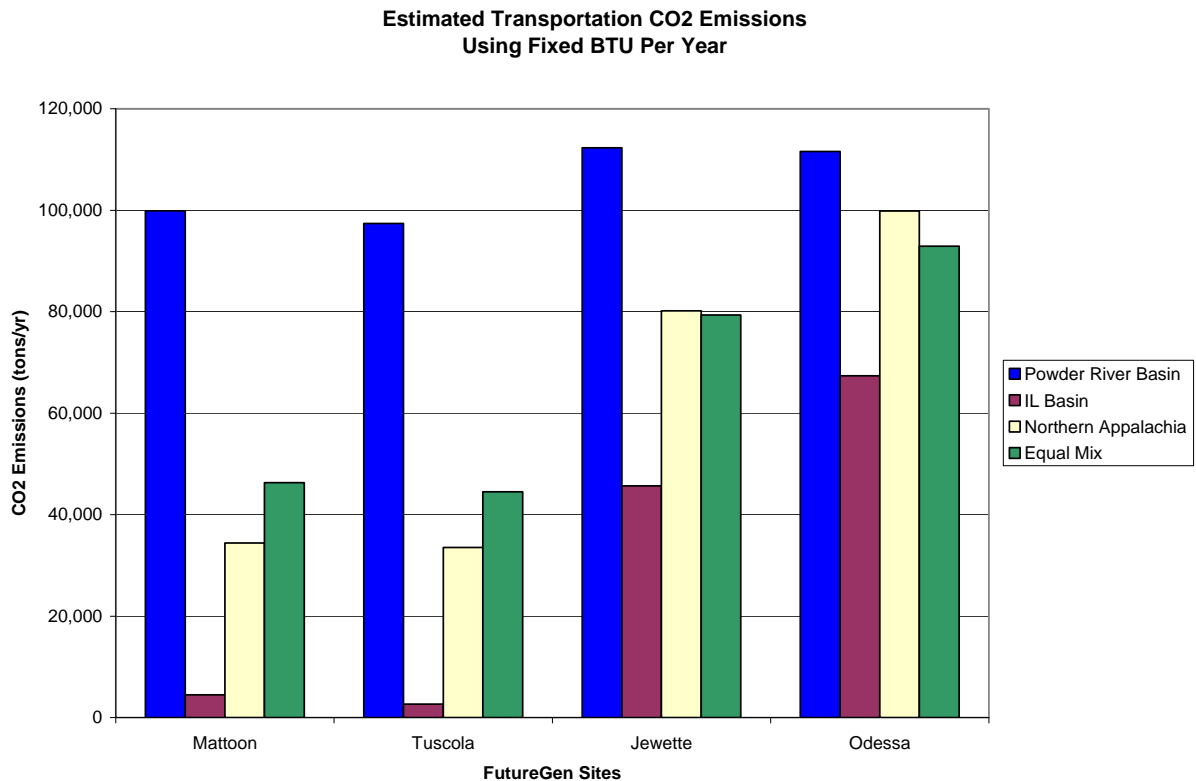
DCEO and Patrick conducted studies to assist the Alliance in this next evaluation stage. Patrick initiated an electric transmission network interconnection study through MISO (Midwest Independent Systems Operators) to determine the requirements and cost to connect FutureGen to the utility network at both sites. In addition, Patrick prepared a report on power marketing under the recently revised utility regulations in the State of Illinois. A geotechnical evaluation and aerial topographic survey of both Illinois sites were conducted to help further determine facility design and construction costs. Water quality samples were taken from both proposed process water supplies in July and September of 2007 to help determine process water treatment costs. Patrick worked with both sites to develop plans and agreements to supply the required 4.3 million gallons per day of process water.

In order to assess the competitive situation between the Illinois and Texas sites Patrick prepared engineering cost estimates for all four sites. Estimates for the Texas sites were very speculative as they were prepared based only on information provided in the EIS and from other sources such as press releases. Patrick included calculations (including incentives where known) of site acquisition and preparation costs, process water supply and reservoir construction and operating costs, utility connection costs, waste disposal costs, construction, operation and monitoring of CO₂ pipelines, drilling and operation of CO₂ sequestration wells, drilling and operation of measurement, monitoring and

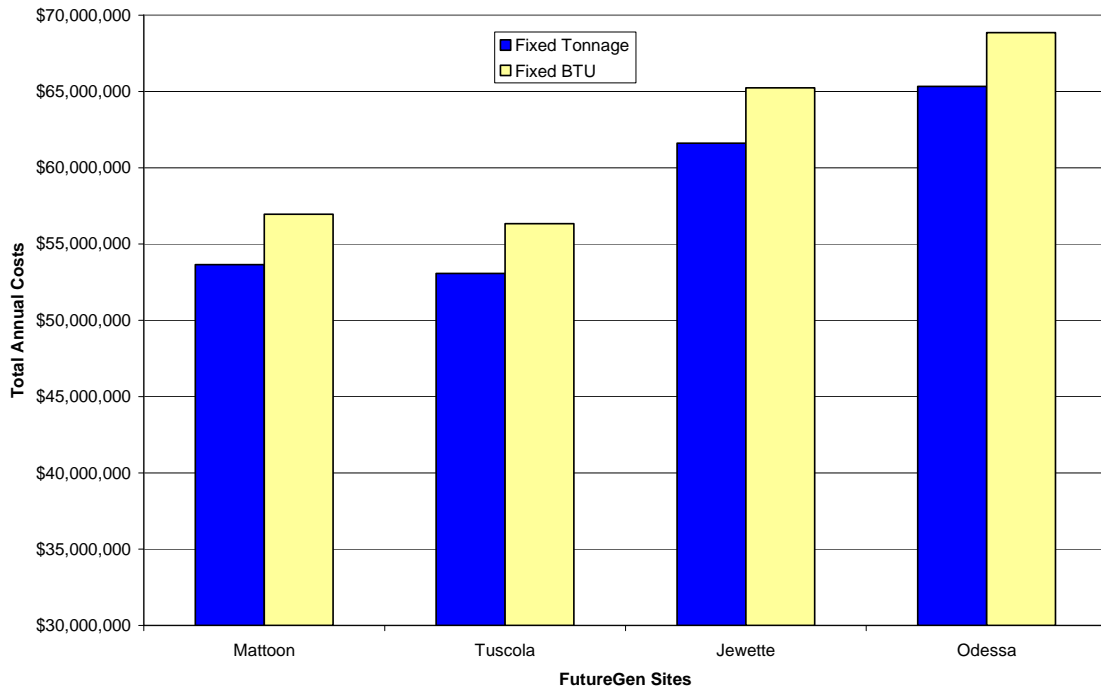
verification (MMV) wells and sensor networks, relative wage and materials costs for power plant construction, and fuel supply costs. The last of these was one of the significant advantages for Illinois.

Patrick compared the estimated costs to provide coal to the Tuscola and Mattoon FutureGen sites in Illinois and to the Texas sites at Jewett and Odessa from the Powder River Basin in Wyoming, the Illinois Basin mines, and the Northern Appalachian coal mines as required by the Alliance. The analysis takes into account spot market prices for coal and rail transport, the rail shipping distances from each mine site to each potential power plant site, the round-trip travel time by rail and the energy (Btu) content of each coal type. Calculations were conducted assuming either a constant consumption of coal by the FutureGen facility on a tonnage basis, or alternatively, on a constant energy input per day. Since the major goal of the FutureGen project is to demonstrate carbon capture and sequestration, and near-zero emissions, the analysis tool also calculated CO₂ emissions from the rail transport operations.

Significant advantages were found in both dollar and CO₂ emission costs for the Illinois sites over the Texas sites in all scenarios. Summary charts are provided that indicate the advantages.



Estimated Costs Per Year



Patrick contracted with local title companies to provide property title abstracts for the land required for the power plant site and easements for the utility corridors. The Illinois team realized the importance of risk to the Alliance and providing clear title to all properties required for construction of the facility, as well as the properties for the CO₂ plume, was critical to reducing risk. The local groups obtained options to purchase the land, and abstracts were matched with the options to show legal access to the property.

On July 31, 2007, Patrick delivered six hard copies and five electronic copies of the Best and Final Offers for Mattoon and Tuscola to the Alliance. On August 24, 2008, following a review of the BAFOs, the Alliance prepared a draft set of clarification questions for each site followed by a final set on September 4, 2008. On September 13 and 14, 2008, Patrick, along with the site proponents and DCEO, met with the Alliance at SIU-Edwardsville to review and discuss the BAFO and clarify any questions. Patrick worked closely with the local site proponents and the State to prepare answers to these questions. The responses were submitted to the Alliance on September 28, 2008.

On December 18, 2008, after extensive review and evaluation of the advantages and disadvantages of the four candidate sites both individually and in comparison to one another, the Alliance announced its selection of **Mattoon** as the host site for the FutureGen facility, pending the outcome of USDOE's Record of Decision. The Alliance listed the following advantages provided by the Mattoon site:

- *Clear legal title to the power plant site can be provided, including the injection site, which results in minimal land ownership risk.*
- *Onsite CO₂ injection eliminates the need for an extended length, offsite CO₂ pipeline, which reduces capital and operating costs while still providing an excellent test of the integration of the power plant with CO₂ injection and sequestration. This site will provide both operating- and construction-related integration efficiencies that will reduce costs and staffing requirements.*
- *With both power production and injection on the same site, public access and educational opportunities will be exceptional.*
- *The Mt. Simon geologic injection formation is regionally extensive and is widely considered to be one of the most important geologic storage reservoirs for anthropogenic CO₂ in the U.S. The thick geologic injection formation, multiple thick overlying and low permeability formations which provide multiple seals, and lack of penetrations into both the primary or secondary seals substantially decrease geologic risk.*
- *There is a secure water source from two wastewater treatment facilities, which when combined with the construction and operation of an onsite reservoir, will ensure an adequate water supply to the plant.*
- *The site is near interstate highways which connect to major waterways to provide an opportunity for modular construction of the facility.*
- *There is very strong community support for the FutureGen project in Mattoon and surrounding communities.*
- *There is a good potential for self-sufficient post-project operation of the plant because of the power plant's projected revenue potential and the projected low operating cost of the FutureGen plant at this site.*

Balancing overall cost and associated financial risks, and other risks and benefits such as legal issues, water issues, geologic conditions, sequestration opportunities, construction issues, and environmental issues, the Alliance found that Mattoon would best serve the overall project mission. However, to date, the USDOE has not released its Record of Decision on the EIS.

Phase 6 – Post Selection

At the request of DCEO, Patrick continued to support Mattoon and the Alliance in site specific development activities. Patrick met twice in Houston with the Alliance and its

prime contractors to discuss the site plot plan and initial development activities at Mattoon.

Patrick also coordinated a meeting between IEPA, USEPA Region 5 and other State agencies to discuss policies, procedures and unresolved issues regarding underground injection of CO₂.

The City of Mattoon's offer (BAFO) to the Alliance included the construction of a pipeline to supply process water to the FutureGen plant site from the Mattoon and Charleston waste water treatment plants. Patrick provided surveying of the pipeline route and developed the preliminary engineering designs that will enable Mattoon to obtain bond financing for the construction.

Patrick assisted the City and the Alliance in planning a preliminary 2D seismic survey covering the 16 square miles surrounding the proposed plant site. Patrick assisted with the grant application for funding this activity through the Coles Together Economic Development Organization. The project has not yet been authorized.

Patrick conducted a detailed property survey of the proposed power plant site to reconcile some discrepancies found in an earlier plat provided by the local site proponents. Patrick also completed a Phase 1 environmental assessment of the power plant site.

Patrick conducted a local marketing survey to assess the potential for beneficial reuse of the FutureGen gasifier slag by-product, the results to help the Alliance prepare cost estimates of operation costs required USDOE.

CONCLUSIONS AND RECOMMENDATIONS

The objectives of the project were completely met by the selection of Mattoon by the Alliance as the optimal site for the construction of FutureGen. The Mattoon site was shown to supply all the necessary infrastructure requirements to support an IGCC powerplant and the geological sequestration potential to store the CO₂ output of the facility.

It is recommended that the Alliance, with the support of the State of Illinois and the Mattoon site proponents, advance to detailed engineering design and cost analysis of the FutureGen power plant. It is also recommended that USDOE release its Record of Decision on the FutureGen EIS, and recommit itself to the development of this globally important project.

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DISCLAIMER STATEMENT

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